World Meteorological Organization

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WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (OF UNESCO)

SHIP OBSERVATIONS TEAM
NINTH SESSION

London, United Kingdom
27-31 March 2017

2017

JCOMM Technical Report No. 134

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NOTES

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C O N T E N T S

Group Photo

SOT-9, London, Uinted Kingdom

EXECUTIVE SUMMARY

The Ninth Session of the JCOMM Ship Observations Team (SOT) was held from 27 to 31 March 2017 at the International Maritime Organization (IMO) Headquarters, London, United Kingdom, and at the kind invitation of the, IMO. The Session was chaired by the Ship Observations Team Vice Chairperson Mr Shawn Smith (USA). SOT members from 14 countries participated the meeting with a balanced representation from science/research, operations/services, industry and also gender with approximately 30% of female participation.

As for previous SOT Sessions, a Technical and Scientific Workshop focusing on new initiatives and / or new developments in shipboard meteorological or oceanographic instrumentation, observing practices, data management procedures, and quality control and ocean products was organized during the first day of the meeting. Ten presentations were delivered during the workshop, which covered each of the theme areas, and permitted to prepare further discussions at the main SOT Session. Of particular interest was the presentation by Dr. Elizabeth Kent (UK) which discussed key performance indicators, a topic of further discussion during the session that resulted in the formation of a new Task Team.

The Secretariat reported on issues of interest from the WMO and IOC Executive Bodies. WMO Secretariat emphasize the importance of WIGOS implementation during its pre operational phase during 2016-2019 leading to a fully operational WIGOS in 2020. The Team recognized the work done by various task teams and the Technical Coordinator during the intersessional period focused on the migration of metadata into the WIGOS. Members were reminded to ensure ship metadata are submitted to JCOMMOPS, complete the transition from Traditional Alphanumeric Codes to Table Driven Codes, and to increase the number of ship-based observations, particularly in the polar regions. The Team also recognized the need to strengthen coordination with other observing networks.

The Team noted the reports from the JCOMM Observations Programme Area Coordinator, the SOT Vice-Chair, and the SOT Technical Coordinator(SOT TC), and reviewed action items from the previous SOT Session. The Team agreed to simplify the management of future action items by separating ongoing/continuing actions from those that have a specific deadline. The Team noted the good progress and developments of the SOT TC and thanked Mr. Kramp for his continuous support. The Team recognized the OCG request for additional coordination between panels and programs for the recruitment of platforms to make observations and deploy instrumentation. With the assistance of the SOT-TC and the Secretariat, a panel discussion was moderated by the SOT vice-chair on 27 March with representatives of the IMO, IHO, ICS, WOC, IMSO, VOSP, SOOPIP regarding how the SOT could better engage with ship operators and other maritime organizations to recruit observing platforms.

The meeting reviewed the collaboration with associated organizations and programmes. Issues of common interest were discussed, including logistical aspects, and the sharing of the data. One recommendation by the IHO that was supported by the Team was to identify opportunities to record and deliver both new and historical Digital Bathymetry data to the IHO Data Centre from vessels contributing to VOS and SOOP.

The SOT Task Teams(TT) reported on their activities and made a number of key recommendations to the Team as follows;.

1. Approved the TT-High Resolution Marine Meteorology(TT-HRMM) plan to design a work flow for HRMM data from AWS-equipped VOS and to initiate a pilot project leveraging support from one or more Members operating AWS.
2. Updated the SOT annual report forms based on recommendations of the Task Team on Satellite Communication Systems (TT-Satcom) and on Instrument Standards to capture metadata from members related to satellite data transmissions and to observing instrumentation.
3. Combine the Task Team on Satellite Communication Systems (TT-Satcom) with the Task Team on Instrument Standards and established the Task Team on Instrument Standards and Satellite Communications (TT-ISSC)

4. Combine the Task Team on VOS Recruitment and Programme Promotion (TT-VRPP) with the Task Team on Training (TT-Training) and established the Task Team on Recruitment, Program Promotion and Training (TT-RPT)
5. Revise and update the IMO MSC Circular 1293 on participation in the VOS Scheme with a view to submission to IMO in due course
6. Arrange intersessional WebEx or Webinars for PMOs to inform/discuss/train on evolving program developments and changes (i.e. BUFR, WIGOS, OSCAR, JCOMMOPS, Pub47)
7. Agreed to the use of SOT station identifiers , the use of the ICES Ship Code as a unique reference for the hosting hull/platform, and that JCOMMOPS will be responsible for allocating such SOT station identifiers on behalf of JCOMM and Member States

The agreement by the team to adopt the SOT station identifiers, led to a further recommendation for Member States to discontinue use of and/or plans to adopt an encode/decode masking scheme. Use of the new ID scheme together with the use of BUFR data formats will fulfil this requirement for members who would like to continue to mask observations from ships. Pending confirmation from Member(s) who had strong interest in developing the encode/decode scheme, this recommendation will require the TT-VOS-Metadata to prepare a recommendation paper to present to the OCG, JCOMM, and the EC to seek approval for the discontinuation of the ship masking scheme and to revoke the previously establish EC Resolution on Ship masking.

The need to recruit additional vessels in data sparse regions (e.g., polar oceans) was stressed. There is a need for better engagement with the vessel operators, whether they be traditional shipping companies, cruise lines, fishing fleets, etc. Within the Team a recommendation was made to prepare an update to the IMO Circular MSC.1/Circ.1293 to strengthen the wording regarding mariners obligations to provide meteorological observations to support SOLAS, which can then be circulated to IMO for review and further action.

The Eleventh Session of the Voluntary Observing Ship (VOS) Panel reviewed the status of the VOS fleet, including status of VOS automation, and trends in recent years, and considered proposals for the evolution of the fleet. In particular the session made proposals to restructure and reduce the current VOS classes and proposed changes to the way VOS metadata are managed as WIGOS enters its preoperational phase.

Following detailed consideration the Panel agreed with the recommendation that the number of VOS classes should be reduced to just three new classes. The Task Team on VOS metadata is tasked with include these classes in their work on the development of new WIGOS compliant metadata.

The Team discussed the migration of WMO Pub47 metadata to the JCOMMOPS database and subsequently to the OSCAR database. The Team agreed that the JCOMMOPS database should be regarded as the main metadata repository for platforms contributing to the SOT mission. Member States are reminded to submit their platform metadata directly to JCOMMOPS, once the full migration of Pub47 to the database is complete in late 2017. Furthermore, the Team decided that the latest version of Pub47 (4.2) should be frozen, and archived, and that no further updates to Pub47 should be made. All future updates will be made directly in the JCOMMOPS database.

The Team recognized with appreciation plans by the NOAA's National Weather Service to transition their VOS to the use of TurboWin software and that Japan had recently migrated some of its fleet over to the use of TurboWin. Some concerns also were raised that the TurboWin software was to some extent reliant on a single software developer. Accordingly KNMI, in liaison with E-SURFMAR, was invited to consider strategies to ensure the on-going continuity and development of the TurboWin Software so as to avoid a single point of failure that could impact numerous TurboWin users.

Having reviewed the criteria for the VOS donation programme(VOS-DP) the Panel agreed that the principles and logic behind the development of the VOS-Drifter Donation Program was sound, despite the fact that it had so far failed to assist any developing countries with setting

up embryonic national VOS programs. However, following detailed consideration the Panel decided that the VOS - DP should be discontinued. Recognizing that the VOS-DP was established as a joint DBCP/SOT initiative it was agreed that DBCP Chair and OCG should also be invited to endorse this recommendation. Exploration of alternatives to VOS-DP, possibly using AWS, are to be considered by the Panel.

The 13th Session of the Ship Of Opportunity Program (SOOP) Implementation Panel (SOOPIP) focused on the implementation status of recommended Expendable Bathy Thermograph (XBT) network. SOOP Science Presentations reinforced the value of decadal time series of high resolution transects by demonstrating the application of XBT transect data to oceanographic research, including studies of the temporal and spatial variability of key surface, subsurface, and boundary currents, meridional heat transport (MHT) and upper ocean heat content monitoring. The Team noted with appreciation the expanding focus of SOOP to include pCO2 and thermosalinograph (TSG) observations. Developing metadata templates for TSGs will be a focus of the TT-SOOP-metadata in the next intersessional period.

The Team reviewed the existing Key Performance Indicators (KPI) and their presentation on the JCOMMOPS website, noted some limitations to the present KPIs and agreed to create a new task team to work on the KPIs to support both SOT and wider JCOMM objectives. The Team reviewed the monitoring reports from (i) the Regional Specialized Meteorological Centre (RSMC) Exeter, (ii) the Real-Time Monitoring Centre (RTMC) for VOS Climate (VOSClim) data (also operated by the United Kingdom), (iii) the Global Collecting Centres of the United Kingdom and Germany, (iv) the Data Assembly Centre (DAC) for the VOSClim fleet (operated by the USA), and (v) the ASAP quality control monitoring reports from the European Centre for Medium Range Weather Forecast (ECMWF) and Météo France. Activities of the Global Temperature and Salinity Profile Programme (GTSPP) and XBT data flow/transmission were also discussed. The Team noted that the decision to reduce the VOS classes to three categories effectively eliminates the VOSClim class. As a result, consideration is needed in the next intersessional period regarding the continuation or possible transformation of the VOSClim RTMC and VOSClim DAC.

Pending official authorization from JCOMM-5, the Team agreed to establish on a provisional basis an SOT Executive Board (SOT-EXB) and a broader SOT Executive Committee (SOT-EC). The purpose of the SOT-EC is to ensure the SOT Panel leads and Task Team leads are in communication and up to date with the activities of SOT. The membership of the SOT-EB and SOT-EC, along with their ToR, were reviewed and approved by the Team. This proposed change will be forwarded to OCG and JCOMM-5 for approval.

The Team reviewed the composition of the SOT-EXB, as well as the role of the JCOMMOPS Ship Coordinator who is also acting as SOT Technical Coordinator (SOT TC) on a part-time basis. The Team agreed that the SOT TC provides a valuable coordination and support service to the component programs of the SOT. The Team noted that the SOT Chairperson is presently vacant and the Team is actively seeking nominations for that position.

The Team reviewed funding issues and status of the ASAP Trust Fund, and made recommendations to Members to make additional contributions to fund SOT activities.

National reports from 14 Members/Member States were presented during the Session

The next Session of the SOT is tentatively planned to be held in March or April 2019 at a venue yet to be decided. The team noted the following potential hosts for SOT-10: IHO-Monaco, Israel, United States, Australia, and Hong Kong (China).

GENERAL SUMMARY OF THE WORK OF THE SOT-9 SESSION

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Session

1.1.1 The Vice-Chairperson of the SOT, Mr. Shawn Smith(USA), speaking on behalf of the outgoing Chairperson of the Panel, Mr Chris Marshall (Canada) who was unable to attend, opened the Ninth session of the Ship Observations Team (SOT) meeting and its associated Scientific and Technical Workshop at 09:00 hours on Monday, 27 March 2017, at the International Maritime Organization (IMO), London, United Kingdom.

1.1.2 Mr. Hiroyuki Yamada, Senior Deputy Director, Maritime Safety Division-IMO and WMO/IOC Secretariats, welcomed participants to the meeting. Mr. Yamada highlighted that the mission of IMO is to promote safe, secure, environmentally sound and sustainable shipping, through cooperation. For this purpose, providing meteorological services and warnings to ships are indispensable. At the same time, ships are encouraged to report meteorological data to shore. These are stipulated in the International Convention for the Safety of Life at Sea, SOLAS, which is the base IMO instrument related to SOT activities. IMO has also developed numerous recommendations and guidelines, in cooperation with relevant international organizations, WMO and IHO.

1.1.3 IMO is preparing its new Strategic plan for the Organization for the six-year period 2018-2023, which will be adopted by IMO Assembly in the end of this year. In its overarching principles, it is stated that, as a UN specialized agency, IMO has an important role to play in achieving the 2030 Agenda for Sustainable Development. Among the seven Strategic Directions that set out the areas of particular focus for the 2018-2023 period, "Respond to climate change" and "Engage in ocean governance" are related to SOT.

1.1.4 Under SOLAS, meteorological reporting, services and warnings between ships and shore are carried out, using radio communications under the Global Maritime Distress and Safety System (GMDSS). GMDSS is now under comprehensive review, taking into account state-of-art digital technologies. Also, IMO has been implementing e-navigation, one of the aims of which is providing digital infrastructure between ships and shore. Finally he mentioned that IMO will further strengthen its collaboration with relevant bodies in the United Nations system and with all stakeholders.

1.1.5 IOC Secretariat was represented by Dr. Albert Fischer Head of the Ocean Observations and Services Section of Intergovernmental Oceanographic Commission(IOC)of UNESCO. He welcome the participants on behalf of the IOC/UNESCO. IOC has 148 Member States and working towards cooperation in ocean observations, services, policy, and science support of good governance of the ocean. High-level objectives of IOCare; climate mitigation and adaptation, operational services and early warning systems, safeguarding ocean health, identifying ocean science and emerging issues.

1.1.6 Dr. Fischer further mentioned that IOC is working towards 4 common UN frameworks:

- SDG 14 - IOC custodian agency measuring progress against targets related to OA and scientific capacity
- Paris Agreement of the UNFCCC
- Sendai Framework for DRR
- Samoa Pathway for SIDS

1.1.7 He emphasized the importance of SOT and identified its essential contribution of observations for climate and operational services, symbol of cooperation between government and industry, and between meteorology and ocean science. IOC hopes there is scope for more Carbon SOOP, GACS, deployment opportunities.

1.1.8 Ms. Champika Gallage welcomed the participants on WMO behalf. She emphasize the importance of in situ ocean observations and ship observations in particular. Further she mentioned several important decisions made by WMO bodies which are important and directly relevant to the SOT community.

1.1.9 Ms. Gallage highlighted the WIGOS pre operational phase as one of the current priorities for WMO. She further mentioned that WMO is currently working on the strategic priorities for next financial period from 2020-2023 where major changes can be expected, in particular focus on working with partner organizations and private sector, emerging technologies and data issues

1.1.10 During the opening addresses, all speakers highlighted their support for SOT based on the global need for marine observation networks. WMO and IOC thanked the International Maritime Organization for providing the excellent facilities to host the SOT-9 meeting.

1.2 Adoption of the Agenda

1.2.1The Panel adopted its agenda, as reproduced in Annex I

1.3 Working arrangements

1.3.1 The Panel decided on its working hours and other arrangements for conducting the session. The Joint Secretariat then introduced the documentation in accordance with the provisional agenda. Secretariat requested the members to review the draft meeting report that will be provided to the participants on Thursday evening and propose any changes before the finalization of the meeting report at the end of the meeting on Friday.

1.3.2 The list of participants to the session is reproduced in Annex II.

2. SCIENTIFIC AND TECHNICAL WORKSHOP

2.1. Ms Paula Rychtar (USA), Chairperson of the Scientific and Technical Workshop, opened the Scientific and Technical Workshop. The workshop introduced and reviewed new initiatives and / or new developments in shipboard meteorological or oceanographic instrumentation, observing practices, data management procedures, and quality control and ocean products. Members of the Team were invited to report on systems and related technical developments relevant to SOT, either within their own services and operations or with which they have otherwise been directly involved.

2.2. The following presentations were made during the workshop:

i. Current Experiments of XBT Fall Rate Equation at NOAA/AOML (by Dr. Francis Bringas)
ii. 50 Years of XBT Observations, More than 30 Years of Repeat XBT transects: Helping the Oceanographic Community Assess the State of the Ocean. (by Dr. G.Goni, Dr. J.Sprintall)
iii. CLS Satellite services for ocean observations (by Ms. Sophie Baudel)
iv. A simple way to explain the data flow into the GTS. (by Dr. Joaquin Trinanes)
v. JCOMMOPS Integrated coordination and monitoring tools demonstration (by Mr. Martin Kramp)
vi. Sterla- Introduction: objectives and functionalities (by Mr. Christophe Marquet)
vii. NCEI- ICOADS new release highlights (by Mr. Eric Freeman)
viii. Sailing meets science - Innovative Ocean Monitoring (by Mr. Stefan Raimund)
ix. KPI -integrated assessment of the surface marine obs system (by Dr. Elizabeth Kent)
x. The Autonomous eXpendable Instrument System(AXIS) – new scientific and monitoring capabilities (by Mr. Thomas Rossby)

2.3 Abstracts of all presentations are available in Annex III

3. REPORTS BY THE SECRETARIAT, OPA COORDINATOR, SOT CHAIRPERSON AND JCOMMOPS

3.1 Report from the Secretariat

Seventeenth World Meteorological Congress

3.1.1 Ms. Champika Gallage from the WMO Secretariat reported on the outcome of the Seventeenth World Meteorological Congress (WMO Cg-17, Geneva, Switzerland, 25 May–12 June 2015)[1]. The Team noted the following decisions of Cg-17 and urged its members to take it into account when developing their activities

3.1.2 CG-17 noted with concern the continued risks to the sustainability of the implementation of elements of the global ocean observing system (GOOS). Congress noted the good progress with regard to pilot activities such as the use of new satellite data telecommunication systems, Argo drifting floats, OceanSITES, technology developments, instrument intercomparisons, and impact studies. Congress expressed concerns that, other than the Voluntary Observing Ships (VOS) and drifting buoy components, the majority of the network depends on research funding rather than sustained network funding. Congress urged Members to consider sustained funding models

3.1.3 Congress noted with satisfaction the substantial contribution of observational data to WIGOS through monitoring programmes coordinated by the Marine Meteorology and Oceanography Program(MMOP) relying on the Observations Programme Area of JCOMM. Congress encouraged MMOP and JCOMM to continue to sustain and grow these observational programmes including the investigation of new methods and technologies (e.g. the use of submarine cables for climate monitoring and disaster warning). Congress urged Members to maintain and enhance their essential marine meteorological and oceanographic observation systems and to make available in real-time of the data collected by the systems, including ship-based sounding system, weather buoys, oil-rigs and the tide gauge network to WIGOS

3.1.4 WIGOS is one of the key priorities and objectives of the WMO. Congress decided that the development of WIGOS will continue during its pre-operational phase in the seventeenth financial period with the aim of having Members benefit from a fully operational WIGOS from 2020 onward. National implementation of WIGOS is one of the highest priorities of the for the WIGOS pre-operational phase. Members are urged to make necessary actions towards National WIGOS Implementation before 2020. Please refer to Annex I for details on Resolution 23 (Cg-17)[2]

3.1.5 Resolution 42 (Cg-17); amendments to the Manual on the Global Observing System (WMO-No. 544) recommend members should ensure that all research vessels, supply vessels and tourist ships operating in the Antarctic make regular surface synoptic observations at main and intermediate synoptic hours, and transmit these data in real time. When these data cannot be transmitted in real time they should be submitted in delayed mode or as historic data. Members should also ensure that vessels, whenever practicable, also make upper-air observations, and that any observations made are transmitted in real time. Further, members are also encouraged to arrange for making, recording and distributing in real time additional and extended observations from ships and stations in the Antarctic.

Seventh session of Observation Coordination Group

[1] - http://library.wmo.int/opac/doc_num.php?explnum_id=3138

[2] https://library.wmo.int/opac/doc_num.php?explnum_id=3138

3.1.6 Ms. Gallage reported on the outcome of the Seventh Observation Coordination Group(OCG-7) meeting that was held in Esporles, Spain (4-6 April 2016)3.

3.1.7 OCG-7 recommended SOT and VOS Chairpersons, together with PMO community to flesh-out issues regarding coordinating shipboard activities to minimize disruption to VOS crew and operators.

3.1.8 Further OCG-7 noted that commercial ships are recruited as observing platforms by multiple networks (Argo, Drifters, CPR, SOOP-XBT, VOS, pCO2, radiation, etc). OCG identified that there is potential benefit to coordinating, engagement with potential ships. Therefore OCG recommended that Chairpersons of SOT, VOS and ASAP with assistance from SOT TC to work towards a possible action plan to be taken up at the current SOT-9 meeting.

3.1.9 Detailed information on the OCG-7 meeting and other OGC related activities are reported under Agenda item 3.2.

Sixty-eighth Session of the WMO Executive Council

3.1.10 The WMO Secretariat representative reported on the outcome of the sixty-eighth Session of the WMO Executive Council (WMO EC-68, Geneva, Switzerland, 15–24 June 2016)4. In particular, the Team noted the following decisions of EC-68 and urged its members to take them into account when developing their activities in support of the SOT:

3.1.11 Initial version of the Guide to WIGOS5 to assist Members with the implementation of the WIGOS technical regulations; was submitted to CBS-16 and has been reviewed & endorsed. This includes: (i) Introduction to WIGOS, (ii) WIGOS Station Identifiers, (iii) WIGOS Metadata, (iv) Making WIGOS Metadata Available to WMO Using OSCAR/Surface, and (v) Observing Network Guidance. ICG-WIGOS requested to further develop and enhance the Guide to WIGOS with additional material as it becomes available.

3.1.12 Plan for WIGOS preoperational phase 2016-2019 adopted & kept under review by ICG-WIGOS. EC requested CBS & CIMO to provide technical lead in WIGOS preoperational phase. EC invites partners to participate in relevant implementation activities as specified in the Plan. Annex II (EC-68/Resolution 2).

3.1.13 Aspects of manuals managed by the CBS designated as technical specifications that may be updated using the simple procedure. The following components of Manuals and Guides directly applicable to SOT are designated as technical specifications to which the simple procedure may be applied (EC-68/Resolution 12).

- Manual on the Global Telecommunications System (WMO-No. 386)[6]. Attachment I-1 (Arrangements for the collection of Ships weather reports and oceanographic reports (BATHY/TESAC)), Attachment I-2 (Configuration of the Main Telecommunications Network), Attachment II-5 (Data Designators T1T2A1A2ii in abbreviated headings).

- Manual on the WMO Integrated Global Observing System (WMO-No. 1160)7. Appendix 2.4 (The WIGOS metadata standard)

3.1.14 EC-68 endorsed the mechanism for WMO recognition of long-term observing stations. The procedure will include, upon request by a Member, to select stations with at least 50 or 75 years of observations for intermediate-level recognition. Also marine Voluntary Observing Ships (VOS) and moored buoys could be recognized in collaboration with JCOMM (EC-68/Decision 40).

[3] - http://www.jcomm.info/JCOMM OCG-7

[4] - http://library.wmo.int/opac/index.php?lvl=notice_display&id=19656#.WK8DFlUrJtQ

[5] - http://www.wmo.int/pages/prog/www/wigos/WGM.html

[6] - http://library.wmo.int/opac/index.php?lvl=notice_display&id=10728#.WK8bllUrJtQ

[7] - http://library.wmo.int/opac/index.php?lvl=notice_display&id=19223#.WK8bzlUrJtQ

3.1.15 Having considered the need for continuation of the pre-operational testing of CryoNet, which resulted in some modifications of the CryoNet station/site concept, of the minimum requirements for stations/sites and of the procedure for testing stations/sites, ships can become GCW contributing station. Contributing Stations required to measure at least one variable of cryosphere component (e.g. snow, permafrost, sea ice, etc.). Contributing stations are those that provide useful measurements of the cryosphere but do not fulfil CryoNet minimum requirements, or in some other way do not provide the quality and/or consistency of data required by CryoNet stations; for example, where data records may be short or with large gaps. Mobile platforms such as ships, drifting stations and buoys may also be contributing stations. Contributing stations may have a long-term operational commitment and/or long-term (more than 10 years) data records (EC-68/Decision 50).

Sixteenth session of CBS

3.1.16 The WMO Secretariat representative reported on the outcome of the sixteenth session of the Commission for Basic Systems (CBS-16, Guangzhou, China, from 23 - 29 November, 2016). The team noted the following decision and recommendations of CBS-16 which are relevant to the SOT community :

3.1.17 CBS-16 considered that marine meteorological and oceanographic observations are not only required by climate monitoring and ocean applications, but also by other WMO applications areas such as numerical weather prediction(NWP). CBS, recognized the development of new implementation targets by JCOMM for the ocean observing networks and decided that improved support of members is required to implement Marine Meteorological and Oceanographic Observing Systems. Annex III(CBS-16/Decision 20)

3.1.18 There have been updates to the WMO Integrated Global Observing System (WIGOS) manual (WMO-No.1160) Metadata standard (Section 2, Appendix 2.4, Section 8-Technical Regulations). CBS-16 recommended the EC to adopt these updates and further recommended that the attachment to Appendix 2.4 be extracted from the Manual and be processed separately as a stand-alone attachment in order to facilitate frequent updating of its technical content (CBS-16/Recommendation 1).

3.1.19 The initial version of the Guide to the WMO Integrated Global Observing System(Guide to WIGOS)has been prepared by the Inter-Commission Coordination Group on the WMO Integrated Global Observing System (ICG-WIGOS).CBS-16 recommended the EC to adopt the initial version of the Guide to WIGOS and that the Council ensure that it be made available to Members in all WMO official languages (CBS-16/Recommendation 3).

3.1.20 The Manual on the Global Observing System (WMO-No.544) and the Guide to the Global Observing System (WMO-No.488) were reviewed to respond the WIGOS call for increased global standardization of observing technologies and techniques, and to address, in particular: WIGOS station identifiers, Automatic weather station (AWS) systems, Aircraft meteorological stations, Radar wind profiler (RWP) stations, Weather radar stations, and the Voluntary Observing Ships' (VOS) Scheme. CBS-16 recommended the EC to amend the WMO-No.544 and WMO-No.488 (CBS-16/Recommendation 4).

3.1.21 CBS-16 recommended that the EC that code tables supporting the WIGOS Metadata standard should be removed from the Manual on the WMO Integrated Global Observing System (WMO No. 1160) and the revised code tables supporting the WIGOS Metadata standard should be published using the web-based registry http://codes.wmo.int and become effective immediately(CBS-16/Recommendation 7).

3.1.22 Due to the inflexibility of the Traditional Alphanumeric Codes(TAC) and the difficulty and cost of implementing changes to TAC, the migration plan for Table Driven Code(TDC) forms were agreed at successive sessions of the CBS. CBS-16 recommended to the EC that no further development of the traditional alphanumeric codes should take place with the exception of those traditional alphanumeric codes prescribed by WMO for the International Civil Aviation Organization (ICAO) (CBS-16/Recommendation 10).

3.1.23 CBS-16 recommended that Members submit to OSCAR required WIGOS metadata for all observing stations for which observations are internationally exchanged through identified mechanisms. Thus SOT data must be submitted through JCOMMOPS (http://www.jcommops.org) which is the primary data holder for any marine meteorological and oceanographic observing systems (CBS-16/Recommendation 28).

3.1.24 Recommendation 29 made at CBS-16 focuses on the training plan for the use of OSCAR/Surface (web -interface) and urges members to contribute to this effort by offering expertise and resources, especially towards development of e-learning materials for OSCAR/Surface.

3.1.25 Having considered the importance of standardizing marine meteorological observations installed on ships with the view to providing homogeneous observational data of known quality, and to facilitate the maintenance of instruments and data acquisition equipment by Port Meteorological Officers (PMOs), CBS-16 recommended the EC to invite Members to collaborate in the European effort(E-SURFMAR through EUMETNET), to facilitate standardization of Automatic Weather Station (AWS) systems and their observations installed on ships as well as the maintenance of such systems by PMOs Annex IV (CBS-16/Recommendation 30)[8].

JCOMM Management -13

3.1.26 The thirteenth JCOMM Management meeting (JCOMM MAN-13)[9] was held in Geneva, Switzerland (18-21 January 2017). The Primary focus of the JCOMM MAN-13 was on preparation for JCOMM-5 meeting scheduled to be held in Bali Indonesia during 25-28October 2017.

3.1.27 JCOMM MA-13 recommended to improve coordination of activities on observations from ships under the Ship of Opportunity (SOOP) and Voluntary Observing Ship (VOS) programmes under SOT. It further recommended strengthening connections between biogeochemical observations and coordinated networks, such as underway pCO2 observations with SOT.

3.1.28 Co-presidents of JCOMM also requested to consider parallel meetings of DBCP and SOT, with joint sessions on common issues, e.g.. data management. Subsequent discussions between the JCOMM President and the Secretariat suggested that further discussions are required with the involved groups, including, DBCP, SOT, OCG and JCOMM-MAN before a firm proposal could be made.

3.1.29 JCOMM MAN-13 approved formation of a cross cutting Task Team for TPOS 2020, a cross cutting activity within the JCOMM structure, involving and linking all 3 JCOMM program areas. (the full report can be found online under JCOMM MAN-13 session)[10]

GCOS/WCRP Ocean Observing Panel for Climate (OOPC)

3.1.30 The OOPC had their 19th session[11] in Esporles, Majorca from 6-8th April, overlapping with the JCOMM Observations Coordination Group. In order to meet the observation needs of parent programmes and the range of stakeholders, OOPC has developed a set of EOV Specifications[12], in consultation with other GOOS panels, to meet the needs of climate, real time services, ocean health applications. OOPC is also working with JCOMM OCG to develop network specifications, with a clear articulation of network missions and targets. These specifications have informed enhanced network implementation/data delivery tracking through JCOMMOPS, and also underpinned the actions in the ocean chapter of the GCOS

[8] https://library.wmo.int/opac/doc_num.php?explnum_id=3505
[9] - http://www.jcomm.info/MAN-13
[10] - http://www.jcomm.info/MAN-13
11-www.goosocean.org/oopc19
[12]-www.goosocean.org/eov

Implementation Plan[13] (GCOS-200). Specific actions of relevance to SOT are listed at the end of this document.

3.1.31 The GCOS Implementation Plan was finalized in 2016, following an experts review followed by a public review. It was then presented to the UN Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP 22) in November 2016.

3.1.32 The next OOPC meeting will focus on the development of the OOPC workplan, future thematic evaluations (i.e. Boundary Current/Shelf interactions, and potential network reviews with OCG; including looking towards what should be showcased at the OceanObs19 Conference in Honolulu, September 2019.

3.1.33 TPOS 2020 was presented at the ICG-WIGOS with a proposal to consider as an operational PILOT of WIGOS. The ICG Co-Chairperson noted that the proposed TPOS 2020 activity posed a challenge, as there is no mechanism in WMO to look at inter-regional mechanisms other than those established bilaterally. It was noted that while JCOMM is the most logical home for TPOS 2020 activities, there is a need to have a conversation with other WMO and partner constructs such as CBS, CEOS. The ICG enthusiastically approved the proposal for TPOS 2020 to be a WIGOS Pre-Operational Pilot.

WMO Rolling Review of Requirements (RRR)UPDATE

3.1.34 The Panel was reminded about the Statement of Guidance(SoG) for Ocean Applications prepared for RRR, updated in 2016, which summarizes the key points that are related to SOT; A large part of marine and ocean observing systems is currently maintained by research funding with limited duration. This has the potential of leaving observational gaps unless ongoing funding for sustained observing networks is guaranteed. The ocean observing community should therefore ensure sustained funding for the key observing systems.

3.1.35 The SoG for Ocean Applications also emphasizes the fact that uneven geographical coverage of the in situ ocean observing network is an ongoing issue for ocean applications. Considering the regional variability in requirements as well as the need to ensure optimized planning for observing networks with limited resources, geographical variability in spatial/temporal resolution for ocean observations should be considered in network operations and plans. More ships traversing in data sparse area need to be recruited into the VOS program.

3.1.36 To address the identified gaps, it is recommended that ocean observing communities should (i) ensure that state-of-art technologies are employed to improve accuracy for all measurements; (ii) extend collaboration among themselves at national/regional levels to enhance wave measurement networks (e.g. wave observations from ships) and (iii) develop visibility measurement capability over the ocean (manual observations from ships are important contribution).

IOC governing body meetings

3.1.37 The IOC secretariat representative, Dr. Albert Fischer, reported on the outcomes of the 28th session of the IOC Assembly (June 2015) and the 49th session of the IOC Executive Council (June 2016). He recalled that the SOT was a contribution to the IOC-WMO-UNEP-ICSU Global Ocean Observing System (GOOS, goosocean.org).

3.1.38 GOOS is aimed at the delivery of the integrated and essential ocean observations needed for climate, operational ocean services, and ocean health. Ocean observations are part of a value chain that extends from innovation and research to sustained ocean observations and data management systems. There are then two major branches of information flow: one more operational, through ocean forecast systems to products, early warnings and marine

[13] -http://gcos.wmo.int

services; and one more scientific, through analysis, publications, indicators, assessments, and information for policy. Observing the oceans is an expensive endeavor, and a single GOOS serving multiple purposes increases the investment of each observing operator and Member State. GOOS activities are based on the Framework for Ocean Observing (doi:10.5270/OceanObs09-FOO), defining a common set of requirements and Essential Ocean Variables (EOVs), coordinating a broad set of in situ observations (through the JCOMM Observations Coordination Group and GOOS Regional Alliances), and interfacing with data management and information systems.

3.1.39 Noting a few IOC governing body decisions of interest to the SOT, the IOC secretariat representative recalled that:

- The 28th session of the IOC Assembly (2015) welcomed the contribution of the government of France to JCOMMOPS, and encouraged Member States to continue their support to JCOMMOPS.
- The 49th session of the IOC Executive Council (2016) established a scientific working group on deoxygenation (GO2NE). Amongst its terms of reference is an encouragement to align with the activities of existing observing networks, including those under JCOMM.

Global Climate Observing System

3.1.40 The IOC secretariat representative reported on the adoption of the WMO-IOC-UNEP-ICSU Global Climate Observing System Implementation Plan 2016 (IP 2016, available at gcos.wmo.int). The IP 2016 was developed to respond to the need of the UN Framework Convention on Climate Change (UNFCCC) requirements for systematic observations in support of its objectives, related to climate monitoring, mitigation, and adaptation. The IP 2016 was adopted by the UNFCCC at COP-22 (October 2016, Marrakech, Morocco), and covers requirements for systematic observations and data products for atmospheric, oceanic, and terrestrial domains. For the first time, it has a focus on the major climate budgets: carbon, energy, and water, and notes the importance of these observations (identified by Essential Climate Variable, ECV - many EOVs are also ECVs). Several actions specifically identify the SOT as an agent for implementation:

- Action O48: Underway observations from research and servicing vessels
- Action O49: Improve measurements from VOS
- Action O50: Improve measurements of underway thermosalinograph data
- Action O51: Sustain Ship-of-Opportunity XBT/XCTD
- Action O52: Coordination of underway pCO2 observations and agreed best practices
- Action O53: Underway biogeochemistry observations
- Action O54: Continuous Plankton Recorder surveys

details of these actions can be found in the Implementation Plan.

The Team was encouraged to use these actions in national efforts to raise funds and engagement for Ship Observation Team observations and activities.

OceanObs'19

3.1.41 Finally, the IOC secretariat representative reported on early planning actions for the OceanObs'19 conference to be held 16-20 September 2019 in Honolulu, Hawai, USA. The hosting sponsor will be NASA. The focus of the conference will be on connecting observers with the end user community, but it will provide the SOT an opportunity to showcase its observing efforts and present plans for the future. A Program, Local Organizing, and Sponsor Committee are now being formed. The Program Committee will focus on priority outcomes, the process for preparing the conference, community guidance, and engagement plans. The SOT is encouraged to sign up for updates at the oceanobs19.net web site.

Actions;

3.1/1 Improve the coordination of activities on observations from ships in the JCOMM framework and in particular. strengthen the connections between biogeochemical observations and coordinated networks, such as underway pCO2 observations with SOT.(SOT TC with SOT members, ongoing)

3.1/2 SOT members to make use of initial version of the "Guide to WIGOS" in the implementation of WIGOS in national/regional levels.(SOT members, ongoing)

3.1/3 Members are requested to maintain and enhance their essential marine meteorological and oceanographic observation systems and to make available in real-time of the data collected by the systems, including ship-based sounding system.(SOT members, ongoing)

3.1/4 Members should encourage all research vessels, supply vessels and tourist ships operating in the polar regions make regular surface observations and transmit these data preferably in real time and/or delayed mode.(SOT members, ongoing)

3.1/5 Members should submit complete metadata from ships, stations and cruises to JCOMMOPS which is the primary entry point of marine platform metadata to OSCAR system.(SOT members, ongoing)

3.1/6 Members are requested to transition from Traditional Alphanumeric Codes to Table Driven Code for data dissemination to the Global telecommunication System at their earliest.(SOT members, ongoing)

3.1/7 Requested improved support of members to the implementation of marine meteorological and oceanographic observing systems.(SOT members, ongoing)

3.1/8 Request members to facilitate standardization of Automatic Weather Station (AWS) systems and their observations installed on ships as well as the maintenance of such systems by Port Meteorological Officers.(VOS members, SOT-10)

3.1/9 Member states that wish to contribute to the global ASAP by implementing and financing ASAP stations are encouraged to consult the ASAP Task Team for guidance and advice (SOT members, SOT-10)

3.2 Report from the chairperson of the observations programme area

3.2.1 Dr. Albert Fischer reported on the OCG activities. The OCG has increased activities in the inter-sessional period, including its work plan for 2015-2020, which is reviewed and updated at each OCG meeting. The work plan focuses on key activities to capitalize on the strengths and synergies across the observing networks, to improve the functioning and delivery of the observing system as a whole. Two new Vice Chairpersons have been appointed to support of the work plan; WMO/WIGOS (Jon Turton) and standards and best practices (Juliet Hermes), with 2 additional planned; data management (who will work closely with the DMPA) and new technologies.

3.2.2 A key highlight has been the development of clearer missions and targets for the networks, including Key Performance Indicators, which are updated monthly on the JCOMMOPS website. High-level KPI reports for WMO/IOC stakeholders are presently being developed. In addition, Network Specification Sheets for the various networks, that reference best practice documentation, have also been prepared.

3.2.3 The OCG's current work plan for 2015-2020 provides a basis for an extended vision and actions through to OceanObs19 and into the next inter-sessional period (2017-2022). The five current focus areas form a collective of fundamental functions that will continue, particularly in relation to the Framework for Ocean Observing: Observing System Requirements; Observing System Implementation; Observing System Metrics; Standards and Best Practices; and Data Management, Products, and Information.

3.2.4 With additional emphasis placed in the following areas to coordinate with/integrate new/emerging observing activities:

- Strengthening connections between biogeochemical observations and coordinated networks, e.g. underway pCO2 observations with SOT
- Polar (Arctic and Antarctic ocean observing)
- Connection to Regional initiatives (GRAs, TPOS-2020, SOOS, AtlantOS, etc.)
- Biological ocean observing (intersections with existing OCG networks)
- Emerging new technologies, to consider methods to systematically assess their suitability for wide scale deployment and integration within existing activities
- Provision of information and products
- Transitioning NetCDF to BUFR real-time data reporting template

3.2.5 OCG-7 action items related to SOT community are in Annex I of SOT-9-Doc-3.2. Of particular note is the desire to develop a more coordinated recruitment and engagement strategy to address increasing need for VOS platforms and their contributions towards multiple observing requirements.

Actions:

3.2/1 Review the action items from OCG-7 in Annex I of session report 3.2and report back at the OCG-8 (SOT-Vice Chairperson and SOT TC,OCG-8)

3.3 Report from the SOT Chairperson

3.3.1 Mr. Shawn Smith Vice Chairperson of the SOT reported on behalf of the outgoing SOT Chairperson who could not attend the meeting The SOT chairperson, Chris Marshall, sent his regrets to the SOT regarding his inability to attend SOT-9 and also notified SOT that he was stepping down from his role as SOT chairperson. The Panel recognized and thanked Mr. Marshall's contributions to SOT and wish him well.

3.3.2 SOT is therefore seeking a new Chairperson, which was addressed in the SOT succession planning (item 12.3). Self-nominations are welcome.

3.3.3 The outgoing Chairperson, Vice Chairperson, and the SOT TC proposed the creation of a SOT Executive Committee (item 12.2). The Executive Committee will meet on a regular schedule via WebEx to ensure that the key panels of SOT are aware of ongoing activities of the Team. This will support succession planning and personnel transitions within the SOT.

3.3.4 The unexpected departure of the SOT Chairperson resulted in no official report from the Chairperson for the past intersessional period. Mr. Smith, Vice-Chairperson, was not actively engaged with SOT management group during the intersessional period, but from recent contact with Mr. Marshall provided a brief report on the Chairperson activities.

3.3.5 Mr. Marshall noted that there is a lot of changes within WMO/IOC and the technical approaches to marine measurements that will affect the way SOT achieves its mission.

- WIGOS is moving into its "prototype" phase, raising opportunities and challenges for SOT regarding metadata standards (e.g., Pub 47 migration to JCOMMOPS), platform identifiers (new SOT ID scheme), etc.
- New satellite systems, advancements in AWS, and new observing platforms (autonomous vessels, crowd sourced observing) provide new capabilities for SOT.

3.3.6 Mr. Marshall recognized the need for more coordination between SOT and other panels (e.g., DBCP) that need access to ships to make measurements. For example, there is a need to coordinate inspections of ships by PMOs, and other personnel when a vessel is in port (avoiding multiple requests to single ships, redundant or competing information). This is one purpose of the proposed ship owner's forum which will be the topic of a panel discussion at the current SOT-9 session.

3.3.7 Mr. Marshall noted there is an opportunity for SOT to further engage the IOC and World Ocean Council (WOC) to address a top down approach to vessel recruiting that would provide the shipping community with a unified list of "tasks" that SOT and other panels request from an operator.

3.3.8 To move forward with a coordinated approach, the Team will discuss options for joint workshops and cross-cutting task teams with DBCP (and possibly other panels if appropriate). Cross-cutting teams will be discussed in item 7.2.

3.4 Report from JCOMMOPS (incl. from the SOT Technical Coordinator)

3.4.1 Argo program Technical Coordinator, Mathieu Belbeoch reported on JCOMMOPS developments and the meeting noted with appreciation that JCOMMOPS has achieved many important results for the benefit of the ocean observing networks during the intersessional period, JCOMMOPS currently has 5 staff members (as of March 2017: 2 network coordinators for Argo, SOT/GO-SHIP/Cruises; 1 coordinator for science and communication; 2 IT engineers. The DBCP/OceanSITES TC position has been vacant since September 2016).

3.4.2 Achievements include:

- Implementation of a new information and data management system
- Development of an ambitious website theme for each JCOMMOPS-coordinated network and also an integrated perspective
- Development of a cross-cutting Cruise Coordination and Information System
- Operationalization of core services such as production of harmonized monthly maps
- Development of harmonized Key Performance Indicators (KPI)
- Improved internal organization and efficiency through regular team meetings and work plan tracking

3.4.3 The meeting noted that the JCOMM Management Committee, at its last session (MAN 13), has inter alia:

- invited the secretariats to facilitate JCOMMOPS budget management as far as possible
- decided to promote JCOMMOPS office work during the next JCOMM session
- decided to encourage all implementers to make sure their observing platforms and planned cruises are registered through the JCOMMOPS system for a rigorous monitoring, with unique identifiers allocated by JCOMMOPS, and decided to prepare an appropriate recommendation for the next JCOMM conference
- noted the opportunity for JCOMMOPS to provide coordination for a number of emerging observing systems including gliders, marine mammals, and perhaps HF radars, regional and coastal networks. Expansions into these areas are dependent on JCOMM OPA engagement and more importantly, extra financial resources. First steps have been done recently for GLOSS
- decided to review the Terms of Reference of JCOMMOPS
- acknowledged the strong support of US (NOAA) and France (Brittany local authorities, Coriolis, ESURFMAR, Ifremer, CLS) for JCOMMOPS, and recognized the need to broaden the support of JCOMMOPS

3.4.4 The meeting recalled that Martin Kramp was recruited as JCOMMOPS Ship Coordinator for an 18 months long pilot project in February 2013, with 30% of his time dedicated to the Ship Observations Team. The position was initially created with a fixed-term French CLS contract, afterwards maintained through 2 WMO consulting contracts (SSA), then opened as IOC position, and is after 4 short IOC contract extensions now in transition to WMO as a secondment from UNESCO.

3.4.5 The meeting agreed that the SOT Technical Coordinator position had shown its value and should be maintained long-term, in more stable conditions than before. The meeting also agreed that 30% of a full time employee (FTE) cannot cover all SOT relevant tasks, and discussed how a harmonization could be achieved in comparison to the DBCP coordinator (66% FTE), In particular in terms of funding, i) should be shared by more members, ii) be clearly structured in terms of SOT TC salary and travel budget, and iii) be overseen by an appropriate

SOT body. The meeting also agreed that the SOT TC relies on the JCOMMOPS infrastructure and IT support team, which thus require appropriate contributions.

3.4.6 The SOT Technical Coordinator, Martin Kramp thanked all members and in particular the Tasks Teams for the excellent cooperation in the intersessional period. He reported on his activities and highlighted in particular that he:

- controlled the flow of platform and observation metadata into the JCOMMOPS system, where metrics and maps are calculated and published in a more automated manner and with clear schedules
- attended international meetings and teleconferences as appropriate in the intersessional period, to represent the community
- maintained all SOT mailing lists and organized numerous intersessional teleconferences with all Task Teams; he actively contributed to the work of these groups, including actions, reporting and succession planning
- reported that the WMO secretariat tasked him at SOT-8 with the management of the SOT action item list, in which he i) eliminated duplicates, ii) established progress classes, iii) identified routine actions, and iv) introduced a relevance field for SOT-9 agenda item 4 (actions), with the aim to reduce the number of actions that must be discussed to a reasonable number; even without SOT-relevant actions from PMO, OCG and TT meetings, the number remains very high
- stressed that i) unique identifiers for all SOT platforms, and ii) migration of SOT metadata formats to WIGOS standards, are critical issues for the SOT, but that the TTs have developed good strategies to address them
- initiated a test series for the proposed new ID scheme with key VOS operators around the world, which had not shown any important data processing issues
- stressed that separating platform metadata (e.g. sensor information) from ship metadata (e.g. length) will allow for a better use and measurement of ship contributions across all JCOMM in-situ networks, taking particularly into account that the same ship possibly hosts or deploys a number of platforms from different networks and different international operators
- stressed that all JCOMM networks should therefore refer to a centralized JCOMM ship list, and he recommended i) the use of ICES codes as unique hull identifier for ships without IMO number, and ii) JCOMMOPS as coordination body for the ship list
- reported that a JCOMMOPS-internal common metadata structure and vocabulary had been created for all JCOMMOPS-coordinated networks, which allows for an integrated metadata management, but also imposes some adaption by the networks; all platforms (e.g. buoys, ship stations) belong to a master program (e.g. DBCP, SOT) and follow a platform-family/platform-type/platform-model granularity. Cross-cutting harmonization is in particular required for communication systems (prst in Pub47)
- reported that the migration of the E-SURFMAR metadata base to JCOMMOPS will take place in several steps and be part of the general migration to WIGOS metadata standards. The meeting noted that the WMO OSCAR Surface system is currently fed by JCOMMOPS with a limited set of SOT platform metadata, and will be fed with more exhaustive metadata after this transition
- helped maintaining, fostering or setting up cooperation agreements with civil society or industry partners, all aiming to involve more ships in volunteer contributions to the ocean observing networks and in particular in under-sampled areas
- initiated at the request of the OCG Chairperson an online survey focusing on opportunity ship needs and issues for all JCOMM/GOOS panels. Chairpersons and Coordinators from such panels had been invited to develop and contribute to the survey
- initiated a non-finalized community discussion on a name or acronym for a new, over-arching umbrella program/label for all volunteer ship operations (e.g. hosting SOT platforms, or deploying DBCP and Argo platforms) aiming to harmonize communication between ship owners/officers and JCOMM networks
- worked with the VOSRPP TT i. a. on a proposal for a "Ship Owners Forum", aiming to bring together representatives from all concerned international agencies (e.g. IOC, WMO, IMO, IHO), observing networks (e.g. SOT, Argo, DBCP), shipping community

(e.g. owners, officers, ICS) and other bodies (e.g. WOC) to discuss a joint strategy, based on the preceding items

- reported that progress has been made with using satellite AIS as information source for i) identifying inactive SOT ships and ii) identifying non-SOT ships which repeatedly transit data sparse areas and thus should be prioritized in recruiting activities. It is not clear yet which financial engagement might be needed to operationalize such a tracking
- The meeting thanked the TCs for the good progress made in the intersessional period, and made a number of decisions and recommendations

Actions;

3.4/1 —Stabilize the position of the SOT Coordinator at WMO.(Secretariat, asap)

3.4/2 —Strengthen support for JCOMMOPS infrastructure so that challenges with SOT metadata and identifier developments can be properly addressed.(SOT members, ongoing)

3.4/3 —General JCOMMOPS mailing lists for SOT, VOS, SOOPIP and PMO: While the Task Team mailing lists are manually synchronized with the reference information at jcomm.info, the general mailing lists are open and comprise numerous outdated records; SOT TC, with assistance from SOT Executive Board, to conduct a clean-up.(SOT TC, EXB, July 2017)

3.4/4 —SOT Executive Board to discuss more efficient management of condensed action item list, with improved reporting and regular reviews in the intersessional period, and possibly larger focus, e.g. PMO, OCG, JCOMM, TT meetings.(EXB,SOT-10)

3.4/5 —Investigate further how (in terms of costs, procedures, regulations) AIS information could be better used to i) identify inactive platforms (lack of motivation or technical issues) and ii) identify non-recruited ships which repeatedly sail in under-sampled ocean areas and could thus be beneficial for SOT and other observing panels.(JCOMMOPS, SOT-10)

3.4/6 —TT KPI to also make recommendations on criteria for VOS to be considered as inactive, or closed with the aim to have more representative statistics of the operational networks, which currently take into account hundreds of outdated records. (TT-KPI, Sep 2017)

3.4/7 —Investigate how WIGOS metadata fields and reference tables are governed, with the aim of achieving a higher flexibility and speed for structural changes in SOT metadata than currently the case with Pub47.(TT VOS Metadata, Secretariat, JCOMM 5)

3.4/8 —The role of PMOs includes the support of other observing panels to some extent, but more harmonized and cross-cutting operations could increase these needs; the SOT should investigate if this creates issues with regard to resources, competences and funding.(EXG, PMO 6)

3.4/9 —The recommended new SOT ID-Scheme does not comprise any ship or country reference and basically works like a global Mask-to-Real list, maintained by JCOMMOPS; given that encode/decode will require a complex procedure with the setting up of a corresponding JCOMM focal point for the management and regular submission of keys, the meeting agreed to recommend discontinuation of the encode/decode and SHIP masking schemes, A corresponding new resolution must be prepared for WMO validation.(TT-Masking, 15 May 2017).

3.4/10 —Members to submit cruise plans to JCOMMOPS whenever possible and with the biggest possible lead time, aiming to achieve a better view on upcoming operations, and to exploit more synergies, e.g. by deploying autonomous instruments from SOT ships in data sparse areas.(SOT Members, ongoing)

3.4/11 —Ad-hoc TT on WIGOS IDs to continue its work until next OCG meeting, to develop a decision tree for assigning new IDs (e.g. change of operator, change of system, change of ship.(TT-WIGOS ID, June 2017)

3.4/12 —Review LES list, and in particular incorporate information on acceptance of compressed data and corresponding SAC by LES, and accepted observing hours.(TT-ISSC, with support from Mr. John Dodd, INMARSAT, SOT-10)

3.4/13 —As part of Pub47 to WIGOS migration, review current telecom reference table with the aim to i) harmonize with the JCOMMOPS standards and ii) better represent dependence of the SOT from individual Satcom providers, in particular for observations sent by e-mail.(TT-ISSC, SOT-10)

3.4/14 —: Working group on KPIs and targets to also review JCOMMOPS QC relay tool and corresponding procedures/targets, taking into account the new Météo-France QC synthesis list and upcoming changes at the MetOffice RTMC.(TT-KPI , December 2017)

3.4/15 - With the aim to better coordinate and measure ship operations across networks, JCOMM panels to refer to a shared ship list with ICES ship codes as primary unique identifiers in all ship related operations (onboard installations, float and drifter deployments or recoveries, mooring maintenance, etc.) and JCOMMOPS to host this list and lead a discussion regarding the governance over ship metadata, which ideally would be synchronized with a formal ship register like Lloyds.(JCOMMOPS, Nov 2017)

3.4/16 - OCG to promote the use of the JCOMM Ship list across all networks.(OCG, JCOMM 5)

3.4/17 –Many VOS stations are already connected with the ship's navigation unit to obtain in particular true heading data, with depth information often available from the same data stream; IHO and VOS should therefore investigate how to exploit synergies.(VOS Chairperson, IHO SG, TT-HRMM, October 2017)

3.4/18 –Investigate if partnerships could be achieved with e.g. sailing marinas in critical locations like Panama, or sailing NGOs, aiming to promote the work of the observing programs and recruit ships, and to facilitate logistics with ships that can carry only a small number of instruments.(TT-RPT, SOT-10)

3.4/19 –Based on a recommendation from the DMCG, investigate if QC flags should be incorporated in to the VOS BUFR template, and/or if "third party platform" should be added as value for sequence 003022.(TT-TDC, TT-VOS Metadata , SOT-10)

4. REVIEW OF PENDING ACTION ITEMS FROM SOT- 8

4.1 Mr. Kramp reviewed open action items from previous SOT meetings. The updated action item list is available through JCOMMOPS permanent link[14]. The Meeting decided to separate the ongoing action items as a separate document that can be developed to a SOT best practises document.

5. REPORTS BY ASSOCIATED ORGANIZATIONS AND PROGRAMMES

5.1 Associated Organizations

5.1.1 International Maritime Organization (IMO)

5.1.1.1 Mr. Osamu Marumoto presented the IMO activities and their importance to SOT community. He mentioned that there is an established IMO framework under existing

[14] ftp://ftp.jcommops.org/SOT/Actions/SOT-Actions-previous.pdf

mandatory and recommendatory IMO instruments regulating international shipping relating to ship observations. The last guidance document issued by the IMO (MSC.1/Circ.1293)on the subject days back to 2008.

5.1.1.2 IMO Member States and international organizations are meeting at an annual interval in London at NCSR Sub-Committee sessions to specifically discuss the subject on safety of navigation. Consideration could be made to use this opportunity to raise awareness of the work undertaken by SOT, as well as remind the IMO membership of the existing obligations and recommendations under IMO instruments.

5.1.1.3 SOT to note the existing global framework under the auspices of IMO on ship observations and to consider, if deemed appropriate, submission of a document to the future session of the Sub-Committee of Navigation, Communications and Search and Rescue (NCSR) to raise awareness of the IMO Member States and the international shipping community on the subject, in particular, SOLAS obligations to Contracting Governments and promotion of participation in the VOS scheme.

5.1.1.4 Responding to a question raised at the meeting, Mr Marumoto advised that proposals for any changes to the SOLAS Convention or any recommendations to the IMO must be submitted by a member state before 13 weeks of the meeting. He further offered to assist on such requests from WMO and IOC.

5.1.2 International Chamber of Shipping (ICS)

International Chamber of Shipping (ICS) activities were presented by Mr. John Murray

5.1.2.1 The International Chamber of Shipping (ICS) is the principal international trade association for the shipping industry, representing ship owners and operators in all sectors and trades. ICS membership comprises of national ship owners' associations in Asia, Australia, Europe and the Americas whose member shipping companies operate over 80% of the world's merchant tonnage.

5.1.2.1 ICS is concerned with all technical, legal, employment affairs and policy issues that may affect international shipping and represents ship owners with the various intergovernmental regulatory bodies that impact on shipping, including the International Maritime Organization (IMO)

Feedback on the Voluntary Observing Ship (VOS) Scheme

5.1.2.3 ICS supports and encourages the VOS Scheme amongst its Members through the ICS Radio & Nautical Sub-Committee and many shipping companies either require or strongly recommend that ships actively participate in the VOS Scheme. Ultimately this reflects the significance of weather in safe and efficient ship operations. ICS does however recognise that greater levels of participation are always desirable.

5.1.2.4 The feedback from ICS Members on the use of electronic logbooks and automated weather stations, where installed, is positive. In this regard ICS has identified no decisions or actions for this session of the Ship Observation Team.

5.1.2.6 However, ICS recognises that the provision of accurate and consistent observations is essential for the generation of reliable forecasts. ICS considers that there are opportunities to enhance the collection and reporting of observations, taking into account other aspects of ship operations which require the attention of the crew. In this regard, ICS would support any appropriate initiative to enhance the quality and efficiency of reporting by increasing use of automatic weather stations (AWS). Such systems should, so far as is technically possible, observe, collate and send data to the relevant shore-based authority, without the intervention of the crew.

Future collection of observations from ships

5.1.2.7 In the future, and particularly as international shipping becomes more connected to the shore, the demand for data from ships is anticipated to increase. This includes but will not be limited to observations collected under the VOS Scheme and initiatives such as the International Hydrographic Organization (IHO) crowd-sourcing of bathymetry data. Consequently, ICS sees the potential need for international organizations requesting participation of ships in meteorological, hydrographic and oceanographic data collection schemes to further coordinate such efforts.

5.1.2.8 In particular, whilst automated data collection systems are considered to bring significant benefits for the VOS Scheme, consideration should be given to the use of a single 'black box' solution serving the data collection needs of all international organizations wishing to collect meteorological, hydrographic and oceanographic data. Such a combined system would collect data from all the relevant sensors on board and make this information available for international organizations to download on demand. The data would be pulled from ships, rather than pushed in a report by ships and could yield the opportunities for near-real time observations.

5.1.2.9 In order to support the proposal in paragraph 5.1.2.7 above, further engagement with the IMO may be necessary, particularly were additional connectivity to type-approved ship sensors is required. Similarly, managing the costs for States of on-demand availability of data in near-real time may require engagement with the International Telecommunications Union (ITU).

5.1.3 World Ocean Council

5.1.3.1 Mr. Paul Holthus reported on World Ocean Council (WOC). The World oceans are used in multiple areas; shipping, fisheries, deep water oil, seabed mining, off-shore winds, tourism and submarine cables are few of them. WOC which is an International, cross-sectoral business leadership alliance with 70+ members brings ocean industries together. The goal of the WOC is a healthy, productive global ocean and its sustainable use and stewardship by responsible ocean business community. WOC provide business value for responsible companies through providing;

- Access and social license for responsible ocean use
- Synergies and economies of scale in addressing issues
- Stability and predictability in ocean operations

5.1.3.2 WOC Members include a growing number of research and academic institutions working closely with the private sector to; bring research/academic institutions together with large ocean industry operators who are in need of science, technology and solutions; foster and facilitate science-industry collaboration in identifying priorities and setting the research agenda relevant to sustainable development; and create opportunities for institutions with innovative, solution-providing research, technology and services.

5.1.3.3 Major cross cutting framework areas of WOC with SOT are Sustainable Development Goals (SDGs) for the Ocean Business Community, and Ocean Investment Platforms. Among many program and theme areas of WOC, Improving Ocean Knowledge under the theme, Smart Ocean / Smart Industries provides data from industry vessels/platforms of opportunity. This is an area directly linking with SOT activities. Another theme area directly connected to the SOTis climate change where ocean acidification is monitored.

5.1.3.4 Under the theme, Smart Ocean / Smart Industries,WOC engages scientific institutions and organizations to identify, priority data collection needs and areas, and appropriate cost-effective, ship-suitable technology. WOC also identifies and recruits companies with vessels/platforms operating in the priority areas which are interested and capable of hosting instruments. It also instigates supports and facilitates working relationship between the companies and scientific institutions. WOC ensures industry data collection efforts are efficient, cost effective and contribute to national and international public science programs

5.1.3.5 WOC identified the tsunami detection opportunity using ships traversing tsunami prone areas of the ocean by using a geodetic GPS on ships to transform them into floating tide-gauges that can detect tsunamis in open ocean. This is currently in pilot phase refining methods for filtering time series and improving resolution of tsunami events.

5.1.3.6 The WOC 6th Sustainable Ocean Summit (SOS) will take place in 29 Nov – 2 Dec 2017 in Halifax, Canada.

5.1.4 International Hydrographic Organization

5.1.4.1 Mr. Robert Ward presented the activities of International Hydrographic Organization(IHO)

5.1.4.2 Both the Moon and Mars have been more comprehensively mapped than the world's seas and oceans. Contrary to popular belief, less than 15% of the depth of the world's ocean waters (waters more than 200 metres deep) have been measured directly. Barely 5% of the ocean area has been mapped using multi-beam echo sounder technology. Only about 50% of the world's coastal waters (waters less than 200 metres deep) have ever been surveyed.

5.1.4.3 Bathymetry (a knowledge of the depth and shape of the seafloor) underpins the safe, sustainable, cost effective execution of almost every human activity that takes place at sea, yet most of the seafloor remains virtually unmapped, unobserved, and unexplored.

5.1.4.4 Target 14.a of the UN 2030 Sustainable Development Agenda seeks to increase scientific knowledge of the ocean. In this context, a knowledge of the depth and shape of the seafloor is an underpinning and fundamental scientific dataset.

5.1.4.5 The IHO is committed to the collection and management of reference bathymetric data sets required for modelling the different ocean and coastal mechanisms, in particular through the programme of the General Bathymetric Chart of the Oceans (GEBCO), which is co-governed by the IHO and the IOC, and the IHO Data Centre for Digital Bathymetry (DCDB) that acts as the global data repository for publicly available bathymetry of the world's oceans, seas and coastal waters, including the underpinning data for GEBCO.

5.1.4.6 The IHO is now encouraging innovative supplementary data gathering and data maximizing initiatives, to increase mankind's knowledge of the bathymetry of the seas, oceans and coastal waters including crowd-sourced bathymetry (volunteered geographic data).

5.4.1.7 The advent of particularly inexpensive data loggers means that it is now possible to use existing equipment in a non-intrusive way for all seafarers to collect and render bathymetric data to the IHO DCDB. Most ships are inherently capable of measuring and digitally recording the depth in coastal waters using existing ship's equipment and an increasing number of vessels are capable of taking measurements in deeper water using existing ship's equipment. This is particularly so for scientific vessels.

5.4.1.8 The IHO has recently established a crowd-sourced bathymetry working group (CSBWG) to encourage all vessels engaged at sea that are equipped with appropriate technology, to collect bathymetric data as part of their normal operations – in the same way that mariners currently and routinely observe the weather and make other marine environmental observations.

5.4.1.9 The CSBWG, which is open to IHO and IOC Member States and individual expert contributors representing academia and industry, is providing guidance on such things as minimum metadata requirements, data transfer standards, ways to optimise the value of the collected data, considerations for users to assess the uncertainty of the data in the database, and legal considerations for both observers and users of the data. A first draft of the IHO guidelines on crowd-sourced bathymetry will be distributed for public comment later in 2017. The IHO guidelines on CSB are expected to be adopted by the IHO in late 2018.

5.4.1.10 For all the reasons explained above, the IHO invites the SOT to consider including in its doctrine the measurement, recording and rendering of depth data as a routine environmental observing activity to be undertaken at all times when vessels are at sea and where no restrictions apply.

5.4.1.11 Against a background of little or no knowledge of the depth and shape of most of the world's seafloor, almost any data is better than no data. It therefore follows, that any observations are potentially valuable and should be rendered, whether they have observed the IHO guidelines or not. This includes both data yet to be collected, but most significantly, also includes any data that has already been collected, but its existence has not yet been declared to the IHO DCDB. Which, in effect, this means that the data is not part of the global bathymetric dataset and is not easily discoverable by many potential users.

5.4.1.12 Accordingly, the IHO invites the SOT to encourage all its contributing members to declare the existence of bathymetric data to the IHO DCDB; and wherever possible, to submit the data to the DCDB, or to provide metadata and access availability information.

5.4.1.13 The IHO CSB guidelines seek to assist observers to maximize the utility of their observations by following certain procedures. However, these are designed to introduce a minimum impact on other operations. In any case, all observers are being encouraged to render data regardless of the technology or methodologies used.

***Actions**;*

5.1.4/1 Consider including in its doctrine the measurement, recording and rendering of depth data as a routine environmental observing activity to be undertaken at all times when vessels are at sea and where no restrictions apply. (EXG, SOT-10)

5.1.4/2 Declare the existence of bathymetric data to the IHO DCDB; and wherever possible SOT Members should

(1) submit the data to the DCDB, or
(2) provide metadata and access availability information(SOT Members,SOT-10)

5.1.5 International Mobile Satellite Organization (IMSO)

5.1.5.1 The Director General of IMSO made a presentation on its role in maritime safety communications, in particular, for distress and for maritime safety information (MSI). In his presentation, the Director General stated that IMSO as the global intergovernmental body has been entrusted with the responsibilities by the SOLAS Contracting Governments at IMO to oversee the provision of satellite communications services under the "Global Maritime Distress and Safety System (GMDSS). With a similar objective of safety, IMSO has also been given the mandate by the SOLAS parties for the coordination of the international system on the Long-Range Identification and Tracking of ships (LRIT).

5.1.5.2 In the context of IMSO's role on the GMDSS oversight the Director General mentioned that currently Inmarsat is the only recognised GMDSS service provider and he gave an account of the procedure it follows to ensure the satellite network: resilience, availability and restoration of services by the provider(s) in accordance with the IMO rules. He added that recently IMSO has been invited by IMO to conduct the Technical and Operational Assessment of Inmarsat's FleetBroadband System, which is going to start in near future.

5.1.5.3 Regarding the recognition of additional service provider for the GMDSS service, the Director General added further that at the invitation of IMO, IMSO has also been conducting the Technical and Operational Assessment of Iridium for the possible recognition as a new GMDSS service provider.

5.1.5.4 On the issue of working relationships with other organizations, he highlighted that IMSO has been working among others, with IHO and WMO on the Maritime Safety Information

(MSI) for Navigational Warnings and Meteorological forecasts/warnings. IMSO works closely with WMO under a Memorandum of Understanding (MoU).

5.1.5.5 The Director General concluded that having attended SOT 9 meeting for the first time, IMSO had the opportunity to have an insight about the role of the Team and expressed his willingness to render all possible cooperation to the Team's work within appropriate scope.

5.2 Associated Programmes

5.2.1 Global Ocean Ship-Based Hydrographic Investigations Programme

5.2.1.1 The overall aim of GO-SHIP is to bring together scientists with interests in physical oceanography, the carbon cycle, marine biogeochemistry and ecosystems, and other users and collectors of hydrographic data to develop a globally coordinated network of sustained hydrographic sections as part of the global ocean/climate observing system. It is supported by JCOMMOPS with Martin Kramp as the Go-SHIP coordinator(part time 33%) with financial support from Australia, the US, and the EU through Atlantos.

5.2.1.2 Information on recent and planned GO-SHIP cruises have been gathered in JCOMMOPS and is available at http://www.go-ship.org/CruisePlans.html.

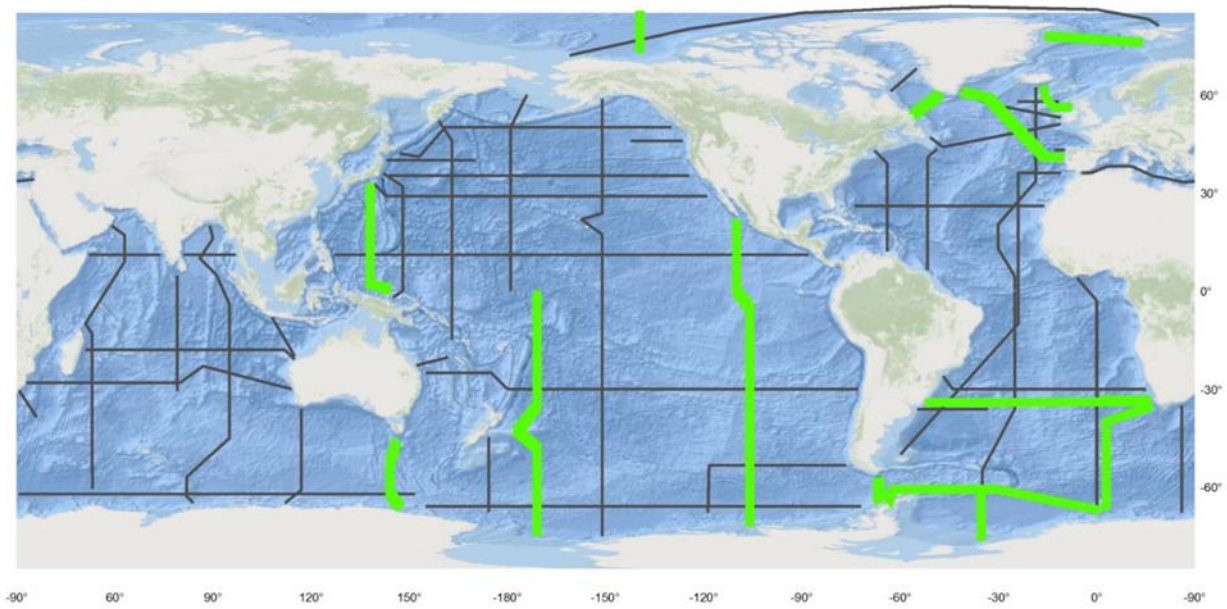
5.2.1.3 In 2016, seven reference sections (one in the Atlantic, two in the Indian, three in the Pacific, and one in the Southern Ocean) have been completed in addition to the total of ten high-frequency and associated sections. South African and Brazilian associated sections in the South Atlantic were connected coast-to-coast by a German cruise on the RV Meteor in spring 2016. Eighteen cruises have been planned (11 funded) for reference sections in 2017 and beyond. Five cruises of the have been planned for the reference sections in the Indian Ocean, including I07N by US, which has not been occupied since 1995, and others by Australia and Japan. Ireland, with support of core measurements by Atlantos, and USA involvement, is planning to conduct A02 cruise, which has been accepted by planning commission for 2017.

5.2.1.4 GO-SHIP Repeat Hydrography Manual ("Hydro Manual") (http://www.go-ship.org/HydroMan.html) which is the authoritative handbook for best practices on measurements, so called standard operating protocols (SOP) on GO-SHIP is now under considerations for an update. In its current edition (V1), a chapter on the measurements of dissolved organic matter (DOM) is missing. The Hydro Manual also does not include SOPs for fluorescence or backscattering. This is urgently needed as GO-SHIP cruises are the venues of choice for deployment and validation of Biogeochemical Argo (BGC Argo) floats that carry these sensors. Operators of the floats often rely on GO-SHIP data for Calibration/Validation. Underway measurements also require better documentation. SCOR nutrients working group is expected to provide a corresponding update in the manual. For all BGC parameters recommendations will be provided by the IOCCP in the next year. Other chapters that need updating include those for CTD methods and underway measurements. The ADCP chapter is also being looked at by experts who will provide a recommendation if changes are needed.

5.2.1.5 The GO-SHIP steering committee has created a set of GO-SHIP recommendations for national representatives prioritizing the following issues:

Priority 1: Sustained funding of the continuation of GO-SHIP including Secretariat support.
Priority 2: National support of GO-SHIP Data Centres.
Priority 3: Production of data products for informed national and international policy advice and decision-making.

5.2.1.6 In addition, GO-SHIP commits to transfer our knowledge and skill for high precision ocean measurements to evolving countries that are not already members of the GO-SHIP consortium.



Maps of GO-SHIP reference sections (black lines) with GO-SHIP occupations in 2016 through January 2017 highlighted in green.

5.2.1.7 It was noted that some of the GO-SHIP lines are the same as the XBT lines which provides the opportunity to assess and compare the status of the ocean between decadal measurements.

5.2.2 International Ocean Carbon Coordination Project

5.2.2.1 The following is a summary of activities of the International Ocean Carbon Coordination Project (IOCCP) presented by Mr. R. Wanninkhof, based on the teleconferences and in person meetings of the scientific steering committee. Full detail on IOCCP can be obtained from http://www.ioccp.org/

5.2.2.2 The International Ocean Carbon Coordination Project (IOCCP) focuses on implementing coordination actions with support from the sponsor organizations, IOC and SCOR for the secretariat of the project. The IOCCP coordinates a diverse set of activities to facilitate the development of globally acceptable strategies, methodologies, practices and standards, homogenizing efforts of the research community and scientific advisory groups as well as integrating ocean carbon programs and activities into globally integrated Earth system observing networks. The IOCCP is recognized as a successful model for global-scale coordination and has expand its mandate to include communication and coordination services for the full range of ocean biogeochemical variables (not only CO2) and to assist the global, regional, and national research programs, as requested, with coordination of research activities.

5.2.2.3 The IOCCP recently expanded interactions with the GOOS-GCOS-WCRP Ocean Observations Panel for Climate (OOPC) and the WMO-IOC Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM) to integrate ocean carbon observation and other biogeochemical information into the plans of the Global Observing Systems for Climate in support of the United Nations Framework Convention on Climate Change, the World Summit on Sustainable Development, the Group on Earth Observations, and other international and intergovernmental strategies. It has now taken on the official responsibilities of the GOOS panel on ocean biogeochemistry to develop an Integrated Framework for Sustained Ocean Observing (hereafter referred to as the FOO). The framework was published in May 2012 and the implementation process started shortly after.

5.2.2.4 The Carbon/Biogeochemistry panel under auspices of IOCCP, has through virtual and in-person meetings and workshops, defined set of Essential Ocean Variables (EOVs) for biogoechemistry that are promoted as fundamental measurements needed to address the

current scientific and societal ocean/climate-related issues. This should facilitate funding and execution of the interdisciplinary, integrated global ocean observing network (the improved, multidisciplinary GOOS).

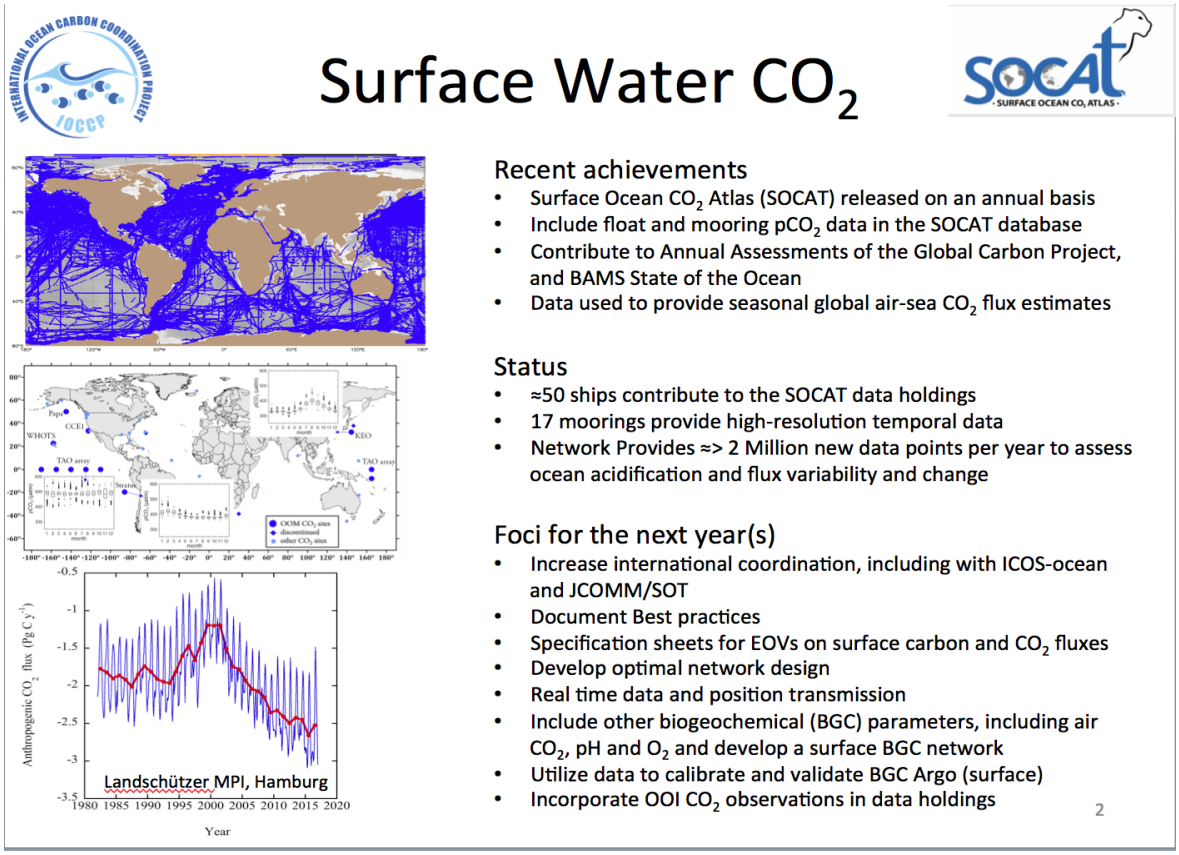
5.2.2.5 The main challenge is expanding the mission of IOCCP to represent the full set of ocean biogeochemical parameters. This includes developing the appropriate EOVs and producing the specification sheets. Negotiating with other panels who will take on new EOVs. For instance Ocean Colour has been adopted as a biogeochemistry EOV. IOCCP is seeking new steering committee members with the appropriate expertise to represent the new biogeochemical variables. IOCCP coordinates the implementation of the updates and releases of the surface ocean carbon atlas (SOCAT). The quality control of the annual releases is done be volunteers and entraining a core of qualified members for quality control remains a challenge. Improved automation of data ingestion and quality control is facilitating this effort.

5.2.2.6 IOCCP will continue to coordinate activities, including workshops and capacity building exercises in its core areas of:

- Underway CO2 Observations
- Ocean Interior Observations
- Time Series Efforts
- Synthesis Activities
- Ocean Acidification
- Nutrients
- Framework for Ocean Observing
- Data and Information Access Services
- Instruments and Sensors
- Technical Training Workshops
- Related Projects and Programs

5.2.2.7 A full description of the work plan can be found at www.ioccp.org under Documents/Meeting Reports. With regards to interactions with the SOT and JCOMMSOPS there will be continued focus on harmonizing efforts with the SOOP panel for surface water measurements, with OceanSITES for mooring based measurements, GO-SHIP for reference sections, and work with JCOMM to execute and support BGC Argo. With regard to SOT the emphasis is on assuring climate quality BGC validation efforts for the float sensors. IOCCP is also exploring mechanisms for JCOMMOPS to serve metadata and real-time position information of the SOOP-CO2 fleet.

Highlights of the surface water CO2 projects that include the SOOP-CO2 effort.



5.2.3 Shipboard Automated Meteorological and Oceanographic System

5.2.3.1. The Chairperson of the Shipboard Automated Meteorological and Oceanographic System (SAMOS) initiative, Mr. Shawn Smith (Florida State University, USA) reported on the activities during the intersessional period. SAMOS aims to improve the quality of meteorological and near-surface oceanographic observations collected in-situ on research vessels (R/Vs).

5.2.3.2. The SAMOS initiative focuses on high-temporal sampling (1-min. interval) meteorological and near-surface oceanographic data collected by the scientific instrument system (a SAMOS) permanently installed on individual R/Vs. The Chairperson noted that the SAMOS initiative does not provide instrumentation to R/Vs, but leverages instrumentation owned by the R/V operators. During the last period, the SAMOS data centre at the Florida State University (FSU) received and processed over 13 million one-minute marine data reports from 32 R/Vs operated by the U.S., Australia, and New Zealand. SAMOS data are collected from R/Vs via satellite email communications, undergo both automated and visual data quality control, and are distributed via the web (http://samos.coaps.fsu.edu/html/) and the U.S. National Centers for Environmental Information (https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.nodc:COAPS-SAMOS).

5.2.3.3. Personnel at the SAMOS data centre continue to partner with the U.S. VOS program to ensure that vessels transmitting 1-min data samples to SAMOS are also submitting standard VOS reports via the GTS. NOAA vessels in the U.S. use SEAS AutoIMET, while other R/Vs use custom software for their VOS reports, and these reports are independent of data sent to SAMOS via daily emails. SAMOS monitors many of the AWS used by VOS on Research Vessels(R/Vs), providing notification to operators when problems occur and aiding VOS by resolving sensor malfunctions. U.S. VOS aids SAMOS by collecting updated metadata when VOS personnel visit U.S. RVs.

5.2.3.4. SAMOS continues to support the JCOMM ETMC, primarily via provision of a subset of SAMOS observations for inclusion in release 3.0 of the International Comprehensive Ocean-Atmosphere Data Set (see section 10.3.3). The SAMOS chairperson also attended ETMC-6 in

2016 and is a member of the JCOMM Cross-cutting Task Team on the Marine Climate Data System (MCDS).

5.2.3.5. Finally, the SAMOS team continues to engage the international R/V community via dissemination of best practices and procedures for stewarding underway meteorological and oceanographic measurements. Meetings with a South Korean delegation from KIOST in October 2015 and RV operators from the United Kingdom in June 2016 provided an opportunity for the SAMOS initiative to provide recommendations to these nations as they work to update their procedures for managing R/V observations. The SAMOS team also continues to provide professional development training for in-service marine technicians at U.S. and international technical workshops. The SAMOS chairperson encouraged all SOT nations operating R/Vs to collaborate with the SAMOS initiative to develop synergistic data stewardship programs for meteorological and/or oceanographic observations from each nation's R/Vs.

5.2.4 Report on High-Resolution SST

5.2.4.1 A Report on the Group of High-Resolution Sea Surface Temperature(GHRSST) was presented by Mr. Werenfrid Wimmer. GHRSST is the international expert group for the provision and application of the highest quality Sea Surface Temperature (SST) data to the global user and research communities. GHRSST is also the scientific expert group of the CEOS SST-Virtual Constellation and provides a suite of global, high-resolution SST products, operationally, in near-real-time, on a daily basis. To maintain the high quality of the various SST products it is essential that the Group has access to in situ ocean surface data provided by a range of accurate instruments located on diverse platforms, over a wide range of climate conditions. Drifting and moored buoys provide a wealth of surface data, but lack repeated calibration (at least for drifters) and provision of the important metadata required for accurate validation of the GHRSST satellite-based products. These latter requirements can only be provided by instruments on research vessels and ships of opportunity. The report to the JCOMM Ship Observations Team 9th Session summarized activities relating to ship measurements of SST that GHRSST has been involved with since the SOT 8 session. Material in the previous Report to the SOT 8 session was not repeated.

5.2.4.2 GHRSST would like to invite JCOMM SOT members to its annual Science Team meeting 5th to 9th June 2017 in Qingdao, China. Registration details are on the GHRSST website (www.ghrsst.org)

Use of ship data in GHRSST

5.2.4.3 The current use of ship-borne SST data within GHRSST falls mainly into two categories. First, radiometric temperature measurements from SI-traceable infrared radiometers mounted on ships of opportunity, commercial and research vessels, are used as a primary reference data set for satellite infrared sensors that provide a retrieval of the skin SST. Examples of such radiometers include the MODerate-resolution Imaging Spectroradiometers (MODIS), the Visible Infrared Imager Radiometer Suite (VIIRS), and the Sea and Land Surface Radiometers (SLSTR's), the first of which was launched in 2016. Second, conventional ship-based temperature measurements that are taken from the Global Telecommunications System (GTS) are used in many of the Level 4 analysis products and for validation of SST at depth products.

Non-radiometric SST measurements

5.2.4.4 The quality of VOS data is highly variable, some data (e.g. IMOS ship data, H. Beggs. et.al. Bureau of Metrology, Australia) is very high quality and comparable to drifter data, while other data sets are of lower quality. One of the tools used in GHRSST to asses data quality of ship observations is iQuam (www.star.nesdis.noaa.gov/sod/sst/iquam/), however qualification of observations (bucket, hull, ERI) is not always easy as data on GTS not consistent.

Ship-borne radiometric SST measurements

5.2.4.5 Following a series of workshops hosted by the International Space Science Institute in Bern, Switzerland, a Ship infrared Radiometer Network (SRN) was formed. An SRN document describing a standardized format for ship-radiometer data has been developed using the CF (Climate and Forecast) metadata compliant NetCDF data format and Radiometer operators have started producing data, which is hosted at CEDA. SRN coordinates the use of common standards, measurement and installation protocols. The SRN protocols help to achieve SI tractability and facilitate inter-comparisons, which not only prove traceability but also validate uncertainties.

Drifting buoys

5.2.4.6 A Workshop between GHRSST and drifting buoy manufacturer was held at Scripps Oceanographic Institution in October 2016. This workshop was to agree on standards for implementation and reporting as well as how SI traceability might be achieved. Agreement in principle and progress will be revaluated in a year's time.

5.2.4.7 Mr. Joel Cabrie was nominated as the SOT representative to the GHRSST group

Action;

5.2.4/1 SOT Vice Chairperson to propose to the OCG-8 to add the SRN network as part of SOT.(SOT Vice Chairperson, OCG-8)

5.2.5 International Quality-controlled Ocean Database

5.2.5.1 International Quality-controlled Ocean Database (IQuOD) was presented by Mr. Matt Palmer. He mentioned the International Quality Controlled Ocean Database (IQuOD) is a collaborative research initiative working towards generation of a "climate quality" ocean profile database to underpin climate science and services. Sponsored by International Oceanographic Data and Information Exchange (IODE) and the Scientific Committee on Oceanic Research (SCOR).

5.2.5.2 IQuOD promotes the development of community best practices in provision of meta-data and quality control (QC)procedures, with the initial focus on historical in situ subsurface temperature measurements. A first data release (v.01) is scheduled for mid-2017 and will include uncertainty estimates for all temperature measurements and "intelligent meta-data" for XBT profiles to promote improvements in future XBT bias corrections. A full IQuOD data release will follow in 2018 and include an optimal set of automated QC checks based on benchmarking exercises currently underway among project participants. IQuOD is committed to open source science and all Python-based QC code and associated academic papers will be available to the public.

5.2.5.3 It is recommended to share the best practices documents with JCOMMOPS to make them available for wider community.

5.2.6 FerryBox Project

5.2.6.1 FerryBox Project report was presented by Mr. Wilhelm Petersen. The principal idea of FerryBox is to use ships of opportunity like ferries or cargo ships on fixed routes to make automatic measurements of important oceanographic and biogeochemical parameters. These measurements are made in a flow-through system where different sensors are applied to measure continuously parameters like water temperature, salinity, turbidity and fluorescence as a measure of the amount of algae. Later on the systems were extended with new sensors for e.g. carbon budget (pH, pCO2, alkalinity), algal composition and on some ferry routes nutrients like phosphate, nitrate and silicate. The sustainability of the systems could be greatly enhanced by using automatic cleaning systems so that maintenance could be reduced.

5.2.6.2 The current status of FerryBox systems in Europe is presented. The European FerryBox community is organized in one of the so called Task Teams within EuroGOOS

(www.ferrybox.org). Furthermore most of the FerryBox systems are embedded in the European Copernicus Marine Environment Monitoring Service (CMEMS, http://marine.copernicus.eu) providing products and services for all marine applications. FerryBox lines cover most of the European seas. While in former years most systems were operated in the North Sea and Baltic Sea meanwhile different lines are operated in the Atlantic and the Mediterranean Sea.

5.2.6.3 Nowadays the focus of the measurements is more and more shifting from measuring only physical oceanographic parameters towards more biogeochemical parameters as new reliable and suitable sensors are on the market. Within the FerryBox Task Team efforts are being made to handle all FerryBox data in a common European database in order to improve the availability and visibility of FerryBox data. Most of the FerryBox lines are operated by scientific users more or less funded by soft money but still suffering on the lack of long-term sustainable funding such as for the Argo floats etc..

5.2.7 EUMETSAT Data Collection Systems

5.2.7.1 Report on European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) Data Collection Systems (DCS)was presented by Mr. Nick Coyne

5.2.7.2 Data Collection Systems are provided by several geostationary meteorological satellite operators, giving almost total coverage around the world, except the polar regions. The DCS is particularly useful for the collection of data from remote and inhospitable locations where it may provide the only possibility for data relay.

5.2.7.3 The Meteosat satellites located at 0° longitude, and over the Indian Ocean, acquire DCP data, in the form of observations and environmental parameters, from operators of DCP, which are located within the footprint of the satellites. The satellites have onboard communication channels for regional and international DCP access.

5.2.7.4 DCPs are automatic, or semi-automatic, in-situ environmental observing systems, which may be integrated into an automatic weather station at a remote site; an automatic river or tide gauge, or on an aircraft, ship, balloon or buoy.

5.2.7.5 If the platform is always under the footprint of a single geostationary meteorological satellite it is allocated to a regional transmission channel. If it is located on a ship or aircraft, which travels across the footprint of several satellites, it is allocated to an International channel.

High Rate Data Collection Platforms

5.2.7.6 EUMETSAT has certified the operation of the OmniSat-3 transmitter from Signal Engineering and SL3 from Sutron/OTT for use in High Data Rate DCP (HRDCP). The HRDCP offers significant improvements in throughput and reliability of DCP message transmitted through the Meteosat satellites.

5.2.7.7 The new generation of DCP transmitters apply Forward Error Correction (FEC) coding technology to reduce interference and, thereby, give a substantial system improvement.
This new HRDCP is now available to the user community for meteorological and hydrological applications. The improvements in the design now mean that HRDCPs are now a potential choice for Ship-borne DCP applications.

DCP Data Access

5.2.7.8 Data is processed and distributed to the user via several mechanisms:

- EUMETCast — Comms Satellite Multicast, which covers Europe and Africa

- Global Telecommunications System (GTS) of WMO, used to transmit environmental data to meteorological services throughout the world.
- Online Data Access — manual download from the website via secure log in. All log in requests (including DCPs) should be directed to the User Service Helpdesk.

6. RECOMMENDATIONS AND ACTIONS BY THE TASK TEAMS

6.1 Task Team on Automated Shipboard Aerological Programme

6.1.1 Chairperson of the Automated Shipboard Aerological Programme (ASAP)Task Team Mr. Rudolf Krockauer, reported on the activities noting the highlights of the intersessional period and specific challenges since previous SOT-8 meeting.

6.1.2 The number of ships which routinely provide upper air soundings on the GTS throughout the year is around 21 worldwide. Occasional campaigns of some further research vessels contribute to the total amount of soundings.

6.1.3 After the reduction of the Japanese ASAP fleet from 5 to 2 research ships in 2010, there is only one significant ASAP programme left: The European (EUMETNET) E-ASAP fleet with 18 ships.

6.1.4 E-ASAP is the only programme worldwide which is based on a fleet of 15 commercial vessels (plus two research ships and one hospital ship). Therefore the report of the ASAP Task Team is focused on E-ASAP.

6.1.5 Following key differences to land based radiosonde stations shall be pointed out:

- 15 out of 18 stations in the E-ASAP fleet are installed on commercial container vessels. The ships sail with 15-20 knots (producing strong turbulences at the launcher) and undergo heavy vibrations from the machinery (thus shortening the lifespan of the technical equipment). Routine maintenance is limited to short berthing times in the port.
- Transmission of sounding data to the NMS is only possible through satellite communication. Satellite communication is generally less reliable than land based cable communications.
- ASAP stations on merchant ships are operated by members of the ships crews, not by professional observers. Skill and experience depend on the respective operator/crew member.
- Japanese ASAP ships are research vessels of the JMA (Japan Meteorological Agency) and Japan Agency for Marine-Earth Science and Technology (JAMSTEC). Since the stations are operated by skilled staff there are less technical and operational problems than in the E-ASAP fleet.
- Soundings on board the German Research Vessel Polarstern are also operated by professional staff with less technical and operational failures than in the E-ASAP fleet.

E-ASAP fleet

6.1.6 Table 1 lists 18 active E-ASAP ships (status Feb 2017). 10 out of 18 stations (ASEU- and ASDE-) are operationally managed by the E-ASAP management team of the Deutscher Wetterdienst DWD in Hamburg, Germany. The other stations are part of the E-ASAP fleet but managed by the NMS's of France (ASFR-), Denmark (ASDK-), and Spain (ASES01). The naming convention of the stations in the E-ASAP fleet is as follows:

Char	Content
1, 2	AS (fixed data type, i.e., 'Aerology' and 'Ship')
3, 4	ISO alpha-2 country code ('EU' for EUMETNET)
5, 6	Sequential number

6.1.7 This unambiguous naming convention is an efficient ship masking scheme which could also be applied to other ASAP stations outside the E-ASAP fleet.

Table 1:Ships in the E-ASAP fleet in Dec 2016

Station	Service	Sounding equipment
ASEU01	No regular service, Research ship	The ship is equipped with a 10’ container launcher and Vaisala MW31 inside the container. Launches are usually carried out by the electronic engineer (system administrator).
ASEU02	Northern Europe – Chile	The ship is equipped with a 10’ container launcher and Vaisala MW31 on the bridge. Launches are usually carried out by the officers and cadets.
ASEU03	Northern Europe – East coast US	The ship is equipped with a 10’ container launcher and GRAW GS-E on the bridge. Most crew members are involved in launching operations.
ASEU04	Montreal – Northern Europe	The ship has a 10’ container launcher portside and a manual deck launcher starboard. The Vaisala MW31 system is installed on the bridge. Launches are usually carried out by two cadets on board.
ASEU05	Northern Europe – East coast US	The ship is equipped with a manual launcher and GRAW GS-E on the bridge. Most crew members are involved in launching operations.
ASEU06	Northern Europe – East coast US	The ship is equipped with a 10’ container launcher and GRAW GS-E on the bridge. Most crew members are involved in launching operations.
ASDE01	Northern Europe – East coast US	The ship is equipped with a manual launcher and GRAW GS-E on the bridge. Most crew members are involved in launching operations.
ASDE02	No regular service, Research ship	The 20’ container launcher is equipped with a Vaisala MW31. Launches are carried out by a professional observer of Deutscher Wetterdienst DWD.
ASDE03	Northern Europe – East coast US	The ship is equipped with a manual launcher and GRAW GS-E on the bridge. Most crew members are involved in launching operations.
ASDE04	Northern Europe – Chile	The ship was equipped with a manual deck launcher and Vaisala MW31 on the bridge. Launches were carried out by the officers and cadets until de-installation in November 2016.
ASDK01	Denmark – West coast Greenland	The ship is equipped with a 10’ container launcher. The Vaisala MW41 sounding system is installed on the bridge.
ASDK02	Denmark – West coast Greenland	The launcher is integrated in the ship. The Vaisala MW41 sounding system is installed on the bridge.
ASDK3	Denmark – West coast Greenland	The ship is equipped with a 10’ container launcher. The Vaisala MW41 sounding system is installed on the bridge.
ASFR1	North West Europe – French West Indies	The ship is equipped with a open deck launcher and MODEM SR2K sounding system in the wheelhouse. Launches are usually carried out by the electricians.
ASFR2	North West Europe – French West Indies	The ship is equipped with a open deck launcher and MODEM SR2K sounding system in the wheelhouse. Launches are usually carried out by the electricians.

Station	Service	Sounding equipment
ASFR3	North West Europe – French West Indies	The ship is equipped with a open deck launcher and MODEM SR2K sounding system in the wheelhouse. Launches are usually carried out by the electricians.
ASFR4	North West Europe – French West Indies	The ship is equipped with a open deck launcher and MODEM SR2K sounding system in the wheelhouse. Launches are usually carried out by the electricians.
ASES01	No regular service, Hospital ship	The 10' container launcher is equipped with a Vaisala MW21. Launches are usually carried out by the 1st officer.

6.1.8 The number of participating ships in the reporting period 2015-2016 was 18. However, some stations had to be transferred to other ships due to changes in the trade pattern. This resulted in 17 active ships at the end of the years. EUMETNET is mainly interested in soundings in the North Atlantic. If ships leave this geographical area for new services the station is transferred to another ship.

6.1.9 One temporary 'laid up' ASAP station was formally transferred to the European land station network in 2014 and is not part of E-ASAP any more.

6.1.10 Table 2 shows the development of the E-ASAP fleet since 2003.

Table 2: Development of the fleet from 2003 to 2016.

Year	Ships leaving the E-ASAP fleet1)	Ships joining the E-ASAP fleet	Active stations at the end of the year
2003	- 1	+ 1	13
2004	- 0	+ 1	14
2005	- 1	+ 4	17
2006	- 1	+ 0	16
2007	- 1	+ 0	15
2008	- 4	+ 1	12
2009	- 1	+ 4	15
2010	- 0	+ 4	18 + 1 temporary land station
2011	- 1	+ 1	18 + 1 temporary land station
2012	- 2	+ 2	18 + 1 temporary land station
2013	- 1	+ 1	18 + 1 temporary land station
2014	- 0	+ 0	18 + 1 temporary land station
2015	- 1	+ 0	17
2016	- 1	+ 0	17

1) Usually due to changes in the trade pattern of the ships (i.e. routes away from the North Atlantic).

Figures 1 and 2 demonstrate the different types of launchers on board the ships.

Figure 1: Examples of 10ft container launchers.

Figure 2: Examples of manual launchers.

Performance of the E-ASAP fleet

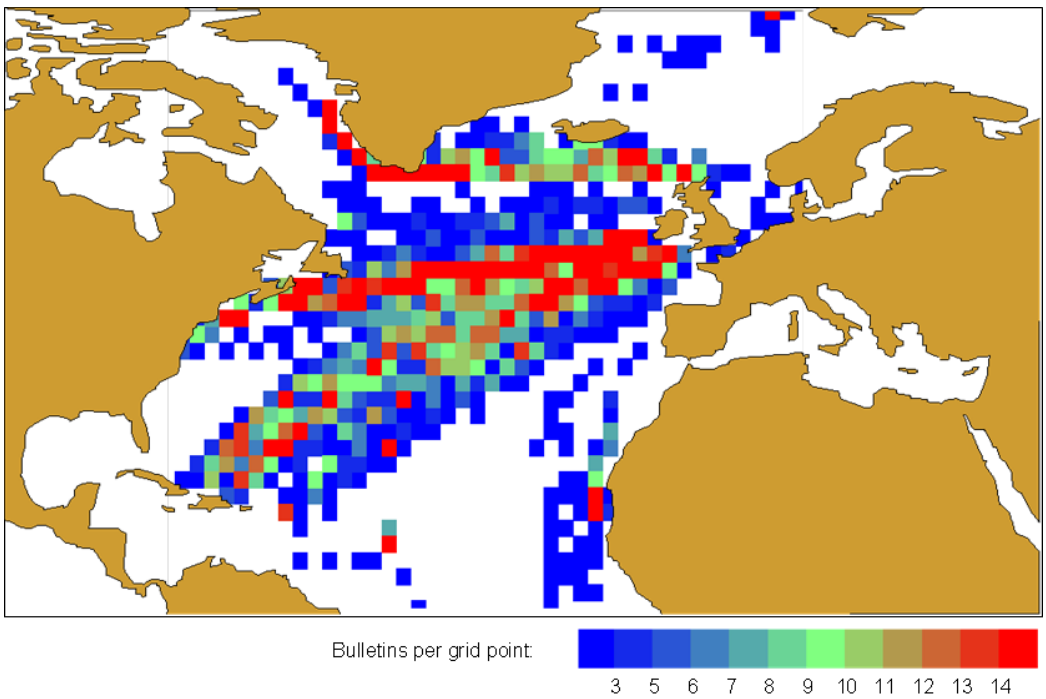


Figure 3: Distribution of BUFR soundings in 2016 on a 2x2° grid without interpolation.

6.1.11 The performance of the ASAP stations is included in the annual EUMETNET SOT ASAP report. Figure 3 shows the spatial distribution of BUFR in 2016 on a 2x2° grid without interpolation. E-ASAP completed the migration to BUFR in 2016 and transmits no TEMP SHIP messages any more.

6.1.12 The distribution demonstrates the main trading routes between Europe and North America of the participating container vessels. Basically, there are three legs:

- Northern leg: Denmark – Greenland,
- 'Fifties' leg: along 50°N,
- Southern leg: Channel – West Indies.

6.1.13 The individual performances differ widely from month to month and from ship to ship. Red spots away from the three main legs are soundings performed on board the Research Vessels MARIA S. MERIAN and METEOR (Mediterranean) and the Spanish hospital ship ESPERANZA DEL MAR (off West Africa).

6.1.14 The total number of soundings on the GTS was 4243 in 2016. Taking into account the total number of launches on board versus the received soundings on the GTS, the average output (GTS/Launches ratio) was 89%. Main reasons for failed launches are

- technical problems of the equipment,
- unfavorable wind conditions at 15-20 knots sailing speed,
- unexperienced operators, and
- poor satellite communication.

Other ASAP ships

6.1.15 Table 3 lists four ships providing ASAP soundings on the GTS in 2016. The Japanese Met Service JMA operates an ASAP station on board the research vessel RYOFU MARU in the western north Pacific and seas adjacent to Japan. JAMSTEC (JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY) operates a station on the oceanographic research vessel MIRAI. In total, 354 soundings were received from the Japanese ASAP ships in 2014.

6.1.16 The German research vessel POLARSTERN operates in polar regions in the summer periods (Apr-Sep in the Arctic, Oct-Mar in the Antarctic) and provided 330 soundings. The Swedish research vessel ODEN provided 24 soundings as temporary ASAP station ASUK02.

Table 3: Other ASAP ships.

Ship name	Station	Area	Sounding equipment	Received soundings in 2016
Mirai (JAMSTEC)	JNSR	North West Pacific	Semi-automatic Container, Vaisala sounding system, Vaisala RS92 GPS radiosondes, Inmarsat-C satcom.	204
Ryofu Maru (JMA)	JGQH	North West Pacific	Semi-automatic Container, Vaisala sounding system, Vaisala RS92 GPS radiosondes, DCP satcom	150
Polarstern	DBLK	Arctic and Antarctic	Manual launches with Vaisala sounding equipment	330
Oden	ASUK02	Arctic	Manual launches with Vaisala sounding equipment	24

Satellite communication and migration to BUFR

6.1.17 All 18 ships in the E-ASAP fleet are equipped with Iridium satcom systems to transmit binary HiRes BUFR reports from the ships. The average timeliness in the E-ASAP fleet in 2016 was around HH+25 min.

6.1.18 Soundings from the two Japanese stations are transmitted via Inmarsat-C or DCP (through Meteosat). The timeliness of the soundings on the GTS in 2016 was HH+156 min.

6.1.19 The vertical resolution of the HiRes BUFR of the E-ASAP stations is 10 sec (ca. 50 m) plus mandatory and significant levels. Purpose is to limit the file size to <20 Kbyte to reduce transmission time. A vertical resolution of 50 m is fully compliant to the minimum WMO requirements (Goal = 100 m, Breakthrough = 200 m, Updated on 28 May 2010).

6.1.20 Data exchange in BUFR format became standard WMO practice in 2010. The Commission for Basic Systems (CBS) set the deadline for the distribution of alphanumeric codes for category 1 data (SYNOP, TEMP, PILOT, and CLIMAT) to November 2014. As of 2016 only BUFR are to be disseminated by the E-ASAP fleet to the GTS.

6.1.21 In total, around 4963 soundings were received in 2016 from all ASAP stations worldwide. The distribution was as follows:

- 85% E-ASAP,
- 7% POLARSTERN,
- 8% mainly MIRAI, RYOFU MARU.

The spatial distribution is shown in figure 4.

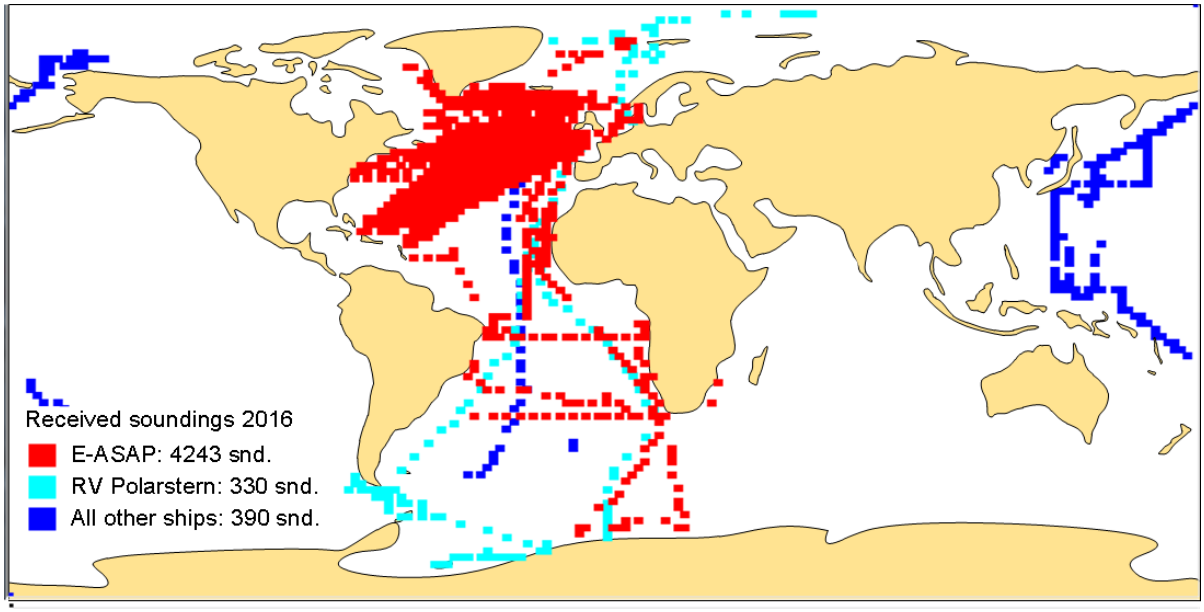


Figure 4: Distribution of global ASAP soundings from sailing ships in 2016.

6.1.22 The spatial distribution of global ASAP soundings show clearly the predominant and unique coverage of the North Atlantic by the European E-ASAP fleet.

6.1.23 Scientific studies confirm the positive impact of upper air soundings in data sparse ocean regions. WMO members are therefore encouraged to participate in global ASAP observations by operating ASAP stations on board ships.

6.1.24 Task team membership and Terms of reference are in Annex VI.

6.2 Recommendations of Task Team on High-Resolution Marine Meteorology

6.2.1 The Chairperson of the Task Team on High-Resolution Marine Meteorology (TT-HRMM), Mr. Shawn Smith, reported on the activities of the team during the last intersessional period. The TT-HRMM was formed during SOT-8 and charged with exploring the ongoing development of automated weather systems (AWS) on VOS and determining the potential for observing marine weather conditions at sub-hourly sampling rates.

6.2.2 The TT-HRMM reviewed the ToR initially drafted and approved at SOT-8 and made several changes to the ToR (Annex A). The TT-HRMM also reviewed its membership and the present membership is provided in Annex B. The team is invited to review and agree on the updated ToR and membership of the TT-HRMM.

6.2.3 The focus of the TT-HRMM during the previous period was determining use cases for AWS measurements made at sub-hourly sampling rates. This effort revealed use cases (Annex C) that would require HRMM data to be provided by VOS in real-time and delayed-mode. Since no infrastructure presently exists to move the larger volumes of HRMM data from a vessel in real-time, the TT decided to focus on delayed-mode use cases during the next intersessional period.

6.2.4 With a solid set of use cases in place, the TT is now investigating options to establish a pilot project to obtain HRMM from select VOS. Options discussed include working with EUCAWS, UKAWS, and/or select AWS deployed on cruise ships by the University of Miami. Several of these existing AWS have the capability (or can be modified) to collect meteorological observations at 1-minute sampling rates and to log these data in memory onboard the vessel. Protocols to retrieve the data, deliver it to an assembly centre, and provide the data to users are yet to be determined. The Shipboard Automated Meteorological and Oceanographic System (see 5.2.3) initiative was raised as a possible data assembly centre for the pilot project. Over the next intersessional period, the TT will develop a conceptual data flow for delayed-mode HRMM from AWS to one (or more) data assembly centres; will evaluate the potential impact on vessel operators and VOS recruiting countries; and will initiate a pilot project if sufficient resources can be secured

6.2.5 Discussions of AWS on VOS led the TT-HRMM to consider the existence of emerging technologies (e.g., wave gliders, sail buoys, autonomous surface vessels) that have the capabilities to observe HRMM. Several of these platforms may be better managed under the DBCP; however, there is obvious overlap in use cases for HRMM on these platforms and from AWS on VOS. Therefore, the TT-HRMM recommends that a member of the DBCP community be invited to join the TT-HRMM to ensure the two communities are leveraging standards and technologies being developed in the VOS and DBCP communities.

6.2.6 One challenge noted by the TT is that VOS AWS are presently designed to meet the forecasting requirements of the NMS and it may be difficult to modify AWS specifications to meet the requirements of the HRMM user community. Although several use cases from the numerical weather prediction (NWP) community indicate that HRMM would be of value for modelers (particularly focused on diurnal cycles), to date there are not any examples of how assimilating HRMM into models may impact their analyses or forecasts. The TT discussed the need to run some NWP tests using HRMM, but noted that this effort is well beyond the capabilities of the TT. The TT-HRMM invites any interested analysis/forecast centres to collaborate with the TT to develop some NWP test cases

6.2.7 Finally, the TT began discussing necessary metadata to be provided along with HRMM observations. The TT plans to review existing standards to determine gaps in the metadata schemes (e.g., tracking instrument sampling rate vs. reporting interval, reported value being an average or median) and recommends that the TT engage with the Task Team on Metadata as needed during the next intersessional period chairperson

6.2.8 The Team agreed on the revised terms of reference and membership for the TT-HRMM in Annex VI.

Actions;

6.2/1 TT-HRMM to engage with the TT-VOS Metadata to ensure that future metadata standards support requirements for HRMM from AWS.(TT-HRMM, SOT-10)

6.3 Recommendations of Task Team on Satellite Communication Systems

6.3.1 The Chairperson of the Task Team on Satellite Communications Systems (TT-SatCom), Ms Paula Rychtar (United States), reported on the activities of the Task Team during the last inter-sessional period and follow-up actions from SOT-8.

6.3.2 During the inter-sessional period, the previous Chairperson of the TT-SatCom Mr. Jan Rozema left his position, to pursue a career changes and hence had decided to step down from participation in JCOMM SOT As a consequence, Ms. Rychtar agreed to serve as Chairperson for this Task Team until after the JCOMM SOT 9. The Team recommended that the new permanent Chairperson for TT-SatCom following SOT-9 would be Jean-Baptiste Cohuet (France).

6.3.3 The Team noted that no progress has been made on the design of a new method for conventional VOS to report observations ashore using Fleet Broadband (FB) terminals (SOT-8 Action 7.1.12 (i)). HWhilst Fleet Broadband (FB) is not yet GMDSS approved. The TT-SatCom was informed that the IMO will address a formal request received from the UK (15 September 2016) to grant formal recognition to Inmarsat's FB for use in GMDSS under the SOLAS convention.

6.3.4 It was noted that the Inmarsat C service is expected to continue well into the 2020's and beyond. The natural successor to the Inmarsat C will most certainly be Inmarsat's Maritime Safety Data Service (MSDS) for Fleet Broadband. The FB system (according to the extensive study by the Maritime Safety Committee UK MSC-97-7-4) had not experienced any major operational outages in either space or ground segments. It's reliability and availability has been in excess of the required 99.9% availability each year since January 2010. The team feels that efforts to engage in preliminary plans for using FB for conventional VOS messages should move forward.

6.3.5 The Team agreed the following Recommendations/Actions:

- The Task Team to liaise closely with Inmarsat and IMSO, in particular regarding the future use of SAC 41, and regarding proposals to introduce a new system for transmitting meteorological messages via Fleet Broadband.
- The Task Team to closely monitor any relevant developments within IMO Maritime Safety Committee and the IMO Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) concerning the future changes to the Global Maritime Distress and Safety System and proposals to incorporate Iridium as a future mobile satellite GMDSS service provider.
- The Task Team to consider the need to propose revisions to IMO Resolution 707 (17) to reflect changes in the way that meteorological messages will be transmitted in the future.

6.3.6 The team noted that the Pub 47 metadata field 'prST' is a valuable tool for monitoring the transmission system for used weather reports. The Team also noted that while most ships use one sole source for transmitting, there are some ships that use multiple methods, switching between systems. For this reason, and in order to correctly monitor these transmission types, the pub 47 should offer multiple data input for prST to accommodate these ships.

6.3.7 The team discussed the benefits for panel inter-comparison on the use of which satellite system is used when ships send observations by email, to measure how much we rely on Inmarsat or Iridium. It is recommended to include this option in the new structure of metadata.

6.3.8 The TT-SatCom had tested TAC ID's compliant with WIGOS, using SAC 41. Test ID's were assigned specifically to each country: Japan, UK, US, Germany, Australia, Netherlands, New Zealand, Hong Kong. The tracking of these test observations sent with these ID's viaLES's Sentosa, Yamaguchi, and Perth were top priority. After testing, ships returned back to the normal ship call ID. The test was completed and results compiled for analysis. The TT agreed that an updated list detailing which LES accept2 and 3 figure SAC's was needed. In addition this LES information should be compiled for both TurboWin and for online reference material for best practices in telecommunication.
The results of this test are available at (ftp://ftp.jcommops.org/SOT/SOT9Docs/Doc3-4_Annexe1.pdf)

6.3.9 The Task Team participants agreed to merge the Task Team on Satellite Communication Systems (TT-Satcom)with the Task Team on Instrument Standards (TT-IS) and form a single new Task Team on Instrument Standards and Sarellite Communication , TT-ISSC. New ToR and membership for the merged TT were adopted with minor changes, and are available in Annex VI.

Actions;

6.3/1 Include fields to capture which satellite system is used when ships send observations by email in the new structure of metadata. (TT-ISSC and TT-VOS-Metadata, SOT-10)

6.3/2 Closely monitor any relevant developments within IMO Maritime Safety Committee and the IMO Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) concerning the future changes to the Global Maritime Distress and Safety System and proposals to incorporate Iridium as a future mobile satellite GMDSS service provider.(TT-ISSC, SOT-10)

6.3/3 Pub 47 should offer multiple data input for prST to accommodate ships with multiple telecommunication systems. (TT-Pub47, SOT-10)

6.3/4 To work with satellite providers(Inmarsat)to clarify how the Fleet broadband system could be used in place of Code 41.(TT-ISSC, SOT-10)

6.4 Recommendations of Task Team on Instrument Standards

6.4.1 The chairperson of the Task Team on Instrument Standards (TT-IS), Mr. Henry Kleta (Germany) reported on the activities of the Task Team during the last intersessional period.

6.4.2 The Chairperson proposed to merge the TT-IS with TT-SatCom similar to the proposal from TT-SatCOM reported in 6.3.10with common Terms Of References (Annex C of SOT-9-Doc-6.4) and a combined membership (Annex D of SOT-9-Doc-6.4).

6.4.3 Chairperson of the TT-IS further reported that the collection of information on used instruments, standards and procedures is laborious and has to be made by NFPs several times. Therefore It was therefore recommended to request the collection of such information via online questionnaires and make the information collected available through JCOMMOPS.

6.4.4 The Chairperson also mentioned that JCOMM TR 63 "Recommended Algorithms for the computation of marine meteorological variables" (SOT-8 action #67): True Wind has been added to TR 63. Further details (calculation of mean values, value for wind from north) have to be considered during next intersessional period. Test cases have to be agreed on and included, example programmes have to be provided.

6.4.5 The Task Team Participants agreed to merge the Task Team on Instrument Standards (TT-IS) and Task Team on Satellite Communication Systems (TT-Satcom),to form a single new Task Team on Instrument Standards and Satellite Communication Systems TT-ISSC. New ToR for merged TT were adopted with minor changes, new ToR and membership is available in Annex VI.

Actions;

6.4/1 Consider the use of online questionnaires to collect information on instrument standards guidelines (see Annex A of SOT-9-Doc-6.4) and instrument standard equipment (see Annex B of SOT-9-Doc-6.4).(SOT TC, TT-ISSC; SOT-10)

6.4/2 Encourage members to contribute to the compilation of JCOMM TR 63 and follow the recommendations from that TR (see Annex E of SOT-9-Doc-6.4).(SOT members, SOT-10)

6.5 Recommendations of Task Team on VOS Recruitment and Programme Promotion

6.5.1 The Chairperson of the Task Team on VOS Recruitment and Programme Promotion (TT-VRPP), Ms Sarah North (United Kingdom) reported on the activities of the Task Team during the last inter-sessional period. The full Task Team report is provided at http://www.jcomm.info/SOT-9

6.5.2 The meeting made the following recommendations and decisions:

(i)To update the membership of the Task Team.

(ii) To appoint Ms. Paula Rychtar as the new Chairperson of the Task Team following SOT-9.

(iii)The Task Team on VOS Recruitment and Programme Promotion should be combined with the Terms of Reference of the Task Team on Training into a new 'Task Team on Recruitment, Promotion and Training'.

(iv)The remit of the Task Team should be widened to include all SOT Panels and networks (e.g. SOOP and ASAP).

(v) OCG should be invited to consider the need for a cross cutting JCOMM-wide recruiting and promotion Task Team.

(vi) The content and scope of the SOT Recruitment Presentation should be revised to encompass all observing ships that are recruited to SOT Panels and JCOMM observing networks (VOS, ASAP, SOOP, Argo, DBCP etc.), and taking into account, as appropriate, decisions regarding a common umbrella brand for volunteer ships.

(ix)The number of VOS Classes currently defined in WMO Pub 47 guidance should be reduced to just three classes as follows;

- Ships that are recruited by a national meteorological service which also supplies the necessary observing instruments, sensors and equipment
- Ships that are recruited by a national meteorological service but use their own instruments, sensors and equipment
- Third party ships that are not recruited by a national meteorological service but contribute indirectly to the VOS Scheme

(x) Task Team on metadata should include these new VOS classes in their work on the development of new WIGOS compliant metadata.

6.5.3 Members agreed that in the light of proposed changes to the VOS Classes, the role of VOSClim Focal Point should be discontinued and references deleted from VOSClim literature and websites where relevant.

6.5.4 In the light of proposed changes to the VOS Classes it was also agreed that the VOSClim certificate was no longer necessary and references to the certificate should be removed from literature and websites where relevant.

6.5.5 The Task Team participants agreed on the membership of the new combined TT on Recruitment, Promotion and Training(TT-RPT) and on the merged ToR for the new TT-RPT.

Actions;

6.5/1 All references to the VOSClim should be archived and removed from literature and websites where relevant once the new VOS classes are approved. (SOT TC, , SOT-10)

6.5/2 Following the migration of the E-SURFMAR database to JCOMMOPS, the JCOMMOPS database should be considered as the main repository for listing VOS Climate standard ships and relevant literature and websites amended accordingly. (VOSClim DAC/SOT TC December 2017)

6.5/3 The VOS Flyer is no longer necessary to promote ship participation, accordingly should be removed from the VOS website and archived. (SOT TC– December 2017)

6.5/4 Technical Coordinator to monitor the content of the VOS brochure to ensure that it is maintained up to date, liaising with the VRPP Task Team when any major modifications are needed. (SOT TC,TT-RPT, ongoing)

6.5/5 VOS Operators to submit copies of promotional videos related to the VOS scheme VOS operations for inclusion on the YouTube VOS Channel. (VOS members & S Bond – ongoing)

6.5/6 Technical Coordinator to monitor the VOS Poster to ensure that it is maintained up to date, liaising with the VRPP Task Team when any major modifications are needed.(SOT TC, TT-RPT – ongoing)

6.5/7 VRPP Task Team to update the quick reference guides, in liaison with the Technical Coordinator, to reflect decisions taken during the SOTsessions .(SOT TC, TT-RPT, ongoing)

6.5/8 The media section of the JCOMMOPS website should be the main access point for VOS related articles and publications and articles held elsewhere (e.g. on the E-SURFMAR or VOS website) should be transferred accordingly. (SOT TC,SOT-10)

6.5/9 VOS Operators to provide the Technical Coordinator with copies of their national PMO Work instructions, checklists and associated flow diagrams for uploading to the JCOMMOPS website as appropriate .(VOS members,SOT TC, ongoing)

6.5/10 Consider the need for a questionnaire to survey the views of shipowner's and managers on ship based observing. The survey would encompass more than just the VOS community and could be used to provide input into the proposed Ship Forum. (EXB, Dec 2017)

6.6 Recommendations of Task Team on Training

6.6.1 The Chairperson of the Task Team on Training (TT-Training), Ms. Paula Rychtar (United States) reported on the activities of the Task Team during the last inter-sessional period. The full Task Team Report is ANNEX A of SOT-9-Doc-6.6

6.6.2 The Task Team members made the following recommendations and decisions:

(i) Update the membership of the TT-Training

(ii) Th Task Team on Training should be combined with the Task Team on VOS recruitment and Program Promotion and the Terms of Reference (ToR) for both be combined to reflect one Task Team under the new name as "Task Team on Recruitment, Promotion and Training." The new Task Team should be inclusive to all SOT panels and networks. (SOOP,ASAP)

(iii) For training purposes, to accumulate video clips of instructional video to provide as reference material for all SOT platforms (VOS,SOOP,ASAP).

(iv) The repository for all reference material should be in one location for the international usage and it was recommended that either IODE or JCOMMOPS would be the most practical.

(v) The International PMO Workshop; that the TT should establish a reasonable scheduled session and be supported by JCOMM SOT and NMS as much as practical to reinforce the need, benefits and resources as well as establishing a protocol for such workshops.

(vi) The Team has concluded that the Drifter Donation Program was not successful. At the SOT 8 "Regarding the DBCP/VOS donation programme, from nine countries that had shown interest, only Tanzania successfully accomplished the first few steps of the procedure, including ship recruitment, national contact point (NCP), and PMO with "buddy". The Panel had agreed to continue with the VOS-DP to gain more experience with further countries, and review the VOS-DP at SOT-9." The Task Team on Training recommends that this program should be discontinued.

(vii) The Team recommends that a consorted effort in having WebEx monthly training on Pub47 data entry would be beneficial to successfully analyze VOS and all aspects of the health and progress of the program.

6.6.3 Panel agreed to initiate WebEx training supported by SOT TC to support engagement of PMO through anticipated changes between PMO face to face training sessions, including Pub47 and data entry to JCOMMOPS.

Actions;

6.6/1 Develop and maintain Best Practices (SOT, SOOP, ASAP) resources and reference material and provide these resources globally by placing them on the Ocean data practices website hosted by IODE.(TT-RPT, SOT-10)

6.6/2 Develop a new JCOMM guidance document to address, as is practicable, the full scope of PMO work instructions, duties and responsibilities. (TT-RPT, SOT-10)

6.6/3 Prepare a workplan to initiate a PMO exchange program between countries. (TT-RPT, SOT-10)

6.6/4 Set up a drafting committee group to revise text on the handbook for marine observations and place that on TurboWin software .(TT-RPT, August 2017)

6.6/5 Arrange intersessional WebEx or Webinars for PMOs to inform/discuss/train PMOs on evolving program developments and changes (i.e. BUFR, WIGOS, OSCAR, JCOMMOPS, PUB47, etc.,).(TT-RPT, SOT-10)

6.6/6 TT Chairperson to identify the outdated training requirements derived from IMO Conventions for possible revision.(TT-RPT, Dec 2017)

6.7 Recommendations of Ad-hoc Task Team on WIGOS/SOT-Identifiers

6.7.1 The ad-hoc Task Team presented the structure of the WIGOS station identifiers (WIGOS IDs, noting that for land stations member states shall allocate the WIGOS IDs directly. The task team, however, noted that the situation is more complicated for marine platforms and in particular stations that are not moored in a fixed location or stationary. The task team gave an example of a weather station operated by country A hosted on a ship with flag state B and that sails through multiple regions and territorial waters. In this case it is unclear which member state should assign the WIGOS ID, if any.

6.7.2 The TT reported that this responsibility issue had been discussed with i) the JCOMM Management Committee, ii) the WMO Chief for Data Representation, Metadata and Monitoring (Steve Foreman), iii) the WMO Chief of the Observing Systems Division (Etienne Charpentier), and iv) the WIGOS metadata Task Team Chairperson (Mr. Jörg Klausen); this group agreed that the allocation of IDs for such marine stations through an international coordination body would be more appropriate, with the Member States asking this body to issue the number on their behalf; JCOMMOPS could fulfil this role and WMO has therefore tentatively allocated 22000 as WIGOS issuer ID for JCOMMOPS.

JCOMMOPS to allocate SOT Station Identifiers

6.7.3 SOT panel agreed that JCOMMOPS should be tasked with the allocation of SOT Station Identifiers, on behalf of JCOMM and Member States. For non-unique IDs previously allocated and that had been reused, in particular ITU call-signs and 5-digit WMO IDs, the issue number element of the WIGOS ID will be used to create IDs which will then be unique. For ITU call-signs the issuer ID will also be set to 20003.

6.7.4 Noting the requirements for the WIGOS ID, and operational requirements for assigning and transmitting the WIGOS ID the Team adopted the TT recommendation for the SOT station identifier:

Format of the SOT Station Identifier

6.7.5 Proposed SOT station identifier (WIGOS Station ID local identifier) should be exactly 7 characters long and have the following format:

$$n_1n_2n_3n_4n_5n_6n_7$$

Where

i. n1, n4,n5 and n6 be letters or digits
ii. n2, n3 and n7 be letters
iii. the identifier be allocated by JCOMMOPS
iv. the identifier not comprise any country or ship reference
v. n_1 may comprise a station type via a reference table
vi. n_2 may comprise a recruitment type via a reference table
vii. n_7 may contain a quality / test indicator, noting that his information is not present in the current BUFR template

6.7.8 The TT reminded the Team that a ship may host simultaneously a variety of different instrument packages from different SOT panels, which are possibly operated by different agencies from different countries. In addition, these SOT host ships possibly also contribute to other GOOS networks, such a DBCP or Argo, by deploying and/or recovering autonomous instruments (floats, drifters) at sea. All these units should have their own unique identifier, and only share a common ship reference. The Team agreed with the decision to use the ICES Ship Code should be used as a unique reference for the hosting hull / platform, given that IMO numbers are not allocated to all ships. If available, the IMO number should be used as additional hull reference. SOT panel agreed on the proposed SOT station identifier scheme.

6.7.9 Group agreed to continue this ad-hoc Task Team until JCOMM-5.

Assignment of hull / platform ID

6.7.10 The Panel agreed that the ICES Ship Code should be used as the unique identifier for hulls / platforms in the wider JCOMM station metadata list.

Action;

6.7/1 JCOMMOPS should allocate SOT Station Identifiers, on behalf of JCOMM and Member States(SOT TC, JCOMMOPS, inline with WIGOS implementation)

6.8 Recommendations of Task Team on Call Sign Masking and Encoding

6.8.1 Miss. Emma Steventon reported on the activities of the TT on behalf of the chairperson of the TT. The Task Team worked inter-sessionally by WebEx, email and phone. Task Team membership was reviewed and agreed. New Task team membership is available in Annex VI.

6.8.2 The Task Team reviewed its ToRs and agreed that new ToRs and a workplan must be developed, in particular given that it is planned to replace the use of call signs by a new 7 character SOT ID scheme (without any ship reference).

6.8.3 The Task Team noted that the ASAP TT had implemented its own unique ID scheme, but that the involvement of the ASAP TT Chairperson was more important in the VOS metadata TT than in the Masking TT(agreed 28 July with Mr. R. Krockauer).

6.8.4 Task Team recalled items 7.6.4 and 7.6.5 of the SOT-8 FR (rationale for ship masking in times of e.g. AIS). TT agreed that security issues (piracy) as initial driver for the implementation of mask schemes (generic SHIP ID, or mask2real reference) are less important now, especially as progress with satellite AIS now allows for global and continuous tracking of most ships on public websites; shipping companies might therefore be willing to soften their security policies.

6.8.5 Task Team noted that monitoring/QC-ing of platforms using "SHIP" is only possible with nations that also submit unmasked data in bilateral agreements, as it is the case for Canada. Hundreds of registered ships using "SHIP" from other countries however cannot be identified on the GTS at the moment.

6.8.6 Task Team also noted that around 200 SOT platforms submit data with unique masked IDs which are currently only available to authorized users through the JCOMMOPS maintained mask2real list. However many of these platforms are assigned masks are used to facilitate accounting(e.g. within E-SURFMAR for compensation purposes) rather than for security reasons.

6.8.7 Panel noted that few of the masked UK VOS (using SHIP) are military or defense ships which anyway are not permitted to submit RT data to the GTS or to provide, platform metadata for Pub47.

6.8.8 Task Team recalled that SOT developed ToRs (see SOT-8 FR 7.6.2, with Annex 14) for the management of en-/decode keys and related masking issues, comprising a focal point, but that this must be reviewed and submitted to JCOMM co-presidents. No focal point has been announced yet.

6.8.9 The Task Team noted that the structure of the new proposed SOT ID scheme, in conjunction with a recommended separation of platform metadata (such as sensor information) from ship metadata (such as IMO number), permits hiding the ship reference in the platform metadata to non-authorized users (as presently done with mask2real scheme) in the designated new home for SOT metadata at JCOMMOPS.

6.8.10 Task Team noted that a WMO EC-59 resolution (27) permitting masking of ships becomes obsolete with completion of BUFR transition. A universally accepted solution will then be required, with encode/decode initially being targeted; other universal solutions as here proposed are possible, but must find general acceptance by the SOT; all solutions require an exception from WMO technical regulations, and thus a new EC resolution, and must before be pushed through SOT, OCG and JCOMM.

6.8.11 Task Team noted that Canada was working on ending the use of SHIP; and that their Coast Guard does not want Ship Identifiers (as Call Signs) publically available on GTS. Encode/Decode and new SOT-IDs both seem satisfactory, but confirmation still needed. Coast Guard Ships can easily go to stealth mode when on sensible mission.

6.8.12 It was also noted that operational centers (e.g. in Canada) are however questioning the feasibility (workload/resources) of implementing en-/decode procedures, and that other solutions of less complexity, which also satisfy the same requirements, would be appreciated. Canada's long term wish is to migrate to the new SOT ID scheme and terminate the use of SHIP

6.8.13 Team noted that the US VOS is planning to move directly to WIGOS 7-character identifiers and not move to another masking scheme, e.g. ENCODE or continue SHIP. The timeline on transition is not yet clear but masking with past schemes will be discontinued in the US VOS program.

6.8.14 Team noted international plans for the future of masking:- 1) E-SURFMAR to migrate to new SOT ID scheme; 2) UK to migrate to new ID scheme (although some isolate Navy ships will remain in stealth mode); 2) Australia- all masking terminated. Japan currently uses SHIP but plans to migrate to encode/decode. Japan informed the Team that to implement changes in procedure, a change of policy with the shipping community would be required (which would also be required if moving to encode/decode)- so use of the new SOT ID scheme remains an option.

6.8.15 The Team noted that in particular most automated stations can be migrated to the new ID scheme very quickly, given that the ID is assembled ashore, not on the ship; Turbowin stations on manually reporting vos would however require manual onboard modification of the ID on every single ship. Task Team noted that E-Surfmar automated stations could be used as a test data set for the new ID scheme e.g. it would be very easy to do for UK automatic AMOS ships as the masks are only applied once ashore by use of a configuration file.

6.8.16 The Team noted that WMO regulations require all internationally exchanged data to provide a set of (evolving) metadata, in particular the identifier. The Team was informed that Mr. Jörg Klausen (WIGOS metadata TT chairperson) and Mr. Luis Filipe Nunes (WMO Secretariat) could be consulted by the SOT VOS metadata TT regarding upcoming changes/WIGOS requirements of SOT metadata.

6.8.17 The Team was informed that platform operators will have the possibility to hide the identity of ships in the JCOMMOPS metadata management system by use of a checkbox. Non-authorized users would then only be able to see platform related metadata (e.g. sensor information) and observations derived positions, but NOT the ship-related metadata (ship name, call sign, IMO, length...). It was noted that maintenance of this check box system would be very similar to the current mask-to-real list currently maintained by JCOMMOPS.

6.8.18 The Team agreed that TT-ISSC will be consulted regarding former issues with the use of IMO numbers in Inmarsat SAC 41 transmissions, and potential impacts on the proposed SOT ID scheme.

Actions;

6.8/1 SOT developed ToRs (see SOT-8 FR 7.6.2, with Annex 14) for the management of encode/decode keys and related masking issues, require a focal point, but that this must be reviewed and submitted to JCOMM co-presidents. No focal point has been announced yet and should be nominated.(TT-Masking, May 2017)

See also decision 3.4/9 under paragraph 3.4.6 about the discontinuation of the encode/decode scheme.

6.9 Recommendations of Task Team on Metadata for WMO Publication-No.47

6.9.1 The Team noted that Dr. David Berry had stepped down as Chairperson of the Task Team on metadata for WMO Pub47 in November 2016 due to pressure of other work commitments. Ms Sarah North (United Kingdom) had agreed to act as the interim Chairperson of the Task Team until the SOT-9 session.

6.9.2.The full Task Team report is provided at http://www.jcomm.info/SOT-9

6.9.3.The meeting made the following recommendations and decisions:

(i) Membership of the Task Team was reviewed and updated. An updated membership list is available at Annex VI

(ii) That Miss. Emma Steventon be appointed as the new Chairperson of the Task Team following SOT-9.

(iii) That the Terms of Reference for the Task Team be revised to recognise the need to migrate and harmonise WMO Pub47 metadata with WIGOS Pub 1160 metadata requirements, and the need to merge WIGOS metadata collection at the SOT level to ensure consistency. Updated and approved ToR are available at Annex VI.

(iv) That OCG should be invited to consider the need to establish a cross cutting working group to oversee and ensure consistency in the way that JCOMM observing networks are collecting metadata and to benefit from synergies.

(v) That the current requirement for structural changes to Pub47 be formally approved by JCOMM should be discontinued i.e. in order to facilitate the level of flexibility that will be needed to introduce new WIGOS compliant metadata, and for consistency with other JCOMM networks [OCG/JCOMM to advise accordingly].

(vi) Team agreed that WMO Pub 47 should be frozen in its current (V4.2) status, and should be archived for historical records when the new composite metadata structure for VOS becomes operational.

(vii) Further agreed that a new composite WIGOS metadata document should be drafted for the VOS, to eventually replace WMO Pub 47.

(viii) Team agreed that the JCOMMOPS database should be regarded as the main metadata repository i.e. when the E-SURFMAR metadata database has been fully migrated to JCOMMOPS. Keep CSV and XML data formats to provide the metadata to JCOMMOPS at the moment and migrate to xml.

(ix) That JCOMMOPS should continue to submit only the mandatory Pub47 fields to OSCAR (as already developed and successfully tested between OSCAR and JCOMMOPS) until such time as the proposed new metadata structure has been validated.

Actions;

6.9/1 VOS operators to consider moving over to the direct use of the JCOMMOPS database in future i.e. in lieu of their national VOS databases.(VOS Focal Points; SOT-10)

6.9/2 Copies of the latest version (4.2) of the guidance document for WMO Pub 47 metadata to be uploaded to the SOT-VOS website (http://sot.jcommops.org/vos/resources.html) and to the WMO website (http://www.wmo.int/pages/prog/www/ois/pub47/pub47-home.htm) until such time as this document can be archived in favor of the new composite WIGOS compatible metadata requirements when finalized.(SOT TC, WMO Secretariat ; April 2017)

6.9/3 Technical Coordinator to inform VOS Operators and PMOs via the JCOMMOPS mailing lists when migration to the JCOMMOPS integrated database has been completed.(SOT TC; December 2017)

6.9/4 Metadata management and associated training for VOS Operators and Port Met Officers in the collection of metadata should considered in liaison with the new Task Team on Recruitment, Promotion and Training.(TT-RPT, TT-VOS Metadata; Ongoing/SOT 10)

6.9/5 Proposals for Quality Controlling metadata submissions should be developed by the metadata Task Team and that this issue should be added to their Terms of Reference.(TT-VOS Metadata; SOT 10)

6.9/6 VOS operating members and PMOs should be invited to review the proposed composite new metadata requirements and to notify the Task Team if they identify any gaps in the metadata requirements or consider that further amendments are needed.(VOS Operators/PMOs;: August 2017)

6.9/7 Links to official ship data repositories (e.g. Lloyd's Register information) should be considered in order to ensure consistency of ship related metadata. Technical Coordinator to investigate feasibility and costs and make recommendations as appropriate.(SOT TC; August 2017)

6.9/8 A *new composite metadata document should continue to be drafted for the VOS based on WIGOS requirements, with a view to eventually replacing WMO Pub 47.(TT-VOS Metadata; August 2017)*

6.10 Recommendations of Ad-hoc Task Team on SOOP Metadata

6.10.1 Chairperson of the ad-hoc Task Team on SOOP Metadata Dr. Joaquin Trianes reported the activities of the task team during the intersessional period.

6.10.2 SOT-8 established an ad hoc Team on SOOP metadata whose terms of reference are specified in Annex IV of the SOT-8 Final Report. These terms of reference are;

1. Review the SOOP metadata format
2. Create a list of active SOOP agencies and programs, with contacts
3. Create a SOOP platform metadata format and collection, linked to a ship list

6.10.3 This report describes the activities performed during the intersessional period to achieve the goals that are implicit in the terms of reference.

6.10.4 The JCOMMOPS Ship Coordinator and other members of the team conducted a concise review of the metadata standards defined for SOOP, and discussed the specifics via teleconferences, and also during the 6th Session of the IODE Steering Group for the GOSUD Project and the Third Session of the IODE Steering Group for the GTSPP project. The specific and goal-oriented outcomes of these meetings are described in the next section.

6.10.5 The working team identified and reviewed 4 core metadata categories:

i) SOOP-XBT Platform Metadata
ii) SOOP-XBT Cruise Metadata
iii) SOOP-XBT RT Deployment Metadata
iv) SOOP-XBT DM Deployment Metadata

6.10.6 The members of the Task Team came to consensus on accepting the following mandatory and optional fields for each category:

I) SOOP-XBT RT Deployment Metadata: Submitted by platform operators to GTS in appropriate BUFR format. Relevant metadata from the individual deployments are extracted and submitted to JCOMMOPS.
II) SOOP-XBT DM Deployment Metadata: Submitted by platform operators to JCOMMOPS yearly.

Mandatory fields:

1.Operator Platform ID
2.JCOMMOPS Platform ID (assigned during JCOMMOPS platform registration)
3.National program/agency (choose from drop-down menu)
4.Unique Ship Reference (Query tool on JCOMMOPS website)
5.Installation date (YYYYMMDD in csv)
6.De-installation date (if applicable, YYYYMMDD in csv)
7.Launcher model (WMO code table 0 22 178)
8.Recorder type (WMO code table 0 22 068)
9.Firmware version
10.Telecom type (WMO code table 0 02 148 – only for near-real time platforms)
11.Standard deployment height (meters)
12.Target XBT line(s), if any
13.Metadata format version (if applicable, i.e. for csv submissions)

Optional field:

14.Comment (text)

I) SOOP-XBT Cruise Metadata: Metadata on cruises of ships equipped with an XBT platform, and actively deploying probes; e.g. departure date, line, ship. Submitted and updated by authorized platform operators through online-form on www.jcommops.org or comma-separated (csv) file. Goal: Estimate the future implementation of the XBT network, and also assist with the implementation of other networks (e.g. Argo, DBCP). Every single cruise must be submitted, so action is required regularly. Mandatory fields grow with the progress of the cruise status from "planned" to "confirmed". "Planned" only means that an agency will try to set up a cruise, while "confirmed" means that the cruise is really going to happen. Based on submitted cruise dates and DM data submission, the status later changes automatically to "at sea", "completed" and "DM metadata submitted".

Mandatory fields:

1.Status (planned or confirmed)
Mandatory fields for status "planned":
2.Line number (choose from drop-down menu or map)
3.National program/agency (choose from drop-down menu)
Mandatory fields for status "confirmed":
4.Departure date (select estimated date from calendar tool, or YYYYMMDD in csv)
5.Arrival date (select estimated date from calendar tool, or YYYYMMDD in csv)
6.Unique Ship Reference (Query tool on JCOMMOPS website)
7.Operations Manager (choose from drop-down menu)
8.Metadata format version (if applicable, i.e. for csv submissions)

Optional fields:

9.Deployment opportunities (number of instruments)
10.Comment (text)

II) SOOP-XBT RT Deployment Metadata: Submitted by platform operators to GTS in appropriate BUFR format. Relevant metadata from the individual deployments are extracted and submitted to JCOMMOPS by Météo-France. Daily onboard action during XBT cruises. Goal: RT monitoring

III) SOOP-XBT DM Deployment Metadata: Submitted by platform operators to JCOMMOPS yearly.

Mandatory fields:

1.Line number (e.g. AX01)
2.Operator Cruise ID
3.JCOMMOPS Cruise ID (assigned by JCOMMOPS)
4.Date (YYYYMMDD)
5.Time (HHMM)
6.GTS Platform ID
7.JCOMMOPS Platform ID
8.Unique Ship Reference (Query tool on JCOMMOPS website)
9.Latitude (in decimal degrees, N>0, S<0)
10.Longitude (in decimal degrees, E>0, W<0)
11.Deployment height
12.Instrument type (WMO code table 0 22 067)
13.Software / version
14.Probe serial number
15.Probe batch date (date of manufacture, YYYYMMDD)
16.Metadata format version

Optional fields:

17.Drop number
18.Quality flag ('good' if there is any good data in the profile, 'bad' if the entire profile fails)
19.Total depth
20.Comment (text)

6.10.7 The working team compiled a list of active SOOP agencies and programs involved in XBT deployments and available on the meeting document SOT-9-Doc-10.2. This list of agencies cannot be considered final or complete as it can change depending on the degree of involvement of these and other partners in XBT deployments.

Actions;

6.10/1 Technical Coordinator should keep an updated list of active SOOP agencies and programs, including contact information.(SOT TC, ongoing)

6.10/2 SOOP-XBT platform operators (or partner agencies) to submit delayed mode deployment metadata in the format required yearly to the JCOMMOPS SOT TC.(SOOP operators; ongoing)

7 PLENARY DISCUSSION ON RECOMMENDATIONS FROM TASK TEAMS

7.1 Metadata and WIGOS Readiness

7.1.1 Unique Identifiers for SOT

7.1.1.1 Mr. Kramp reported further on the proposed SOT Station ID scheme. Some concern was raised on combining metadata i.e. ship class or owning county into the platform ID using lookup tables. The Team agreed to migrate to the new platform ID scheme in the format/procedure proposed by the TT, with no information encoded in n1, n2, n7.

7.1.1.2 The Team recognized the importance of new ID scheme to eliminate issues such as the changing ship call sign which used to be the platform identifier. They also recognized that there is a need to identify the criteria necessary to issue new IDs. Some of the suggestions were , when moving from manual to automated system or when the ship ownership changes , etc.

7.1.1.3 The TT-ASAP noted that they may have problems adopting the new SOT unique identifiers. Presently, ASAP program recycle instrument identifiers and use 5 or 6 digit IDs, as compared to the planned seven alphanumeric character SOT identifiers. ASAP has to clarify whether the present ASAP software will handle the new SOT identifiers. JCOMMOPS mentioned that this may not be an issue as the number of ships in ASAP program are few(20).

7.1.1.4 The WMO Secretariat mentioned that ownership of the WMO IDs lies with WMO. However, WMO can delegate responsibilities for JCOMMOPS to be the ID issuer . JCOMMOPS needs to develop a document explaining the tasks and responsibilities necessary for a platform ID issuing body.

Action;

7.1.1/1 Prepare documents on the new proposed ID scheme to provide to the OCG and to JCOMM-5(TT-WIGOS ID, 10 May 2017)

7.1.1/2 Establish criteria (e.g. a decision tree)for issuing new platform IDs.(TT-WIGOS ID, June 2017)

7.1.1/3 Develop a document on the tasks and responsibilities that JCOMMOPS will need to perform as a platform ID issuing body delegated by WMO.(JCOMMOPS with assistance from Secretariat, June 2017)

7.1.2 Metadata requirements and SOT metadata formats

7.1.2.1 The majority of Team members agreed that there is no ongoing requirement or benefit for continuing with ship masking as there are many other ways that third parties can find the ship position. Encode and decode of ship IDs would require additional effort and would also create complications when preparing network status statistics . Going forward the panel agreed to discontinue encode/decode for ship masking and use the new ID scheme and BUFR data format to fulfil the requirement for members who would still like to continue to mask their ship observations. Japan mentioned that they agree with the new ID scheme, although they required to notify the Japanese maritime authorities of the proposed changes.

7.1.2.2 EC Resolution 27 from EC-59 recommended to maintain the ship masking scheme until such time where there is a suitable replacement. As a consequence of the proposed new SOT ID scheme and data distribution in BUFR format, the Team agreed that the ship masking scheme should be discontinued.

7.1.2.3 It was noted that there are instances where multiple observation platforms from different organizations are installed on the same ship. In such situations call signs cannot be used as the platform ID for both platforms on the same ship. Accordingly the Team agreed on the new ID scheme for the platform IDs. Further the Team had already agreed to separate ship metadata from platform metadata in new WIGOS metadata structure. After discussions on pros and cons of using different identifiers for the Ship, the Team agreed to use ICES code as the ship identifier.

7.1.2.4 To ensure a more integrated effort for work on metadata within SOT community, a proposal was made to merge the SOOP and VOS metadata Task Teams. However the Team expressed varying opinions on merging the metadata TTs. TT-SOOP metadata considered that there were benefits of maintaining the separate TT on SOOP metadata for simplicity and specificity. Following discussions the Team agreed to keep the metadata TT separate for VOS and SOOP but with a representative from each TT siting in the other TT.

Action;

7.1.2/1 TT-ASAP to map their metadata to OSCAR requirements.(Chairperson of TT-ASAP, Dec 2017)

7.1.2/2 TT-SOOP to map their metadata to OSCAR requirements.(Chairperson of TT-SOOP, Dec 2017)

7.1.2/3 SOT chairperson to contact the DBCP Chairperson requesting nominations from the DBCP panel to participate in the TT-VOS metadata.(SOT Chairperson, Aug 2017)

7.2 Harmonized Operations with Ships across all GOOS networks

7.2.1 Cross-cutting recruiting issues

7.2.1.1 Recruiting a vessel begins when scientists decide on a route between two ports that is interesting for their scientific purposes. Once those ports are set, the search for a vessel begins. After a vessel is identified, the first step is to contact the company or owners of the vessel. This presents a challenge in that obtaining the first contact and conversation with the owners/operators of a vessel is difficult and lengthy.

7.2.1.2 Once contact is made, plans begin to be made for two or more months before the voyage. This includes shipping, repair of equipment, and arranging a scientific rider. This process is very dynamic and the vessels are always changing between routes and ports, presenting another challenge. At times, these changes can cause a preparation for a cruise to be wholly lost and must be started again.

7.2.1.3 It would be beneficial to create a database of shipping companies and their corresponding contact within the pertinent agency. This would facilitate a way for agencies that need a certain platform to have access to a shipping company without overstepping any boundaries, causing issues with the shipping company, or causing issues with ongoing operations.

7.2.1.4 It would also be beneficial for JCOMMOPS to head up an effort to initiate relationships with shipping companies so that they can provide the first point of contact to the SOT agencies.

7.2.1.5 Amendments to the MSC.1/Circ.1293 which is owned by WMO and IOC, were proposed by the Team. IMO recommended that the Team should to draft a revision to near completion before forwarding it to IMO.

Action;

7.2.1/1 Prepare an amendment to the IMO Circular MSC.1/Circ.1293.(TT-RPT, SOT EXG with Secretariat, Oct.2017)

7.2.2 Opportunity to rebrand met-ocean observations from/with ships

7.2.2.1 Discussion between SOT members and key stakeholders from, IMO, IHO, WOC, and ICS took place during the week to identify the purpose and importance and of re-branding ship based observation efforts and the benefits of such arrangement. Very positive feedback was received from the participants for such arrangement which will provide a centralized and harmonized approach. Because it would allow to provide common entity to represent all ship-based observing activities, it was beneficial to hear the shipping companies views on this approach. Therefore the SOT Vice Chairperson suggested to work towards a common brand to represent all scientific activities on ships. However the SOT Vice Chairperson also considered that the community was not yet ready for rebranding or labeling and suggested this aspect should put on hold pending the outcome of the ongoing discussions in the ship forum.

7.2.2 Discussions on possible ship forum is available in Annex VIII

7.3 Other Recommendations

7.3.1 No other recommendations were made by the Team.

7.4 Task Team structure

The Team agreed with TT proposals that the;

- Task Team on Instrument Standards and Task Team on Satellite Communications merged into Task Team on –Instrument Standards and Sattalite Communications(TT-ISSC) and that Mr. Jean-Baptise Cohuet should be the new the Chairperson.
- Task Team on Pub 47 metadata be renamed as Task Team on VOS Metadata (TT-VOS Metadata) and that Ms.Emma Steventon should be the new Chairperson.
- Task Team on VOS Recruitment and Program Promotion and the Task Team on Training should be merged to become a new Task Team on Recruitment Promotion Training (TT-RPT) and that Ms. Paula Rychtar should be the Chairperson.
- Ad-hoc Task Team on SOOP metadata should be converted into a full Task Team on SOOP Metadata(TT-SOOP Metadata) and that Dr. Joaquin Trianes should be the Chairperson.
- Ad-hoc Task Team on WIGOS should continue such time as its report can be delivered to OCG-8.

Action;

7.4/1 Mr. Eric Freeman was proposed as the Chairperson of TT-Masking. Mr. Shawn Smith to confirm with Eric Freeman.(SOT Vice-Chairperson, end April 2017)

8 ELEVENTH SESSION OF THE VOS PANEL (VOSP-11)

8.1 VOS Programme activity reports (including implementation status)

8.1.1 Report by the VOSP Chairperson

8.1.1.1 The meeting noted that Ms. Sarah North (United Kingdom), had retired from the Met Office in January and, as a consequence, had decided to step down as the Voluntary Observing Ship (VOS) Panel (VOSP) Chairperson. The meeting further noted that following approval by the JCOMM co-presidents Mr. Henry Kleta had formally been approved to succeed Ms North as the new VOSP Chairperson.

8.1.1.2 As the outgoing VOSP Chairperson, Ms. North briefly reported on activities undertaken following the SOT-8 session held in Cape Town from 20 to 24 April 2015. A summary of these activities is attached at Annex A of SOT-9-Doc-8.1.1 and a copy of the VOS Panel's Terms of Reference is attached at Annex B of SOT-9-Doc-8.1.1.

8.1.1.3 Ms. North attended and helped organize the fifth International Workshop of Port Meteorological Officers, held from 20 - 24 July 2015, at Vina del Mar, Chile. The final report of the OCG-5 meeting is available on the JCOMM website[15].

8.1.1.4 Ms. North also represented the SOT Chairperson at the Sixth Session of the JCOMM Observations Coordination Group (OCG) held from 27 - 30 April 2015, in Cape Town, South Africa., and participated in several OCG WebEx meetings during the intersessional period.

8.1.1.5 The Team noted that throughout the intersessional period Ms. North actively participated as a member of nine of the current SOT Task Teams. She had in particular been heavily involved in the work of the Task Team on VOS Recruitment and Programme Promotion (TT-VRPP), which she also chairs. In late 2016 she also took over as the Chairperson of the Task Team on Pub 47 Metadata. This work entailed a complete review the scope and content of WMO Pub47 metadata and the development of new WIGOS compliant metadata requirements to eventually replace Pub 47.

[15] www.jcommops.info

8.1.1.6 As Chairperson of the Drifter Donation Programme Evaluation Committee (PEC) Ms. North was kept informed of all proposed drifter donations. It was noted that although several countries had shown interest in developing national VOS networks no drifters had been donated yet.

8.1.1.7 In this regard Ms. North also pointed out that approximately 90 % of the VOS observations in 2016 came from just 7 participating members. Consequently there remained a need to increase the capacity of other countries that are seeking to implement VOS networks, and to involve other countries that have large national merchant fleets but have no established VOS fleet.

8.1.1.8 Ms. North also actively participated in meetings of the E-SURFMAR Expert Team on VOS held in Rome and in Hamburg She also attended the workshop to train Port Met Officers in the use of the new EUCAWS Automatic Weather Station, also held in Hamburg.

8.1.1.9 Ms. North advised the Team that she had extracted information from the National VOS Reports submitted by members in order to provide input to the 2015 and 2016 SOT reports concerning the use of electronic logbooks and automated observing systems. These reports, together with information extracted from the E- SURFMAR metadata database, are essential to assess the status of participation in the VOS Scheme. In this regard Ms. North was pleased to report that 25 national VOS reports had been submitted for 2016, compared to only 16 reports in 2015 and 20 reports in 2014.

8.1.1.10 However she pointed out that extracting data from national reports took considerable time and stressed the need to replace the system of hardcopy VOS reports with an online system whereby VOS operators could enter their information directly to the JCOMMOPS database. This would hopefully also encourage greater and more considered response from members and would in turn provide a better overview of how the VOS Scheme is performing.

8.1.1.11 Ms. North drew the meetings attention to figures that she had extracted from the E-SURFMAR metadata database and from the national VOS reports at Annex C of SOT-9-Doc-8.1.1. For some countries there were clear inconsistencies between the numbers of ships being reported, and those recorded in the database. Further inconsistencies were apparent when the numbers of active ships reported in the database were compared with the number of ships recorded in the E-SURFMAR Observation Counters2 as having submitted real time observations in 2016. It was nevertheless recognized that there may be legitimate reasons for such discrepancies e.g. use of masked call signs, ships only recruited to submit delayed mode data etc.

8.1.1.12 Ms. North therefore stressed the need for national VOS Focal Points to ensure that their metadata records are maintained up to date, and that the full suite of metadata is available for each ship. Linking national reports to metadata records in the new JCOMMOPS database would therefore help to ensure this, although a new system would need to be introduced to automatically request VOS operators to confirm that their metadata records are up to date. Whilst this would need to be done annually it was also suggested that quarterly confirmations should be requested i.e. as is currently required for WMO Pub 47 submissions.

8.1.1.13 Accordingly, the Technical Coordinator was requested to ensure that an online VOS reporting system linked to the new metadata fields is developed in time to allow compilation of the 2017 annual national reports. VOS Focal Points should be requested to pro-actively confirm the accuracy of their metadata records, and the system will need to be able to generate graphics to show trends e.g. in the use of automated systems, electronic logbooks, PMO activity etc.

8.1.1.14 During her career it was noted that Ms. North had attended all SOT sessions to the current date, had Chaired both the VOS and ASAP Panels (i.e. before the ASAP Panel was made into a Task Team), and had also Chaired the Task Teams on SatComs, Metadata and VOS Recruitment and Participation. She had also helped to set up, and Chaired, the VOS

Climate Project for several years, and had actively participated in three international PMO workshops.

8.1.1.15 She pointed out that the increased use of automated systems was gradually changing the traditional nature and composition of the VOS Scheme, and with it the role and skills of the Port Met. Officers. In addition increased linkage with shipping companies, and the increased use of broadband communications at sea could provide real opportunities to further enhance and strengthen the VOS Scheme in the coming years. Ms North thanked VOS Panel members for all their assistance over the years and wished them well for the future.

Actions;

8.1.1/1 Technical Coordinator to ensure that an online VOS reporting system linked to the new metadata fields is developed in time to allow compilation of the 2017 annual national reports. Under the new system VOS Focal Points will need to proactively confirm the accuracy of their metadata records and the system will need to be able to generate graphics to show trends e.g. in the use of automated systems, electronic logbooks, PMO activity etc.(SOT TC, VOS Focal Points; December 2017)

8.1.1/2 National focal points to provide complete and timely national reports to the secretariat.(SOT members, Ongoing)

8.1.2 SOT Technical Coordinator report on VOS support activities

8.1.2.1 Mr. Martin Kramp reported the SOT TC activities in the intersessional period, the SOT TC supported the VOS panel by:

- Routine metadata, platform and network monitoring, and corresponding communication with VOS operators
- Contributing to all Task Teams as active member (see Task Team reports)
- Setting up a daily machine to machine synchronization mechanism between E-Surfmar and the new integrated JCOMMOPS database, but restricted to mandatory Pub47 elements, with minor issues based on presently non-unique identifiers (call-signs).
- Maintaining the Mask to Real List, which has also been incorporated into the new JCOMMOPS system
- Reviewing the automated QC relay procedure, with the aim to send warning messages to instrument operators when the platform appears on a suspect list
- Producing a set of monthly network maps, available through FTP, JCOMMOPS and SOT websites, and inviting the community to provide further requirements
- Producing monthly statistics and additional (draft) KPIs and corresponding (draft) targets, available on JCOMMOPS website
- Promoting the VOS scheme, and in particular setting up third party partnerships with vessels transiting data sparse areas, including also uncommon vessel types such as ocean racing yachts and balsa rafts, and by creating simplified TurboWin instructions.
- Continuing with the VOS-DP initiative in Tanzania, which eventually failed after a staff change in Tanzania
- Maintaining the VOS website
- Implementing the VOS questionnaire as online survey and pdf document, with assistance from the JCOMMOPS communication coordinator

8.1.2.2 The Panel thanked the SOT TC for his continuous support and made a number of decisions.

Actions;

8.1.2/1 Continue with innovative and in particular third party partnerships with the aim to recruit more vessels particularly in data sparse areas, and promote the work of the SOT.(SOT TC, ongoing)

8.1.2/2 Create an advanced version of the simplified TurboWin instructions, with support from the TT-RPT.(SOT TC, TT-RPT, SOT-10)

8.1.3 E-SURFMAR Expert Team on VOS status report

8.1.3.1 The observation programme of the EIG EUMETNET includes activities in the area of Surface Marine Observations: (i.e. The E-SURFMAR operational Service) Dr. Paul Poli (France) reported on the VOS activities of E-SURFMAR. He pointed out that nineteen member countries are currently supporting this service: Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Serbia, Spain, Sweden, Switzerland, and United Kingdom.

8.1.3.2 The service is managed by Météo-France with VOS activities coordinated by Mr. Jean-Baptiste Cohuet (France) and coordinated by a group of VOS Experts Chaired by Mr. Henry Kleta(Germany).

8.1.3.3 In 2016, observations transmitted by European VOS accounted for 56% of all VOS reports (i.e. that report surface pressure) onto the GTS and for which the ship recruiting country can be identified. Considering all the VOS reports (i.e. including those with masked identifiers, or non-recruited ships) this proportion is reduced to 45%.

8.1.3.4 It was note that some of E-SURFMAR topics were discussed under other agenda items. Dr. Poli drew the meeting's attention to a number of developments carried out since SOT-8.

EUCAWS:

8.1.3.5 (see also agenda item 8.2.2) The development of a European Common S-AWS (EUCAWS) has entered its deployment phase. A last round of developments has been carried out to fix issues on the first three prototypes. A hands-on technical workshop was held in Hamburg 18-19 April 2016 and attracted over 30 participants from 7 countries. All three EUCAWS prototypes were gathered for the occasion, with their differing setups and configurations, and participants were able to interact with the stations using both direct and satellite communications. Through the framework agreement put in place at the start of the project, several countries have ordered their first series. The expected total count is around 300 units over the next few years. The resulting product meets the stringent and varied specifications from a various countries and regulations, and the consortium is willing to share the experience with other countries that wish to start a S-AWS program.

Ship-to-shore data transmission:

8.1.3.6 The E-SURFMAR ship-to-shore data formats have been evolved to take stock of latest developments in the EUCAWS. These formats have been finalized in close cooperation with the JCOMM Expert Team on Marine Climatology (DMPA/ETMC). Data format #100 has been implemented in several S-AWS using Iridium SBD to report their observations ashore, including EUCAWS and the OceanoScientific system (e.g., on the Bugaloo). Meanwhile data format #101, combined with the half compression technique, is devoted to conventional VOS. And its implementation in TurboWin had now completed.

TurboWin (software developed by The Netherlands):

8.1.3.7 The developments and the maintenance of TurboWin software(including TurboWin+ and TurboWeb) have continued at KNMI, with partial financial support by E SURFMAR. Notable developments include;

- Update of Themes (colour schemes)
- GPS link via USB (reduces errors in positions otherwise entered manually)
- Export of observations to the Weather Observations Website (WOW), though only for fixed stations at present (support for mobile station is planned in a future phase)
- Export of observations in format #101 to a web server

- Automated pressure reports (a number of common barometers are supported), at configurable time intervals
- Event logging
- First seeds for a light-weight version, TurboWin Light

Data monitoring:

8.1.3.8 The data monitoring tools maintained by E-SURFMAR are available to all data buoy and VOS operators reporting their observations onto the GTS[16]. These tools are already widely used by the VOS and data buoy communities.

Data impact and benefit delivery:

8.1.3.9 Several impact studies funded by EUMETNET and European NWP centres have assessed the impact of surface marine observations from buoys and ships on Numerical Weather Prediction. Results generally indicate that drifting buoys have a large impact, but ships are also important. The coverage of all observing systems ensure complementarity, with long time-series at fixed-point allowed by moored buoys, ships covering generally largely-travelled areas where maritime safety is all the more important, and drifting buoys making no attempt to avoid bad weather areas but remaining generally in the wider oceans and away from coastlines (as they generally tend to run ashore rather quickly there).

VOS metadata:

8.1.3.10 Dr. Poli gave an update status of the E-SURFMAR metadata database. As recommended on two occasions, in OCG discussions and in the European group of VOS experts at its meeting in Hamburg in April 2016, this database is being transitioned to JCOMMOPS. The transition plan calls for replicating first the current capacity and engaging with users (asking them to change their bookmarks), putting JCOMMOPS in the position of interacting with the wide variety of ship program operators.

8.1.3.11 This phase should not be under-estimated as it builds on years of trust established between the operators and the database owners and it is essential not to lose this link. For this reason, it is important that the visual aspect of the database and capacity remain at first unchanged. However, this new location of the database will have immediate knock-on benefits, by enabling to trace all the marine programs, which are deployed from ships in their vast majority.

8.1.3.12 The future of the VOS metadata now rests largely with the community-at-large but E-SURFMAR will continue to do its part. For example, a first mapping of the Pub.47 metadata into WIGOS metadata has been proposed by E-SURFMAR to the Pub.47 Task Team, paving the way for a more complete process that has seen community-wide efforts (see Pub.47 TT separate agenda item).

8.1.3.13 The next phase calls for merging Pub47 within the WIGOS metadata, based on recommendations of the dedicated task team, with a possible consolidation of items that are shared between the various ship programs. An important element will be to preserve the climate continuity of all elements and for that reason it is important to give sufficient time to this mapping exercise.

8.1.3.14 With a liaison between JCOMMOPS and OSCAR/Surface already in place, the target is for all ship metadata to be populated directly by ship program managers online, where this will feed automatically OSCAR/Surface and allow stakeholders to fully appreciate the scale of the engagement and efforts borne by the ships, in maintaining the global observing system over the World Oceans. This vision was behind one the proposal made by E-SURFMAR at the last SOT session(which was endorsed Recommendation #93 "to add three non-Pub47 fields to in the VOS metadata database to tell if the ship is participating or not in ASAP, SOOP and/or

[16] http://www.meteo.shom.fr/qctools/.

GOSUD programmes"), but in the end it was deemed more efficient to explore merging into the WIGOS metadata standard, where all ship programs (not just VOS) may be served.

Visual observations:

8.1.3.15 The number of ships from Europe reporting visual observations has continued to decline, though this decline has been more than compensated (in numbers) by increases in the number of automated reports.

8.1.3.16 However, the diversity in the observation reports is declining as automated reports often lack the visual elements. Some of this human-observer-reported information, like sea-state and present weather, is key information for forecasters to appreciate the severity of a fast-developing crisis situation that could unravel quickly for other factors (ship mechanical failure, etc.).

8.1.3.17 The Team agreed the arrangements for moving the PUB 47 database from ESURFMAR to JCOMMOPS.

8.1.3.18 The IHO representative suggested to try to get a resolution suggesting the strong contribution from Mariners to provide observations. In response to the discussion, IMO mentioned that under the SOLAS Convention coastal countries have an obligation to provide the weather information for the safety of life at the sea (SOLAS).Because IMO provides globally agreed minimum standards if the maritime community is not getting feedback from meteorological organizations, then mariners may forget the need to cooperate in providing observation data.

8.1.3.19 The Team agreed once again the importance of reviewing the IMO document MSC circular MSC.1/Circ.1293 and stress the need to change the wording to encourage much stronger support from the mariners for ocean observations.

Proposed work plan until SOT-10:

- Work with JCOMMOPS to transition the E-SURFMAR database;
- Explore ways to collect more visual observations from European VOS, which have been declining in numbers over the years;
- Roll-out the EUCAWS to E-SURFMAR participants, through an adoption program to encourage starting new AWS fleets at national levels;

8.2 VOS Developments

8.2.1 Electronic logbooks

8.2.1.1 Ms Sarah North drew the Panels attention to information she had extracted from VOS national reports between 2002 and 2016 showing the status of members use of electronic logbook software (Appendix A of SOT-9-Doc-8.2.1). It was noted that despite a gradual rise in the provision of e-logbook software on observing ships over the last decade, there had been a disappointing fall in numbers over the last three years.

8.2.1.2 It was recognized that there were several possible reasons for this decline. Firstly some national VOS operators had again failed to submit their 2016 VOS reports and some estimates had to be made on the basis of previous years' submissions. Secondly the plans by some NMS to migrate to automatic weather systems were having a consequential impact on the size of national manually reporting VOS fleets. Thirdly some VOS Operators had been rationalizing the size and composition of their manually reporting fleet's e.g. by focusing mainly on the higher quality VOSClim ships and by transferring some ships to the new third party status.

8.2.1.3 The Panel noted that there continue to be three main types of electronic logbook software currently in use on VOS – OBSJMA developed by the JMA, Amver/SEAS developed by NOAA, and TurboWin2 developed by KNMI in cooperation with E-SURFMAR.

8.2.1.4 It was recalled that the VOS Panel has been working to increase the number of e-logbooks and in particular to concentrate on the use of one particular logbook Software – TurboWin. This would help to ensure consistency of reporting and would reduce duplication of effort.

8.2.1.5 The Panel was therefore pleased to note that as a consequence of the NOAA's National Weather Service decision to transition their VOS to the use of TurboWin software, the use of Amver/SEAS had declined significantly since the last session. The Panel was also pleased to note that Japan had recently migrated some of its fleet over to the use of TurboWin.

Electronic Logbook Developments

8.2.1.6 The Panel reviewed current initiatives for the enhancement of e-logbook software programs. In particular it was understood that, although delayed, version 5.5 of the TurboWin software was almost ready for formal release. A key feature of the new version is the facility for manual reporting ships to send messages using the compressed E-SURFMAR #101 data format by email (details available at the E-SURFMAR website1). This which allow the easy translation of incoming messages to the higher resolution BUFR format prior to circulation on the GTS.

8.2.1.7 Meanwhile TurboWin+ software, which is available for download from the KNMI website2., is increasingly being used on VOS. It can be used in the same stand-alone version as the traditional TurboWin software, and is already being used on a significant number of US observing ships. Whilst the TurboWin+ software doesn't include as many of the add-ons that are available in the traditional TurboWin software it has the additional facility to:

- send observations directly via the internet to an NMS server
- display pressure and pressure tendency graphs and data when connected a suitable barometer (i.e. Vaisala PTB330 or PTB220, MintakaDuo barometer)
- interface with the new EUCAWS (European Automatic Weather Station) shipborne AWS system to display the measured sensor parameters, whilst also allowing the observer to add visual observations to the measured values

In addition it can make and submit AMVER reports and has the facility to check the ship observation positions on Google maps when the internet is available. It was noted that the URL to be used to send observations via the web to the KNMI server had recently changed to http://www.knmi.nl/samenw/turbowin/webstart/turbowin_jws.jnlp.

The Panel noted that in addition to the KNMI server, it was now also possible to send observations to other servers maintained by national meteorological services.

8.2.1.8 One of the prime advantages of using TurboWin+ via the web (also called TurboWeb) is the ability to update the software remotely, thereby avoiding the need for Port Meteorological Officers to visit the ship to update the software locally. Once set up it therefore also avoids on board security issues. This method of reporting is of course only available to ships that have internet access and suitable bandwidth, and where the parent ship owner has agreed to its use on board. Even then it broadband capability may not be available at all times so some ships may need to revert to sending observations by Sat C code 41 or email on occasions.

8.2.1.9 The Panel noted that Java 7 needs to be installed on the ships computer to enable TurboWin+/TurboWeb software to run. The software is designed to work on a variety of computers (e.g. Windows, Linux, Mac, Solaris) and that the ships call sign use to transmit the observations needs to be on the white list currently maintained at KNMI. It was recalled that at the last session VOS Operators were encouraged to liaise with ship owners and managers with a view to increasing the use of TurboWeb on suitable observing ships.

8.2.1.10 The Panel was reminded that TurboWin software also allowed observations to be transmitted in a half-compressed format by using a dedicated three figure Inmarsat Special Access Code (SAC) which the national VOS operator will need to register prior to use. The raw

messages are currently sent via Inmarsat-C (usually via Burum LES) and are relayed to Meteo-France for processing and for insertion on the GTS. Use of the half compressed system helps reduce the currently unfair cost burden borne by the small number of NMS that currently host SAC 41 Land Earth Stations.

8.2.1.11 The Panel noted that since the last session KNMI had convened two WebEx meetings to address and priorities the long wish list of changes and additions to the software proposed by members. In this regard KNMI, in liaison with E-SURFMAR who currently part fund the software, was requested to outline it plans for the future functionality of TurboWin versions for consideration at the next session.

8.2.1.12 Some concerns were raised that the TurboWin software was to some extent reliant on a single software developer. Accordingly KNMI, in liaison with E-SURFMAR, was invited to consider strategies to ensure the on-going continuity and development of the TurboWin Software avoiding reliance on single points of failure.

Actions;

8.2.1/1— TurboWin/Web; Perform a risk analysis with regard to dependency of the VOS Panel on new TurboWin/Web developments, in particular related to the transition to a new ID Scheme and the impact on AMVER reporting.(VOS Chairperson, E-Surfmar ET-14)

8.2.2 VOS automation Status

VOS automation Status

8.2.2.1 Ms North drew the Panels attention to information she had extracted from VOS national reports between 2002 and 2016 to show the status of of automation on VOS (Appendix A of SOT-9-Doc-8.2.2) It was noted that the expected growth in the use of shipborne AWS systems had not yet materialised and that there had been very little growth in the overall number of automated systems since the last session. She suggested that there were probably two main reasons for this – the delayed introduction of the E-SURFMAR EUCAWS system, and financial/resource constraints on VOS Operators.

AMOS Developments

8.2.2.2 Ms North reported on the roll out status of Met Office's Autonomous Marine Observing System (AMOS). She explained that 59 systems had now been installed on UK VOS. Most of the systems had been installed on ferries and coastal vessels operating around the UK coast and in near continental European waters. However systems had also been on several research and survey ship operating in the data sparse areas of the Southern Ocean.

8.2.2.3 It was planned to install a further fifteen AMOS Mk 1 systems in 2016 with an eventual target of 100 AMOS systems, set by the Met Office. However, these plans had now changed as a second generation AMOS model is being developed and trialled. Hence there were no plans to roll out further AMOS(Mk 1) systems.

8.2.2.4 At the end of 2015, the system was granted a Provisional Production License and is now considered a licensed Met Office Service/System. In order to obtain this, the procedures and processes necessary for dealing with fault and asset management had been developed, and fully documented work instructions prepared. A production Readiness Review will be initiated, where consideration for a full license will be given.

8.2.2.1.5 It was noted that there were currently two variants of the AMOS system – a stand-alone solar powered version that required no links to the ships systems, and a 24 volt that only required connection to the ships power supply. Whilst both systems were now operating well the preference was to install 24V version, and to increasingly move over to using such systems in the future. However several ship owners had expressed a preference for the solar

variant. A new 2-sided solar cell arrangement is currently being trailed on a number of ships, with plans to phase out installation of the original solar cube in preference to the newer design.

8.2.2.6 The Panel noted that a Mk2 version of the AMOS had been developed and was currently being trialled on a variety of marine platforms, including coastal buoys. The new system has the capability to connect, either wirelessly (via Bluetooth) or via cable, to a visual display on the ships bridge (although the display has yet to be developed). Many captains had expressed a wish to have such display information available to them to assist with their shipboard and navigational operations.

8.2.2.7 It was noted that internal monitoring web pages for AMOS had been further developed within the Met Office. Based on Google Maps, the site offers the facility to view the whole network on a map or select individual ships to view a track from the last two weeks, with clickable hourly data points giving the position, reported elements and engineering data. Each data point also has links to a time-series which is displayed on the page and to Meteo France Quality Monitoring QC tools page.

8.2.2.8 At present the raw CSV data from the AMOS systems is being processed by a third party company and converted into FM-13 ship code. However the Met Office is in the process of developing a new marine data gateway which would permit the raw data to be processed within the Met Office and converted into BUFR format for circulation to members via the GTS. However, these plans have been subject to multiple delays and the future plans remain uncertain.

EUCAWS developments

8.2.2.9 The Panel recalled that E-SURFMAR, as Surface Marine Operational Service of the EUMETNET Observations Programme, published in 2012 an invitation to tender in order to design a common system for European ships: the European Common Automatic Weather Station (EUCAWS).

8.2.2.10 Due to there being a wide variety of members involved in its design, the EUCAWS was specified to be highly flexible and adaptable to different kind of sensors. Stringent specifications were applied regarding data quality and operating environment.

8.2.2.11 The EUCAWS is straightforward to install and operate. Interaction with the host ships equipment is limited to power supply. The station can be configured locally and remotely by two dedicated software packages. Transmission of weather messages is ensured through Iridium satellite communication at very low cost using Short-Burst Data (SBD). The costs can be as low as 35€/month depending on the Iridium contract, or even lower for those countries that have access to US DoD Iridium unlimited airtime SBD (where only a one-time activation fee of around 50$ is required). This low cost is made possible by an optimised data format for transmission from ship to shore, similar to what has been used in buoys for years.
A key difference is the use of two-way communication, to interrogate the status of the AWS, change reporting settings, etc. The station can also be connected on board to the TurboWin software, to display measurements to the officers and crew, and to allow weather observations to be complimented with manual input of visual parameters.

8.2.2.12 After intensive tests in laboratories and on ships coordinated between Météo-France, DWD and KNMI, the EUCAWS prototypes were validated in March 2016. Several national members of EUMETNET have already purchased EUCAWS series, with installations started since early 2017.

8.2.2.13 In addition, E-SURFMAR has been tasked with purchasing every year a limited number of EUCAWS (2 in 2016), for capacity building inside the participating countries. This "adoption program" works by entrusting the EUCAWS stations to National Meteorological Services members of E-SURFMAR or other partner institutes from participating countries, in order to help them to start and develop their own AWS fleet. The stations are to become part

of the National fleet recruited by the receiving country. Help with the installation is offered on a best-effort basis by the E-SURFMAR members who already operate EUCAWS stations.

8.2.2.14 The sensors to be installed on such capacity building EUCAWS are those already used by the national institutes, and shall not be much different from those used already for the land stations, allowing thus to save on procurement and calibration costs and procedures. If the sensors cannot be interfaced yet with the EUCAWS, the E-SURFMAR management team offers help to develop the necessary software. The Panel noted that it is presently not in E-SURFMAR remit or intention to ensure calibration and maintenance of national instruments. For such capability, it is hoped that a Regional Marine Instrument Center (RMIC) will be able to fulfil this role.

8.2.2.15 It was further noted that E-SURFMAR can provide a common data processing denominator for European countries, by enabling for the GTS transmission of the weather messages. However handling the monitoring of data transmitted, and switching on/off sensors, remains a responsibility of the national institutes. It was further noted that E-SURFMAR had developed web-based tools for these tasks.

8.2.2.16 The Panel noted that the first two EUCAWS stations to be provided under this capacity building scheme will be adopted by Spain and Portugal, covering areas where maritime safety is essential for the safe transportation of passengers and goods.

Other AWS developments

8.2.2.17 The Panel noted that KNMI were currently trialling a system whereby a GPS and a TurboWin compatible digital barometer are linked to a ships computer in the ships wheelhouse. Subject to agreement with the ship owners/managers the system had the potential to be an inexpensive alternative to installing a full shipborne AWS system.

Actions;

8.2.2/1 VOS operators that have installed other types of AWS systems on their VOS (i.e. other than AMOS or EUCAWS systems) are invited to share basic information on such systems and developments at the next session.(VOS Operators, SOT-10)

8.3 PMO Status and Activities

Ms. North and Ms. Rychtar drew the Panels attention to the following PMO related activities and issues.

8.3.1 PMO-5 Conference

8.3.1.1 Ms North reported on recommendations arising from the Fifth International Port Meteorological Officers Workshop (PMO-5) which was held a Vina Del Mar, Chile, from 20-24 July 2015. The JCOMM PMO-5 website[17] provides an extensive list of the documents and presentations made at the Workshop which covers many of the factors that should be taken into consideration for the multiple facets of the PMO's duties out in the field. A copy of the recommendations arising from the Workshop is at Annex A of SOT-9-Doc-8.3[18].

8.3.1.2 The workshop was attended by 49 participants from 20 countries. Key aims of the workshop were to standardise best practices, particularly with respect to metadata collection, and to promote global standards of service for the VOS Scheme. Moreover it provided an opportunity to strengthen relationships in a role which relies heavily on international cooperation and which increasingly requires PMOs to acquire new and additional skill sets (e.g. computer skills, deploying drifters and floats, using e-logbooks, remote sensor management, retrieving delayed mode data and maintaining shipborne AWS platforms).

[17] http://jcomm.info/index.php?option=com_oe&task=viewEventRecord&eventID=1645

[18] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=15895

8.3.1.3 It was noted that that a total of 57 Recommendations were made PMO-5 relating to ship recruitment, operations, quality management, Health and Safety, metadata, collaboration, training, capacity development and marine services. Specific recommendations were also targeted to the JCOMM Observations Programme Area (OPA) and the JCOMM Services and Forecasting Systems Services Programme Area (SFSPA). Ms North and Ms Rychtar drew the Panel's attention to the some of the key recommendations that had implications for the VOS Panel

8.3.1.4 The Panels attention was further drawn to the nine actions arising from PMO-5. It was noted that while the majority of these actions were either completed or ongoing, the following actions remained to be completed

a. GDP to provide the list of beached drifters to JCOMMOPS for distribution through the mailing lists.
b. JCOMMOPS to provide a web-based form to facilitate the collection of information on instrument practices for ship-based observations.
c. JCOMMOPS to routinely prepare maps showing ship's last position vs. last observation (can be useful to see the recent activity of a VOS at a glance and before a ship visit).
d. to create an information sheet and brochure on the VOS donation programme.

The Panel supported these actions but recognised that the need to create an information on the VOS Donation program was dependent on the outcome of its discussion on agenda item 8.4.4.

8.3.1.5 The Panel agreed that momentum that was observed from the activities and the peer networking at PMO-5 should not be left to wane away. Such workshops greatly helped to foster international cooperation whilst also raising the PMO skill sets. Noting the success of the PMO-5 workshop the Panel recommended that planning should start for the next International PMO Workshop proposed to be held in 2019. Invitations were invited from Team members to host the next Workshop.

8.3.1.6 In considering the proposed workshop the Panel also noted that in accordance with the SOT Implementation Strategy[19], the Team was committed to capacity building through the development of partnerships between developed countries and developing countries. Moreover it recognized that organising regular PMO workshops was an efficient means of realising the PArtnerships for New GEOSS Applications (PANGEA)6 concept established by JCOMM. It is therefore necessary to commit to regularly scheduled workshops to encourage capacity building with emphasis on standard best practices, mentoring and embracing the PANGEA concept.

8.3.1.7 Accordingly the Panel considered that the current four yearly interval between international PMO workshops was too long to ensure that best practices are maintained and recommended to OCG that such workshops should be convened more frequently, and ideally at two yearly intervals. The WMO Secretariat mentioned that the funding for more frequent PMO workshops may not be a possibility and recommended to consider e-learning or teleconferences. In addition it was recommended that PMO training should be increasingly be offered globally via video conferencing (e.g.WebEx) and by Webinar sessions.

8.3.2 Role of the PMO

8.3.2.1 The Panel reiterated its view that Port Meteorological Officers (PMOs) play an essential role in supporting all of the observing programs of the SOT. Their roles are described in Chapter 6 of WMO Publication No. 471 (see excerpt at Annex B)[20]. PMOs also play a vital role

[19] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=9936
[20] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=6094

in maintaining the strength of the VOS Scheme, as well as contributing to the volume and frequency of accurate observations.

8.3.2.2 The primary functions of the PMO are to maintain a national fleet of VOS participants by:

(i) Recruiting ships of any nationality to take record and transmit weather observations while at sea.

(ii) Monitoring ships to ensure adequate participation and data integrity.

(iii) Determining a ships dedication to providing quality data in a timely fashion and at appropriate time intervals. De-recruiting ships as deemed necessary.

(iv) Maintaining accurate records and metadata for recruited ships.

(v) Ensuring that all instrumentation is recorded and adjustments/calibrations are undertaken and logged appropriately.

(vi) Regularly visiting recruited VOS, and maintaining current contact information with the observers/ship/management.

(vii) Providing ongoing training for observers, particularly with respect to coding and the use of e-logbooks, and updating instructions when needed.

(viii) Providing barometer/sensor accuracy checks, coding and e-logbook entry checks, and updating software when required.

(ix) Ensuring the collection of delayed mode data for archival.

(x) Promoting and maintaining liaison with international NMS, neighboring PMO's, harbour authorities, shipping companies, merchant marine schools and yacht clubs.

(x) Providing support for all SOT activities were appropriate e.g. SOOP XBT activities, Upper air ASAP activities and the deployment of drifting buoys and profiling Argo floats and assisting with other JCOMM observing activities when so requested.

8.3.2.3 The panel reviewed the JCOMM website listing of available PMO contacts[21]. It was noted that this list is primarily drawn from information submitted in national SOT reports. Moreover, it was noted that the number of PMO's contacts was currently 103, compared to 116 listed at the last (SOT-8) session. However, it was recognised that not all the PMO's listed are full time PMO's and, in addition, some are merely focal points assigned to assist in some PMO duties as time, and skills sets, permit. With respect to PMO skills it was further recognized that not all PMO's are capable or comfortable to assist in the area of supporting AWS needs on VOS.

8.3.2.4 The Panel noted that there were several actions arising from the last session that remained outstanding. In particular it had been agreed at the last session that the SOT national report format should be amended to include a field to report the percentage of PMO time actually spent on PMO related activities and VOS ship inspections. Although this action had not yet been completed it was recognised that SOT national reports would in future be submitted online via JCOMMOPS. The Technical Coordinator was therefore requested to take this into account in future JCOMMOPS developments.

8.3.2.5 In considering this issue the Panel was reminded that SOT Implementation Strategy[22] document called for the development of simple metrics to calculate the intensity of PMO effort in maintenance of the observing networks. Such metrics could have an impact on the future

21 http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=9936
22 http://jcomm.info/index.php?option=com_oe&task=viewEventRecord&eventID=1645

role of the PMO as they would allow the scope and percentage of PMO participation to be gauged more accurately and would also help to assess the level of PMO support that is actually available and needed.

8.3.2.6 Having suitable metrics would also help to assess ever increasing requests for support made by other programs (in particular for oceanographic observations). Furthermore they could help to ensure that volunteer ships are not being over-tasked and burdened by demands by various programs.

8.3.2.7 Recognising that most ships officers would contact PMOs via email the Panel once again recommended that the JCOMM PMO listings should include PMO office contact email addresses

8.3.2.8 The Team noted that the present Google tool will be replaced by a more appropriate tool in the JCOMMOPS environment, which does not require any software installation.

8.3.2.9 Following detailed analysis of PMO inspection data submitted in the 2015 and 2016 national VOS Reports (Appendix C of Sot-9-Doc-8.3), there appeared to have been an slight increase in PMO activity when all types of ship visit are taken into account. However it was recognised that this could be due, in part, to an improvement in filling out the National Reports by members. In this respect it still appeared that some countries were using old forms while others were failing to fill in the necessary details. Notwithstanding, whilst it was difficult to draw any clear conclusions from the information provided, it appeared that more manned VOS were registered than AWS. The proposed future collection of such PMO inspection information via the JCOMMOPS website could potentially help to ensure the future accuracy of such information.

8.3.2.10 Because the procedures involved with inspecting a manual observing ship are largely universal it is relatively easy for a PMO from one VOS operating country to inspect a ship from another, thereby helping to foster increased cooperation between PMOs and encouraging continued participation in the VOS Scheme. However in the case of automated systems it is likely be much harder to maintain the currently levels of cooperation because each AWS system is likely to require specialist technical knowledge and experience, and replacement sensors are unlikely to be readily available in other inspecting countries.

8.3.2.11 The expected increase in the automatic component of the VOS fleet will inevitably have an impact on the future of the PMO role and the skills sets they will require. Although increased technical competencies would probably be needed the level of technical knowledge needed would depend on the type of AWS system being used. In the case of the small 'autonomous ' systems the PMO would only need limited technical knowledge because the whole unit could be simply replaced in the event of a major failure, and the old unit returned to the technicians for repair ashore. In the case of complex 'integrated' AWS systems, which need to be interfaced with the ships own systems, substantially greater and more specialized and technical competence would be needed for routine maintenance and failure resolution.

8.3.2.12 Nevertheless, the traditional PMO competencies would still be needed for complex AWS systems that employ a visual display on the bridge and require ships officers to manually add the visual observed elements (e.g. waves, swell, weather, cloud types/heights etc.) to the measured automated AWS observations. In addition, to verify the quality of the AWS data, the PMO will still need to use transfer standard instruments to check the accuracy of the AWS sensor output - but may now also need to be equipped with an internet enabled notebook to connect to the AWS systems' configuration port.

8.3.2.13 Consequently there is a growing need for future PMOs to be trained in the basic technical skills necessary to maintain an AWS in service. The Panel was therefore pleased to note that such issues were now being addressed by the Task Team on Training. It was recommended that such technical skills training on the use and maintenance of AWS systems should be included on the agenda for the next International PMO workshop

8.3.2.14 It was noted that E-SURFMAR had already held a Workshop to train PMOs on the functionality of the new EUCAWS AWS system, and that all UK PMOs had received electrical skills training to help them resolve technical faults with the AMOS system.

8.3.2.15 The Panel was reminded that the SOT Terms of Reference called for coordination of Port Meteorological Officer (PMO)/ship greeting operations globally, and for actions to be proposed to enhance PMO standards and operations, and to contribute as required to PMO and observers training.

8.3.2.16 In view of the increasing scope of demands being placed on PMOs it was suggested that, where possible, efforts should be made to harmonize and standardise PMO practices. Having a level of uniformity in the procedures carried out by PMOs would help to ensure that ships are inspected and maintained to a common, high standard, and would also help to ensure that the message given to ships' observers is consistent. Consequently the work being undertaken within the TT-RPT to develop – where possible - comprehensive work instructions, check lists and guidance should gradually help to ensure a consistent approach.

8.3.3 VOS & AWS inspection reports - implications of automation

8.3.3.1 The Panel noted that while there is a variety of inspection forms in use by the different National VOS operators, for manned and automated VOS, many of the details and metadata collected are common. In this respect it was recalled that a harmonized list of such details had previously been collected by E-SURFMAR with a view to establishing a common web-based inspection form that could possibly link to the E-SURFMAR metadata database.

8.3.3.2 Recognising the plans to migrate the E-SURFMAR database to JCOMMOPS it was agreed that the common web based inspection forms for manned and automatic VOS should be developed to allow inspection data to be automatically ingested into the JCOMMOPS database. This would offer the potential to avoid the intermediate stage where PMOs currently transcribe details and metadata into their national databases. In addition, when electronic tablets or IPads are used by PMOs for collecting inspection details and metadata, it should be possible to upload such information directly to the JCOMMOPS database whilst on board.

8.3.3.3 The Panel also noted that E-SURFMAR had established new 'Rules for collaboration on PMO activities' between its European member nations with a view to financially compensating members who undertake more than 15 courtesy inspections of VOS from other E-SURFMAR member countries. In order to qualify for compensation under the E-SURFMAR scheme the inspecting nation was required to upload a completed a copy of the VSOP001- Report of Inspection to Foreign VOS form5 to the E-SURFMAR metadata database as a permanent record of the inspection.

8.3.3.4 In considering this initiative it was recognised that there was a need to keep closer track of PMO courtesy inspections undertaken internationally, whether for the VOS or to other programs or observing networks. At the last session it was suggested that it would be good practice for all international PMOs to upload completed copies of their foreign VOS inspection forms to the E-SURFMAR database. It was assumed, but remained to be clarified, that when the E-SURFMAR database is migrated to JCOMMOPS that this facility will continue to be available.

8.3.3.5 Furthermore the Panel recognized that having ship inspection information fed into a common JCOMMOPS database would also offer the potential for keeping track of inspection activities across other JCOMM programmes. This would be a particularly useful development for when the new WIGOS metadata standards become fully operational. Accordingly the Technical Coordinator was requested to liaise with the TT-VRPP and the TT on Metadata with a view to developing common JCOMMOPS web based inspection forms for manned and automated VOS.

Actions;

8.3/1 PMO training to increasingly be offered globally via video conferencing (e.g. WebEx) and by Webinar sessions. (TT-VRPP; December 2017)

8.3/2 Technical Coordinator to take into account the need to collect information on the percentage of PMO time actually spent on PMO related activities and VOS ship inspections when developing web based capabilities for compiling National Reports. (SOT TC; November 2017)

8.3/3 JCOMM PMO listings to include PMO contact email addresses.(WMO Secretariat; Nov. 2017)

8.3/4 Technical Coordinator to ensure that Find-a-PMO facility exists and remains updated.(SOT TC; November 2017)

8.3/5 Technical Coordinator to liaise with the TT-VRPP and the TT on Metadata with a view to developing common JCOMMOPS web based inspection forms for manned and automated VOS.(SOT TC, TT-VRPP, TT-VOS Metadata; SOT-10)

8.3/6 Planning should start for the next International PMO Workshop to be held in 2020.(VOSP Chairperson, SOT TC, WMO Secretariat, TT-VRPP:2019)

8.3/7 Technical skills training on the use and maintenance of AWS systems should be included on the agenda for the next International PMO workshop.(VOSP Chairperson, SOT TC, WMO Secretariat; December 2018)

8.3/8 SOT TC together with TT on training to arrange regular (quarterly) webinars with PMOs.(SOT TC with TT-RPT; December 2017)

8.3/9 Develop a common web based PMO inspection report.(SOT TC; SOT-10)

8.4 VOS Issues

The VOSP Chairperson invited the session to consider a number of topical and interrelated issues that are expected to impact on future VOS operations.

VOS Scheme Participation

8.4.1 The Panel noted that, using figures extracted from the E-SURFMAR metadata database[23] there had been a sight fall in the number of active VOS, from a total of 3045 at the last session in 2015, to the current total of 3,028 active VOS (on 6 March 2017). However the number of participating VOS countries had remained constant at 29.

8.4.2 These figures took into account the number of ships that had been transferred to the new third party support class. However, taking into account only the traditional VOS classes (i.e. Selected, VOSClim, Auxiliary and Supplementary), there had been a more noticeable reduction in the overall size of VOS fleet to 2761 active ships (in March 2017). Details of the number of ships recruited to each of the VOS Classes, compared with figures at the previous sessions, are at Annex A of SOT-9-Doc-8.4.1-2.

8.4.3 In terms of ship numbers recorded on the E-SURFMAR metadata database, the automatic component of the VOS Fleet appeared to have increased slightly to ~10.5% compared to ~8.4% at the last session. However it was noted that number of automatic ships recorded on the E-SURFMAR database was inconsistent with the number of automatic ships being reported in national VOS Reports. This was due to the failure of some countries to maintain their metadata records up to date.

[23] http://surfmar.meteo.fr/doc/vosmetadata_v6/

8.4.4 The Panels attention was also drawn to the numbers of observations that had been submitted by VOS Operating countries in 2016 (according to figures derived from the E-SURFMAR observations counters website[24]) – Annex B of SOT-9-Doc-8.4.1-2. Whilst it was recognised that the figures may not be totally accurate they nevertheless gave a good indication of observation trends. It was noted that whilst to more than 2.2 million observations had been submitted in 2016 there had been a steady decline since the peak in 2013, when almost 2.8 million observations were recorded.

8.4.1 VOS Classes

8.4.1.1 At present there are ten main VOS Classes specified under the vsslM code in code table 2202 (Annex C of SOT-9-Doc-8.4.1-2). In addition an eleventh 'Other' entry is also still permitted for use within Pub 47. The current approved VOS Classes are as follows:

- Selected
- Supplementary
- VOSClim
- Auxiliary
- Third Party Support
- Selected (AWS)
- Supplementary (AWS)
- Auxiliary (AWS)
- VOSClim (AWS)
- Third Party Support (AWS)
- Other

8.4.1.2 Ms. North pointed out that the traditional classes for manual reporting ships – Selected, Supplementary and Auxiliary were largely related to the number of elements in the FM-13 WMO Ship Code that were to be reported. The Panels attention was drawn to the list of elements reported by each VOS Class (Annex D of SOT-9-Doc-8.4.1-2)

8.4.1.3 However traditional alphanumeric codes (TAC) like FM-13 SHIP Code had now been superseded by the binary Table Driven Codes (TDC) for international data exchanges between national Meteorological Services i.e. FM-94 BUFR. Consequently the need to link VOS Classes to SHIP Code parameters no longer existed.

8.4.1.4 Although the use of the FM-13 SHIP code on board ships for transmitting data ashore would likely continue for a few more years, new electronic software would allow the transmission of BUFR compatible data formats e.g. E-SURFMAR format #101. This would therefore allow the volume of higher resolution data to be gradually increased and shared internationally.

8.4.1.5 It was recalled that at the last session the TT-VRPP, in liaison with the VOSP Chairperson, was requested to undertake a review of the current VOS Classes with a view to making recommendations to the Panel for consideration and approval at SOT-9.

8.4.1.6 Accordingly Ms. North invited the Panel to consider, in further detail, the implications of the recommendation made by the Task team on VOS Recruitment and Programme Promotion (TT-RTP) to reduce the number of VOS Classes currently defined in WMO Pub 47 guidance to just three classes, as follows:

- Ships that are recruited by a national meteorological service which also supplies the necessary observing instruments, sensors and equipment

- Ships that are recruited by a national meteorological service but use their own instruments, sensors and equipment

[24] http://www.meteo.shom.fr/vos-monitoring/counters.htm

- Third party support ships that are not recruited by a national meteorological service but contribute indirectly to the VOS Scheme

8.4.1.7 It was noted that the proposed three new classes were generally supported by the Task Team on Pub 47 Metadata, who were planning to include them within their considerations for a new WIGOS compatible metadata list for the VOS.

8.4.1.8 To assist consideration of this issue Ms. North pointed out that, using figures extracted from the E-SURFMAR metadata database at the end of February 2017, the changes in VOS Classes were as follows:

- 52% of ships in the international VOS fleet were currently recruited to the 'Selected' Class (i.e. excluding the new support class ships). This figure was therefore unchanged since the last session and only slightly lower than at SOT-7 when it accounted for 59%

- The number of 'Supplementary' class ships continues to fall but still accounts for14% of the VOS fleet

8.4.1.9 Following detailed consideration the Panel agreed with the recommendation that the number of VOS classes should be reduced to just three new classes as proposed by the TT-VRPP and that the Task Team on metadata should include these classes in their work on the development of new WIGOS compliant metadata. The Secretariat explained the approval process for this change i.e. implementation of changes should not take place once required until approval is acquired.

8.4.1.10 It was recognized that the VOS Class changes would have numerous down-stream implications for WMO Publications, websites and databases. The Panel therefore agreed with the Task Teams recommendation that a small drafting group be established to coordinate the revision and updating of relevant WMO publications (e.g. WMO no 558, WMO No 471, and WMO No 8. GOOS GCOS documents etc.), and to prepare amendments to the relevant website material (e.g. the SOT-VOS website, VOSClim website).

Actions;

8.4.1/1 Task Team on metadata should include new VOS classes in their work on the development of new WIGOS compliant metadata.(TT-VOS Metadata, SOT-10)

8.4.2 Future Composition of the International VOS Fleet

8.4.2.1 The Panel recognized that the proposed changes to the VOS Classes would have significant implications for the future composition and operation of the VOS Scheme. Based on the current composition, subdividing the existing fleet into the three new proposed classes, the new fleet composition would be as follows:

- 2565 Ships that are recruited by a national meteorological service which also supplies the necessary observing instruments, sensors and equipment
- 196 Ships that are recruited by a national meteorological service but use their own instruments, sensors and equipment
- 222 Third party support ships that are not recruited by a national meteorological service but contribute indirectly to the VOS Scheme

8.4.2.2 The Panel recognized that it would be very difficult to predict what the composition of the VOS fleet would look like in the coming years. However, it was envisaged that as a consequence of crowdsourcing initiatives like WOW, the size of the third party support component would most likely grow. Furthermore given current NMS and PMO resource limitations it was envisaged that the recruited VOS components would not change significantly in coming years, although the number of recruited manned ships was likely to fall further as automated systems are increasingly used.

8.4.2.3 It was noted that there are currently 45 ships classed as 'Other' (currently permitted by WMO Pub 47 for use in metadata field vsslM). The Panel agreed that the ability to use this 'Other' category should be discontinued in the new metadata requirements, and that ships considered as contributing to the VOS Scheme should in future be restricted to one of the three new classes. Accordingly the Task Team on Metadata was invited to take this into account when developing fields for the new metadata requirements.

8.4.2.4 The Panel also discussed the future governance of the VOS Scheme, and in particular the likely growth in third party support class ships. Because these support ships would not be subject to formal recruitment and would only contribute indirectly to the Scheme it raised several questions. For instance should the NMSs pay for observations that are sent from support ships that use Inmarsat Code 41, and how could quality monitoring feedback be provided to ensure their data quality of third party support ships. Accordingly the Panel requested the Task Team on Recruitment Promotion and Training, together with the Task Team on Metadata, to develop more precise definitions for the three new classes and make proposals on how the new third party ships should be administered in the future.

VOS Data Coverage

8.4.2.5 Ms. North drew the Panels attention to the need to target VOS recruitments to fill data voids, particularly in the Polar Regions. In this regard she pointed to the new JCOMMOPS maps which show the dearth of VOS activity in Arctic and Antarctic regions.

8.4.2.6 She also drew the Panels attention to the website[25] maintained by the Scientific Community on Antarctic Research (SCAR) at which lists all the ships which were known to be operating in Antarctic waters during the 2016/17 season (Annex F of SOT-9-Doc-8.4.1-2). It was noted that, so far this season (at January 2017), there were 23 ships making reports and 57 named ships without reports, which is broadly comparable to the previous year. A graph showing the relative trend between ships reporting and not reporting in recent years is at Annex G of SOT-9-Doc-8.4.1-2. The general picture therefore continues to be one of an overall increase in shipping in Antarctic waters, but with the number of ships reporting observations not changing.

8.4.2.7 For some ships it appeared that reports go missing when they cross the 60°S latitude while several others report only occasionally in Antarctic waters. In addition there appeared to be a large number of un-named vessels operating in Antarctic waters. For example in January 2017 there appeared to be at least 48 vessels in British Antarctic Territory waters, but only four of these ships appear to have submitted reports to the GTS.

8.4.2.8 It was noted that one of the issues being discussed at the WMO Executive Council Panel of Experts on Polar and High Mountain Observations, Research and Services (EC-PHORS) held in Ushuaia, Argentina, from 21 to 24 March 2017, was how to further develop and enhance the observing systems in the Arctic so that it is better addresses Numerical Weather Prediction and the requirements of the Global Cryosphere Watch[26] (GCW).

8.4.2.9 To that end contact had been made with the Association of Arctic Expedition Cruise Operators (AECO) with a view to increasing the volume of data available from tourist ships operating in polar Arctic areas. In this regard it was noted that only about a quarter of the ships operated by AECO member companies appeared to have been recruited to the VOS Scheme. A list of vessels operated by full AECO members is available on the AECO website[27] and is also at Annex H of SOT-9-Doc-8.4.1-2.

8.4.2.10 In view of the number of ships now operating to Polar Regions the Panel requested VOS operators to make determined efforts to recruit ships that operate to these data sparse areas to participate in the VOS Scheme. If possible it was considered that such vessels should be equipped with Automatic Weather Stations (AWS) that typically produce hourly

[25] https://legacy.bas.ac.uk/met/jds/met/SCAR_oma.htm

[26] http://globalcryospherewatch.org/about/

27 http://www.aeco.no/

observations (atmospheric pressure, wind, air temperature, air relative humidity, etc.) although where this is not possible recruitment as manned observing vessels would also be beneficial. Each candidate ship would need to be considered on its merits and it would be helpful if the relevant shipping companies are supportive of the VOS Scheme. Notwithstanding it was appreciated that the Polar Regions can present logistic problems for VOS operators, AWS technicians and PMOs to maintain observing sensors/instruments and to ensure they remain within calibration.

8.4.2.11 Ms. North reported that a teleconference had already taken place between AECO, the WMO Secretariat, JCOMMOPS and the VOSP Chairperson to consider the best way forward, and help to overcome logistic obstacles to recruitment. To that end contact had also been made with Norwegian Meteorological Institute representatives to consider the potential for a meteorological officer from Longyearbyen in Spitzbergen to as part-time PMO for ships operating to the Arctic regions. PMO resources may also be available to assist with inspections in Tromsø, Norway.

8.4.2.12 The Panel invited the E-SURFMAR Expert Team on VOS to consider, in liaison with the Norwegian Meteorological Institute, the potential to recruit, and provide PMO support for, AECO tourist vessels operating in the Arctic at its forthcoming meeting in May. In addition the E-SURFMAR Expert Team was requested to investigate the potential to equip a suitable AECO vessel with a EUCAWS system.

8.4.2.13 The Panel agreed that collaboration with AECO could provide opportunities to help improve data coverage and that close collaboration with AECO should therefore be encouraged. To that end the Technical Coordinator, together with the VOS Panel Chairperson, was requested to prepare a short document to define the potential scope of future SOT – AECO collaboration, and thereafter convene a further meeting with AECO to discuss the way forward.

8.4.2.14 In considering this issue the Panel recalled that at the last session it was reported that a paper had been submitted to the International Maritime Organization's Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) in July 2014 by Canada, Iceland, Norway, Sweden and the United States encouraging enhanced participation in the VOS Scheme in the Arctic (Appendix K of SOT-9-Doc-8.4.1-2). At the time it had been suggested that WMO should also consider submitting a paper to IMO providing information on areas where it seeks IMO member's assistance with increasing participation in the VOS Scheme. The Panel was therefore invited to reconsider the need for, and scope of, such a submission.

8.4.2.15 The Ship Forum committee which was established as a result of side meeting discussions took place during the session, should prepare the text for submission to IMO from appropriate body of JCOMM urging ships traversing in polar regions to provide observations.

Actions;

8.4.2/1 Use of the metadata field 'Other' currently used for field vsslM in WMO Pub 47 should be discontinued in the new metadata requirements, and that ships considered as contributing to the VOS Scheme should in future be restricted to one of the proposed three new classes.(TT-VOS Metadata; August 2017)

8.4.2/2 Develop more precise definitions for the three new classes and make proposals on how the new third party ships should be administered in the future.(TT-RPT, TT-VOS Metadata; June 2017)

8.4.2/3 Prepare a short document to define the potential scope of future SOT – AECO collaboration, and thereafter convene a further meeting with AECO to discuss the way forward, considering the possibilities offered by YOPP.(SOT TC, SOT Vice .Chairperson; May 2017)

8.4.2/4 prepare necessary documents proposing the changes to the VOS classes to forward to OCG, JCOMM, CBS and EC for approval.(Chairperson TT-VOS Metadata, 15 May, 2017)

8.4.2/5 E-SURFMAR Expert Team on VOS to consider, in liaison with the Norwegian Meteorological Institute, the potential to recruit, and provide PMO support for, AECO tourist vessels operating in the Arctic at its forthcoming meeting in May.(E-SURFMAR ET, VOS Chairperson; May 2017)

8.4.2/6 E-SURFMAR Expert Team requested to investigate the potential to equip a suitable AECO vessel with a EUCAWS system.(E-SURFMAR ET, VOS Chairperson; May 2017)

8.4.3 Upgrading to VOSClim standards

8.4.3.1 Whilst the Panel was pleased to note that there had been further growth in the overall number of reported VOSClim ships (according to figures drawn from the E-SURFMAR metadata database) it was much smaller than had been hoped for at the last session. A table and graph showing the growth in the size of the VOSClim fleet since the initiation of the then VOS Climate Project is at Appendix A of SOT-9-Doc-8.4.3.

8.4.3.2 The number of active VOSClim and VOSClim (AWS) ships currently reported on the E-SURFMAR metadata database currently stands at 568 ships. Ignoring ship recruited to the new support class, it was noted that VOSClim ships therefore now accounted for more than 21% of the VOS fleet. More than a quarter of the VOSClim fleet is now automated.

8.4.3.3 Whilst the Panel supported the proposed new VOS classifications, it was recognized that, because VOSClim would no longer be a separate defined VOS class, any determination of the number of ships meeting VOS Climate standards would in future need to be made from interrogation of the applicable metadata fields. Moreover, because Pub 47 would eventually be replaced, it would in future be necessary to use the new WIGOS compliant metadata fields for this purpose.

8.4.3.4 In due course the new VOS metadata fields will be accessed via the JCOMMOPS database, which the Panel agreed should act as the primary listing for VOSClim standard ships. As a consequence the structure of the JCOMMOPS database will need to be amended to ensure that accurate VOS Climate details can be correctly extracted. The Technical Coordinator was requested to investigate the implications of the proposed changes to VOS classes for the JCOMMOPS database and to ensure that accurate VOS Climate ship information can continue to be extracted.

8.4.3.5 In the light of the proposed changes to the VOS Classes the Panel was also invited to consider the future need to issue VOSClim Certificates of Participation. Taking into account the need to continue to encourage higher VOS climate standard ship observations the Panel generally considered that it was premature to stop issuing VOSClim certificates. However it was agreed that the need for such certification should be kept under review by the [new Task Team on Recruitment, Promotion and Training]. Accordingly the Task Team was requested to report on the need for VOSClim certification at the next session and, in the light of proposed changes to the VOS Classes, to consider whether new certification was needed for ships in the VOS Scheme]

8.4.3.6 It was also recognized that the proposed changes to the VOS classes would also necessitate changes to the VOSClim Data Assembly Website (DAC)[28]. Should, for instance, the remit of the DAC be extended in future to include all VOS class data and monitoring information, or should it continue to be restricted to the higher quality VOSCLIM standard data. Accordingly the Task Team on Recruitment, Promotion and Training, in liaison with the DAC focal point, was requested consider the need for, and scope of, changes to the DAC website to reflect changes to the VOS classes.

8.4.3.7 The Panel recalled that until recently the additional VOSClim parameters could only be collected in delayed mode i.e. from the IMMT log files downloaded from electronic logbooks.

[28] https://www.ncdc.noaa.gov/data-access/marineocean-data/vosclim

However with the introduction of the BUFR code and the use of new E-SURFMAR format 101# in new TurboWin electronic logbook software (e.g. TurboWin version 5.5 and TurboWeb) it would increasingly be possible to transmit the additional VOSClim parameters in real time. It was also recalled that at the last session it had been suggested that future versions of the TurboWin+ and TurboWeb software should be restricted to only allow VOSClim standard parameters to be reported. This would greatly help encourage future levels of VOSClim standard reporting. In indeed some members had already requested that this should be the software default for their national fleets. Consequently, with time, it was envisaged that all manually reporting VOS will eventually migrate to VOSClim standards anyway.

8.4.3.8 It was noted that plans for the next inter-sessional period included a broader assessment of the quality of the ship data within ICOADS under a project funded by the Copernicus Climate Change service, and the observations made available through the Copernicus Climate Data Store (in partnership with ICOADS). As part of this assessment the quality of the VOSClim data will be assessed. Mr Berry was requested to report on this assessment at the next session.

Actions;

8.4.3/1 Investigate how to use national logos on SOT certification would be acceptable to WMO and IOC. (WMO Secretariat, SOT-10)

8.4.3/2 Task Team on Recruitment, Promotion and Training, in liaison with the DAC focal point, to consider the need for, and scope of, changes to the DAC website to reflect changes to the VOS classes.(Chairperson of TT-RTPP & VOSClim DAC; SOT-10)

8.4.3/3 Investigate the implications of the proposed changes to VOS classes for the JCOMMOPS database, and to ensure that accurate VOS Climate information can continue to be extracted.(SOT TC; SOT-10)

8.4.3/4 Dr. Berry to report to the next session on new assessments of the quality of ship data.(including VOSClim data) within ICOADS. (Dr. D Berry; SOT-10)

8.4.4 Capacity Building - including the Drifter Donation Programme

8.4.4.1. The Panel recalled that the DBCP/VOS donation programme (VOS-DP) was initially proposed by the Fourth International Port Meteorological Officer Conference (PMO-4) held from 8-10 December 2010, in Orlando, Florida, USA). The intention was to assist developing countries in setting up their own national VOS Scheme programmes whereby a donated 'deck' drifter would be installed onboard a suitable host ship. It would, in effect, become a low cost autonomous AWS that would require minimal effort to set up. The Programme was later established and confirmed by SOT-6 and SOT-7 respectively.

8.4.4.2. It was noted that the VOS-DP had been actively promoted to developing countries which currently have no VOS involvement, and that as many as ten countries had shown interest. However only one country, Tanzania, had successfully accomplished the initial steps i.e. identifying suitable host ships, appointing a national contact point and appointing a PMO and PMO buddy to assist with metadata collection. Unfortunately for a variety of reasons e.g. unsuitable vessels (catamarans), high freight costs for shipping the drifters, changes to national contact points etc., the initiative failed to progress to fruition, and consequently was unsuccessful.

8.4.4.3. The Panel noted that since the last session there had only been one further request for a drifter donation - from the Argentinian National Weather Service, who had expressed a clear desire to re-establish a national VOS programme. To that end they were already in the process of recruiting two coast guard vessels equipped with AWS systems. Because these ships visit Antarctica in the summer their data, which is currently being evaluated, should be particularly valuable.

8.4.4.4 To help re-establish a VOS presence Argentina have proposed two possible candidate ships which could possibly host a donated drifter. Furthermore they have appointed a national VOS contact point and are planning to appoint PMOs. The first candidate ships is their Navy school vessel "ARA Libertad", which used to be recruited as a VOS, but had unfortunately, for a variety of reasons, stopped reporting many years ago. The previous observing instruments on board are obsolete and a drifter would therefore be valuable, especially for the vessels forthcoming 6-month yearly trip around the world. The second candidate ship is a coast guard vessel that is at sea most of the year.

8.4.4.5 It was noted that Ms. North, as the Chairperson of the VOS-DP Programme Evaluation Committee (PEC), had responded positively in principle to the request from Argentina, but had pointed out that due to the poor take-up to the programme it would be subject to review at the current SOT-9 session. As a consequence any decision to donate a drifter would be need to be deferred pending the outcome of discussions on the future of VOS-DP at SOT-9. Should the VOS-DP be continued after SOT-8 then the next step in the procedure would be to appoint a PMO buddy.

8.4.4.6 Accordingly the Panel was invited to consider whether the VOS-DP should continue in its current form, be discontinued, or modified in some way. In this latter regard the Panel noted that the E-SURFMAR programme had recently established a new capacity building initiative which could possibly be a model for a modified VOS-DP.

8.4.4.7 Under the E-SURFMAR initiative a limited number of EUCAWS are purchased by the programme each year (2 in 2016), for capacity building for Eumetnet members. This "adoption program" works by entrusting a EUCAWS station to National Meteorological Services members of E-SURFMAR or other partner institutes from participating countries, in order to help them to start and develop their own AWS fleet. The EUCAWS stations become part of the National fleet recruited by the receiving country. Help with the installation is offered on a best-effort basis by the E-SURFMAR members who already operate EUCAWS stations. Accordingly the E-SURFMAR approach is one of 'adoption' rather than 'donation'.

8.4.4.8 The Panel noted that two European countries have recently pledged to adopt a EUCAWS in order to help establish a national VOS presence. A document outlining the criteria required for the Adoption program is attached at Annex A of SOT-9-Doc-8.4.4.

8.4.4.9 The sensors to be installed on such capacity building EUCAWS are those already used by the national institutes, and could be the same as those used already for their land stations, thereby saving on procurement and calibration costs . If sensors cannot be interfaced with the EUCAWS, the E-SURFMAR management team were offering to help develop the necessary software. However it is not within the E-SURFMAR remit to undertake calibration and maintenance of the national instruments.

8.4.4.10 Having reviewed the criteria that had been established for the VOS donation programme at

http://www.jcommops.org/sot/vos/documents/vos-drifter-donation-programme.pdf

the Panel agreed that the he principles and logic behind the development of the VOS-Drifter Donation Program was sound, despite the fact that it had so far failed to assist any developing countries with setting up embryonic national VOS programs

8.4.4.11 However, following detailed consideration the Panel recommended to the Team that the VOS - DP should be discontinued. Recognising that the VOS-DP was established as a joint DBCP/SOT initiative it was agreed that DBCP Chairperson and OCG should also be invited to endorse this recommendation. Subject to their concurrence information regarding the VOS-DP should be removed from the SOT-VOS website and archived.

The VOSP Chairperson was requested to advise the Argentinian Meteorological Service of the outcome of discussions on this issue but nevertheless to offer them support with re-establishing their VOS network

8.4.4.12 Notwithstanding this decision the members continued to be of the view that it remained possible for the Team, and in particular the VOS Panel, to establish other robust initiatives for capacity building in developing countries seeking to establish new VOS or other observing networks.

8.4.4.13 To this end it was agreed that the Panel, together with the wider SOT, should actively create and deliver training workshops targeted at these developing nations to help them become engaged in ship-based observation activities. In addition to inviting such developing countries to attend, or host, international workshops, such as PMO-5, there was also considered to be great value in organising regional workshops with a view to establishing embryonic networks in developing VOS countries. It is therefore recommended by the Panel that regular workshops should be encouraged and convened, especially as a means to help realise the JCOMM PANGEA Concept[29] i.e. to develop partnership between developed and developing nations to realise the socio-economic benefits of ocean observing systems at global and regional scales.

8.4.4.14 It was nevertheless recognised that budgetary constraints on travel to such workshops - for both developed and developing VOS countries - would continue to present a major challenge to capacity building workshops. Furthermore the ability to purchase and maintain observing instrumentation and to fund data transmission costs, together with the ongoing need to ensure data quality, will inevitably present obstacles for any capacity building initiatives.

8.4.4.15 Consequently, whilst regional workshops would help to enhance local skill sets and encourage enhanced international cooperation, the Panel also recognised the value of holding regular video/teleconferences and Webinars as a means of reaching out to potential new observing countries. It was suggested that Webinars on use of the new JCOMMOPS database, use of TurboWin software, and on collection of WIGOS metadata, SOT identifiers, PMO recruitment and inspection activities etc. could be of great value for both developing and developed VOS operating countries. The Panel therefore invited the Technical Coordinator, in liaison with the [new Task Team on Recruitment, Promotion and Training] to formulate a schedule of regular (ideally monthly) training Webinars and/or teleconferences.

8.4.4.16 Group recommended that discussions between SOT-Chairperson and DBCP – Chairperson should take place to decide whether this initiative should be modified, or discontinued or renamed.

8.4.4.17 Group discussed the possibility of EUMETNET AWS adoption as a solution for Argentinian request to drifter donation program. EUMETNET members indicated that this may be not feasible as the program is focused on EUMETNET members.

Actions;

8.4.4/1 TT-RPT to formulate a schedule of regular (ideally monthly) training Webinars and/or teleconferences for PMOs with support from the SOT TC.(SOT TC & TT-RPT; May 2017)

8.4.4/2 The VOS Panel Chairperson to advise the Argentinian Meteorological Service of the outcome of discussions on the VOS-DP and to offer them support with re-establishing their VOS network through NOAA US state department signed letter of agreement for cooperation in ocean or meteorological science as a solution.(VOSP Chairperson with Dr. Goni, April 2017)

8.4.4/3 Information regarding the VOS-DP to be removed from the SOT-VOS website and archived.(SOT TC; May 2017)

[29] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=6386

8.4.4/4 Take up the capacity building activities of SOT at OCG-8.(SOT Vice.Chairperson, May 2017)

8.4.4/5 Develop partnership between developed and developing nations to realise the socio-economic benefits of ocean observing systems at global and regional scales.(SOT Chairperson, OCG; ongoing)

8.4.5 Third party data and non-VOS support ships

8.4.5.1 The Panel was reminded of the discussions that had taken place at the previous SOT-7 and SOT-8 sessions concerning the recruitment of third party observing ships which aren't considered appropriate for formal recruitment to national VOS fleets It was recalled that this was often a consequence of limited PMO resources and financial constraints that prevented the maintenance and supply of calibrated observing instruments.

8.4.5.2 It was recalled that at the last session the Team had decided, following detailed consideration, to discontinue the Ancillary Pilot Project which had been established by the TT-VRPP for such third party vessels. This was because only a limited number of ships had met the required criteria, and those that did meet the Ancillary criteria had generated only a relatively small number of observations. Accordingly it had been agreed that suitable existing Ancillary ships should be transferred to national VOS fleets, and that references to Pilot Project should be removed from the VOS website.

8.4.5.3 Notwithstanding the Team had agreed that there remained a need for a separate category for ships that wish to submit marine observations to support the VOS effort, but which would be unable to comply with the provisions or requirements normally imposed on participating VOS Class ships. The Team had further agreed that such a third party 'support' fleet should be established. Ships belonging to this new Support Fleet' Class would not be considered as belonging to a particular recruiting country and would not be bound by the same restrictive criteria that had been established for Ancillary PP class ships.

8.4.5.4 The Team had recognized that this "support fleet" would mainly consist of ships recruited remotely and without the regulated protocol for a VOS class ship. As a consequence such ships would not be inspected, trained, supported like an established VOS recruit and may often be using uncertified or calibrated instrumentation, hence it is to be expected that much of the data might be of lesser quality.

8.4.5.5 Furthermore the Team had recognized that there was a need to differentiate, and segregate, such 'support' class ships from ships recruited to the established VOS classes. It was generally agreed that this should be achieved by continuing to use the country code (ZZ) which had been used in the E-SURFMAR database for identifying Ancillary PP vessels. This would therefore allow quick identification of such third party support ships that are not recruited to the established VOS by a National Meteorological Service. In addition, it was agreed to use the corresponding class codes i.e. 80 for manual and 85 for automated support fleet ships. The Team noted that these codes in Table 2202 (vsslM), and code ZZ in Table 1801, had subsequently been approved by the JCOMM co-presidents for inclusion in WMO Pub47.

8.4.5.6 It was also recalled that at the last session it was considered that such support fleet ships should be vetted for quality prior to releasing on the GTS, or alternatively that a method should be proposed to "block" the poor quality ships from transmitting to the GTS. It was also suggested that it would be beneficial to have these support observations sent to a processing site suitable for amateur observers or "in-house" use prior to releasing this data onto the GTS. In this regard was suggested the use of Weather Observations Website (WOW) currently in use in the UK, Australia, New Zealand and the Netherlands might provide a possible solution when it is extended to cover marine stations.

8.4.5.7 It was further noted that at the last session the number of ships identified as belonging to the support fleet class stood at 176 ships. This had now grown to a total of 222 ships (at 6 March 2017) comprising 218 manually reporting ships (code 80) and 4 automated ships (code 85).

8.4.5.8 The Panel was invited to consider whether the support fleet should continue form part of the VOS Scheme or should be dealt with separately. However it was recommended that, despite possible quality issues and the fact that they wouldn't be subject to established VOS recruitment criteria, their contribution should nevertheless continue to be recognized as a distinct component within the VOS Scheme. This would allow the Panel to keep general oversight of any quality issues and would also permit suitable support ships to be upgraded to recruitment to an established VOS class when considered appropriate by national meteorological services.

8.4.5.9 The Panel was also invited to consider whether use of the ZZ country code should be discontinued. In this respect it was pointed out that use of ZZ prevented any identification of where a support ships metadata originated from or who had originally registered the ship to participate. As a consequence there was no real level of accountability when code ZZ is used.

8.4.5.10 In considering this issue it was pointed out that the Task Team on metadata was proposing that WMO Pub 47 should be frozen and archived until such time as new WIGOS compliant metadata standards are formally developed and agreed. Nevertheless the Panel agreed that there needed to be some basic governance or oversight of the metadata provided for support ships. As a consequence it was considered that there needed to be a way to identify the country which originally registered a ship to participate in the Support Fleet.

8.4.5.11 The Panel agreed that the best solution to identifying ships registered to the support fleet was by using the new SOT Station Identifier proposed by the Ad-hoc TT-WIGOS-SOT Identifiers. It was noted that this SOT ID would consist of 7 characters and could form the local identifier section of the wider WIGOS Station identifier, which can be up to 16 characters in length and includes a section to identify the organization which issues the WIGOS identifier. Recognizing the Task Team's proposal that such IDs should in future be issued by JCOMMOPS the Technical Coordinator was requested to circulate instructions to members detailing how the WIGOS and SOT IDs will apply to support ships, and how such ships should in future be registered for inclusion in the JCOMMOPS database (Action Technical Coordinator : August 2017)

8.4.5.12 The Panel noted that, to date, support fleet ships continue to send their observations directly to the GTS in common with the established VOS Class ships. As a consequence, their data quality is collected and assessed by the various quality monitoring centres e.g. Met Office UK, Meteo France, ECMWF, National Centres Environmental Prediction (NCEP) and Ocean Prediction Center (OPC) etc. Because they are not subject to the same inspection standards and may be using uncertified instruments, there is a serious risk that support ship data quality will impact on overall VOS data quality. To some extent this is already evident by the disproportionally large number of ZZ support ships that appear on the monthly Met Office suspect lists at

http://research.metoffice.gov.uk/research/nwp/observations/monitoring/marine/VOF/Pub47_SUSPECTS.html

8.4.5.13 Discussion also took place on how to possibly block poor reports in order to help ensure data integrity. In this respect it was noted that the UK were planning to develop a new marine data gateway that could intercept ship observations and may provide a filter to prevent poor quality date being disseminated on the GTS.

8.4.5.14 The Panel's attention was drawn to VOS performance ranking lists that are produced by the Met Office on an annual and monthly basis3 and which ranks ship reports in order of importance to the numerical weather prediction (NWP) system. Using the annual ship performance rankings it is possible to analyse, to some extent, the performance of the ZZ

support fleet. For example in 2015 the average combined score (which takes into account the quality, quantity and timeliness of the observations) was 0.705 (based on 14 active ZZ ships at the time) which compared favourably with the average score for all national fleets.

8.4.5.15 However in 2016 it the quality had deteriorated with an average score of 0.828 (based on 130 active ZZ ships reporting that year). Consequently by moving the poorer quality ships to the ZZ fleet since the last session there had been a noticeable drop in quality. By using the performance rankings it was also possible to compare the quality scores with that of national fleets – for instance in 2016 the average UK fleet score was 0.680, and the average German fleet score was 0.669. Annual Rankings for 2015 and 2016 were used to determine overall quality; Using the combined scoring to visualize data integrity and overall trend, the analysis was done two ways, 1.) using ZZ alone for each year and 2.) using the combined ZZ and "unknown" (assuming that much of these "unknown" are actuality ZZ) (Appendix A of SOT-9-Doc-8.4.5)

8.4.5.16 Whilst the scores could be used to give an indication of the quality or otherwise of the support fleet it was recognised that the accuracy of the scores would require further analysis to take into account masked call signs, and to separate automatic and manual ships. In addition it was suspected that some support ships may be listed as 'unknown' in the rankings.

8.4.5.17 In considering the timeliness of data from third party support ships the Panels attention was drawn to the Met Office timeliness statistics at http://research.metoffice.gov.uk/research/nwp/observations/monitoring/marine/TOR/Pub47_ToR_by_CTRY_Man.html (Appendix B of SOT-9-Doc-8.4.5). It was noted that 82% of support ship data was received within the typical model cut off value of HH+120, although the average receipt time was 104 minutes. However the average number of observations per ship was 44, which was comparable with other major VOS operating nations.

8.4.5.18 The Panels attention was also drawn to an analysis of the communications systems currently used by Support ships to transmit their data. (Appendix C of SOT-9-Doc-8.4.5). It was noted, using metadata recorded in the E-SURFMAR database, that vast majority (87%) were sending their observations via email. Consequently there would be no transmission costs borne by the National Meteorological Services for these ships. However the NMSs would incur costs for the small number of support ships that currently use Inmarsat transmission systems.

8.4.5.19 The Panel noted that figures drawn from the E-SURFMAR metadata database indicated that there were actually 145 Support ships active support ships (slightly more than in the aforementioned ranking lists) and that in 2016 they produced a total of 42851 observations (Appendix D of SOT-9-Doc-8.4.5). All but one of these support ships were reporting manually.

8.4.5.20 Following detailed consideration the Panel agreed the following recommendations:

(i) That the Support Fleet should remain within the remit of the VOS Scheme.

(ii) That the Technical Coordinator should circulate instructions to members detailing how the WIGOS and SOT IDs will apply to support ships and how such ships should in future be registered for inclusion in the JCOMMOPS database

(iii) That the Met Office RSMC should take the new VOS classes into account in the new automatic system they are currently developing for monitoring the quality of VOS data

Actions;

8.4.5/1 Circulate instructions to members detailing how the WIGOS and SOT IDs will apply to support ships and how such ships should in future be registered for inclusion in the JCOMMOPS database.(SOT TC; August 2017)

8.4.5/2 Include the new third party support ship class with the remit of the VOS Scheme.(VOSP Chairperson, SOT-10)

8.4.5/3 Further discuss and decide on using ZZ country code in vessel registration.(TT-RPT , and TT-VOS Metadata, SOT TC, SOT-10)

8.4.6 Marine Weather Observation Website(WOW) developments

8.4.6.1 Miss. Steventon gave an update to the panel on the development of WOW since the last session.

8.4.6.2 She was reported that since 2011, WOW had received more than 850 million observations from over 9000 registered users from over 200 countries worldwide- the majority being from amateur, crowd sourced observers.

8.4.6.3 The panel were reminded of WOW's ability to now capture observations from mobile devices (e.g. cars, mobile phones, ships).

8.4.6.4 It was pointed out that the growing world of social networking online makes it easy for anyone to get involved and to share weather observations. WOW is open to all amateur marine observers and enthusiasts alike and weather reports could be made using all levels of equipment found on board ships. It was noted that as relatively few marine users have access to the web at sea, observations could be stored and uploaded in delayed mode, as long as it was in the correct WOW format.

8.4.6.5 The usefulness of developing a mobile application to send observations was discussed by the Panel, noting how this could significantly expand the marine data pool.

8.4.6.6 The Panel were informed of the Met Office's plans to create a Marine WOW website to help collate and visualize moored buoy, light vessel, VOS and AWS data for the general public and National Met Services, with access to time series data being a possibility for further development. The planned development of a Marine-WOW front end was thought to be a means of promoting the growth of the marine weather observing community, not only in the UK, but worldwide.

8.4.6.7 Miss. Steventon noted that a test Marine WOW home page had been developed and reviewed by the Met Office in 2016. In its current form, only meteorological parameters already part of the WOW platform were being reported, additional marine elements such as SST and wave parameters are yet to be added and visualised.

8.4.6.8 The panel discussed the inclusion of national VOS data in Marine WOW, in addition to amateur, crowd sourced marine data, as a means of providing proof of concept. The use of the new third party VOS class as a source of WOW data was also discussed.

8.4.6.9 In addition, the panel discussed the security issues surrounding certain users e.g. military vessels, where Miss Steventon pointed out that data could be marked as 'official' or 'unofficial' with restricted access being made available. It was highlighted to the group the potential for linking WOW to other dedicated websites, for example major ship owners, to enable them to monitor their own fleets in a password protected layer.

8.4.6.10 The Panel discussed the use of the WOW Engine API capability, as a means to increase the marine data pool and allow linkages with existing applications, such as TurboWin and JCOMMOPS. In particular, APIs would allow the ingestion of basic ship and instrument metadata from JCOMMOPS directly into the WOW cloud. The Panel discussed the security issues surrounding this concept and the possible requirement for licences.

8.4.6.11 Miss. Steventon invited KNMI, BoM and New Zealand Met Services to report on their experiences with WOW to date and provide feedback.

8.4.6.12 The Panel agreed that WOW is a valuable tool and requested the MetOffice to further develop this initiative.

Actions;

8.4.6/1 Investigate potential linkages between WOW and JCOMMOPS.(SOT TC ; JCOMMOPS, Dec 2017)

8.4.6/2 Take the positive message from SOT back to MetOffice to the continue the good work of WOW.(Miss E. Steventon, April 2017)

8.4.7 Collection of delayed mode data

8.4.7.1 Miss Steventon reported on the collection of delayed mode data during the last inter-sessional period recognising that a separate GCC report would be given under agenda item 10.3.1. It was noted the latest GCC 2016 Annual Report would be distributed when available.

8.4.7.2 The Panel noted that the contribution of delayed mode data from VOS had increased by 27% since the last session, with 858 ships from 16 Contributing Members.

8.4.7.3 Members also noted that the size of the global manual VOS fleet was decreasing in favour of automation, and that not all AWS systems have the capability to report in delayed mode (e.g. AMOS).

8.4.7.4 In accordance with WMO Pub 47 it was noted that the primary responsibility for applying the minimum quality control (MQCS) of IMMT data rests with the contributing NMS, before being sent to the GCC's, where further quality control is applied and datasets distributed to Responsible Members.

8.4.7.5 Miss Steventon invited the Panel to agree on the future requirement of delayed mode IMMT data in light of BUFR message capabilities and the transmission of additional VOSClim elements and metadata in real time.

8.4.7.6 Panel members further discussed the requirement for IMMT data in high resolution, noting previously obtained input on the topic, which indicated that delayed mode systems such as ICOADS still have a requirement for IMMT data, both as a valuable QC tool for real-time transmissions and for filling in gaps where real-time transmissions have failed.

8.4.7.7 Panel members were also invited to consider the requirement for a descriptor in the BUFR code or metadata to indicate whether or not corresponding IMMT data will be made available.

8.4.7.8 The Panel also discussed the contribution of VOSClim data from AWS, where no VOSClim elements are transmitted (although it was recognised that this issue would be superseded by introduction of the new VOS classes).

8.4.7.9 Panel members discussed potential changes to TurboWin quality control procedures e.g. restricting dates in the future/flagging to user when a date is significantly different to previous entry; flagging when subsequent entries of same date/time/position are entered; checking quadrants/positional changes; and any others.

Actions;

8.4.7/1 There is an ongoing requirement for delayed mode IMMT data and that efforts should be made to increase availability from AWS systems (ETMC, SOT-10)

8.4.7/2 Metadata format should be amended to include a descriptor for when associated IMMT format available (TT-VOS Metadata, Dec 2017)

8.4.8/3 Provide a wish list for TurboWin to EUMETNET who manages and to prioritize the list.(TT-VOS metadata, 10 May 2017)

8.4.8 VOS Website

8.4.8.1 The SOT TC reported that the VOS website had been migrated to JCOMMOPS prior to the retirement of the former webmaster and SOT chairperson, Graeme Ball. Visitors using the old URL are redirected to the new location (http://sot.jcommops.org/vos/).

8.4.8.2 The meeting noted that the SOT TC maintained the VOS website during the intersessional period and in particular updated VOS brochure, contacts, and certificates. The VOS poster had also been added. The Pub47 metadata format document had not yet been replaced on the website by final version 4.2 as it was still awaiting JCOMM validation.

8.4.8.3 The meeting discussed how many websites are needed for VOS and SOT panels, and for which target audience; Basic VOS information for a broader public are also available on the redesigned SOT website (hosted by JCOMMOPS) and on the WMO extranet, while contact and Task Team information are available on JCOMM pages, and all operational monitoring and metadata resources are part of the JCOMMOPS SOT theme. In addition, standards and best practice documents are hosted in a JCOMM catalogue and also on a GOOS-wide IODE portal. In most cases these sites are not synchronized and provide sometimes incoherent or incomplete information.

8.4.8.4 The Panel also discussed the potential impact that proposals for a new joint umbrella for all observing networks in need of volunteer ships would have on the VOS website. If such a new overarching JCOMM project should be created, with new name and logo, it would also require a corresponding new website, which would then be the primary website for ship owners and officers.

8.4.8.5 The Panel agreed to use IODE document repository to house SOT documents.

Actions;

8.4.8/1 With JCOMMOPS, all SOT Task Teams and the SOT Management Team work on simplified and better synchronized website information system, including in particular member contact information.(SOT TC, SOT-10).

8.4.8/2 Centralize Standards and Best Practises documents at (IODE, ocean data practises repository and to replace files in other repositories by permanent links to the centralized master files.(SOT TC, SOT-10)

8.4.9 Mercury replacement

8.4.9.1 Ms North presented a document on behalf of Mr Ross Bannister (NZ) addressing issues arising from the Minamata Convention on Mercury. The session noted that mercury instruments currently in use on VOS would need to be urgently removed or replaced by 2020 in order to adhere to the Minamata convention requirements.

8.4.9.2 The Minamata Convention on Mercury a global treaty to protect human health and the environment from the adverse effects of mercury. It was agreed at the fifth session of the Intergovernmental Negotiating Committee on mercury in Geneva, Switzerland on Saturday, 19 January 2013 and adopted later that year on 10 October 2013 at a Diplomatic Conference (Conference of Plenipotentiaries), held in Kumamoto, Japan. 128 countries are signatories to the Convention and so far it has been ratified by more than 40 countries. Details on the Convention are at: http://www.mercuryconvention.org

8.4.9.3 Those VOS operating countries that still use mercury thermometry on their VOS therefore need to make concerted efforts to meet the 2020 deadline and international collaboration within the wider VOS community would be need to be encouraged to assist with

the safe recovery, especially when recruited ships rarely return to home ports within the recruiting country. In this regard it was noted that the UK alone will need to recover ~1500 mercury thermometers, many from ships that often don't return to UK home ports

8.4.9.4 Mercury is a toxic substance and the safe removal and transport delivery throughout the process should therefore be the top priority. Safe recovery of mercury overseas will involve a major logistic exercise and is already made difficult due to restrictions on the air transport of mercury. Close co-operation is therefore be needed from of VOS operators, PMOs, ship owners/managers, ship Captains and officers, shipping agents and freight forwarding companies to ensure safe recovery.

8.4.9.5 Local disposal may prove to be the best solution, but is likely to be expensive. International collaboration at busy major ports such as Singapore and Hamburg, may prove to be the easiest approach to ensuring safe recovery, but may necessitate bilateral agreements. However health and safety regulations of any countries where mercury is landed will need to be closely observed, and any local disposal undertaken by approved organizations.

8.4.9.6 In addition to the need to recover mercury instruments VOS operators need to carefully consider the pros and cons of supplying alternative replacement instruments. For instance, cheaper spirit thermometers may be a simple solution but they would rarely meet the standards currently met by mercury in glass thermometry. On the other hand use of digital instruments may help ensure data accuracy but would incur additional costs especially as the sensors need to be returned more frequently regularly for recalibration.

8.4.9.7 Another option VOS operators could consider is to migrate their fleets to the use of Automatic Weather Stations (AWS). However for larger VOS fleets this would represent a major and expensive undertaking that would be difficult to achieve by the 2020 deadline. Realistic alternatives therefore generally fall into one of the following categories;

- Portable spirit thermometers
- Portable electronic hand held instruments
- Fixed installation electronic instruments
- Portable or fixed electronic instruments

It was stressed however that electronic solutions would not be suitable for tankers and gas carriers unless they were certified for compliance with ATEX requirements for intrinsic safety.

8.4.9.8 Ms North pointed out that mercury replacement options would need to take into account a wide range of considerations, including….

- Equipment costs
- Recalibration costs
- Recalibration intervals
- Complexity and Maintenance issues
- Freight costs
- Observer Training
- Climate records continuity

8.4.9.9 Attention was drawn to some of the errors associated with current glass thermometry such as the effects of heat generated by the ship superstructure, and human errors due to volunteers not taking readings from the windward side, or incorrectly reading or transcribing temperatures into electronic logbook software. If the forecasting and the scientific community are happy to continue to accept such errors then the use of cheaper portable spirit thermometers may be considered more appropriate than more accurate digital alternatives.

8.4.9.10 Whilst the session recognized that air temperature is one of the key elements for forecast modelling and for climate, each VOS operating country would need to assess the benefits of investing in the purchase of new higher spec. technological solutions. Sharing knowledge between VOS operators would therefore greatly help with decision making.

8.4.9.11 in this regard the session noted that a paper[30] had been submitted to the WMO conference on Meteorological and Environmental Instruments and Methods of Observation, TECO-2016, Madrid 27-30 September 2016 by Bruce Hartley (NZ Met Service) outlining many of the mercury alternatives currently under consideration by national VOS Operators

8.4.9.12 In particular it was noted that the New Zealand MetService was in the engineering phase of creating its own thermometer replacement which will be ready for testing mid-2017. It will have a Vaisala HMP155 temperature/Rh probe encased in a weather proof housing that will be permanently fixed in the current used marine screens. Furthermore it will incorporate a programmable LED screen that lights up for a selected time period once a weather proof button is pressed with little or no wait time for the sensors to "warm up". Battery life is expected exceed a year. However no firm decisions on its future use had been taken yet, and it was anticipated that portable spirit thermometers would probably be used in the current marine screens on recruited oil tankers

Actions;

8.4.9/1 VOS Operators to urgently remove and safely dispose all mercury instruments from all VOS vessels by the 2020 Minamata convention deadline.(VOS Operators , before 2020)

8.4.9/2 VOS Operators to urgently cooperate with other VOS countries to remove the current mercury instruments from the ships that do not return to their respective VOS country.(VOS Operators, before 2020)

8.4.9/3 VOS Operators to communicate with each other and with SOT when the changes are been made (metadata)and on how the mercury replacement products are performing both current and those in testing.(VOS Operators, before 2020)

8.4.9/4 Members are invited to provide any comparison studies done on the different type of air temperature sensors to the SOT TC to post on the JCOMMOPS document repository.(VOS Operators, SOT-10)

9 THIRTEENTH SESSION OF THE SOOP IMPLEMENTATION PANEL (SOOPIP-13)

9.1 SOOP Programme activity reports (including implementation status)

9.1.1 Report by the SOOPIP Chairperson

9.1.1.1 The SOOPIP continues to be part of the sustained ocean observing system, with a history of XBT transects over many decades. The SOOPIP network (consisting of XBTs, XCTDs, CPRs and soon, pCO2), contributes to many and various climate studies, along with other components of the global ocean observing system such as Argo.

XBT deployments are maintained along fixed transects, many of which have been in operation since the early 1980s, making the observations invaluable for multi-decadal studies. Transects are operated in frequently repeated or high density modes, depending on their scientific goals for the area.

9.1.1.2 The SOOPIP has participation of 12 institutions globally, with data distributed in real time via the GTS in BUFR and jjvv formats. There is a strong international partnership within the SOOP network, with institutions supporting each other in supply of probes and support for logistical operation of lines that typically originate from their countries.

9.1.1.3 The ships of opportunity used in the SOOPIP program are very often also platforms for deployment of other instruments such as drifters and profiling floats, data collection platforms

[30] https://www.wmocimo.net/eventpapers/session4/O4(1)_Hartley_Minamata.pdf

for TSGs, pCO2 systems and CPRs. SOOPIP supports data acquisition from other programs such as VOS and GOSUD on many of the ships used for XBT deployments.

9.1.1.4 Meetings held during the year include the 5th XBT Science Team meeting in conjunction with the 4th IQuOD meeting, in Tokyo, October, 2016. In addition the GTSPP meeting held in Belgium, November, 2016.

Highlights from these meetings and other intercessional highlights include;

- An XBT Science review paper
- Continuation of XBT fall rate investigations
- Incorporation of the pCO2 group into the SOOPIP
- Recommendations from the XBT Science Team to the IQuOD project
- Review and update of the XBT transects recommended at Ocean Obs'09
- Review of the metadata formats and content supplied to JCOMMOPs yearly
- Participation of the SOOPIP Chairperson in the OCG roundtable meetings

Challenges for the intercessional period;

- Reduction/changes in shipping for many lines
- Reduction in support for some lines and for the XBT program overall

9.1.2 SOT Technical Coordinator report on SOOP support activities

9.1.2.1 The SOT TC supported the SOOP panel by;

- working with the ad hoc SOOP metadata Task Team on new data formats for i) platform, ii) cruise and iii) delayed-mode XBT metadata, with corresponding implementation in the JCOMMOPS system

- based on OCG discussions, working on new metadata requirements for pCO2 and TSG networks, with experts from both communities

- reviewing the SOOP-XBT network with the SOOP chairperson and other experts, and updated the design in the JCOMMOPS system

- producing XBT network maps based on the new design, and available through FTP, SOT and JCOMMOPS websites

- starting an ongoing discussion with Météo-France on the GTS metadata feed to JCOMMOPS for XBT data submitted in BUFR, which is not fully operational yet

- supporting recruiting activities for ships as requested, with mixed success

9.1.2.2 The SOT TC stressed that submitting XBT deployment and platform metadata to JCOMMOPS remains the biggest issue, and he thanked AOML for sharing international data with JCOMMOPS, and hopes that the implementation of the new metadata formats, procedures and JCOMMOPS tools will help overcoming this long-lasting issue.

9.1.2.2 The Panel thanked the SOT TC for his continuous support and made a number of decisions.

Actions;

9.1.2/1 SOT TC and SOOPIP to work together to improve the labeling and layout on the XBT line maps indicating sampling rate for the year.(SOT TC , SOOP Panel, Aug 2017)

9.1.3 XBT Science Team

9.1.3.1 Janet Sprintall presented the XBT science team report together with Rebecca Cowley. The global XBT network is logistically complex and so requires strong collaboration between many organizations and countries. XBT observations are currently used mainly to: 1) Monitor the variability of location and transport of key surface and subsurface ocean currents and boundary currents, 2) Monitor the variability of the meridional heat transport and the Meridional Overturning Circulation across ocean basins, 3) Provide a significant amount of upper ocean thermal observations, particularly in areas under-sampled by other observational platforms, used for global ocean heat content estimates, and 4) Initialization and validation of numerical ocean forecast models. A strong synergy exists between XBT observations and observations from other platforms, such as altimetry, surface drifters, Argo, etc. enabling more robust scientific analysis.

9.1.3.2 The focus of the XBT Science Steering Team is to inform the oceanographic community on the benefits of using XBT transect data for monitoring mass and heat transports in boundary currents, and studies of eddy and frontal variability, and to work with other communities in the global observing network and modellers who use XBT data to improve their models and prediction.

For more information on XBT Science see http://www.aoml.noaa.gov/phod/goos/xbtscience

9.1.3.3 The 5th International XBT Science meeting took place at JAMSTEC Headquarters in Tokyo, Japan on 5-7 October 2016, following on from the 4th IQuOD workshop at the same venue. The workshop was divided in oral presentations and plenary discussions, held with the objective of exchanging ideas on how to proceed with the implementation, maintenance, and enhancement of the XBT Network. A total of 45 scientists participated (7 remotely) from Australia, Brazil, China, France, Germany, India, Italy, Japan, UK, and the USA.

9.1.3.4 The themes of the meeting were:

- understanding and correcting XBT biases for climate research (e.g. ocean heat content) and physical oceanography studies
- scientific and operational uses of XBT observations, to better understand critical ocean phenomena, processes, such as Meridional Overturning Circulation, currents including Western Boundary Currents, and ocean heat budgets
- exploring the synergy of XBT data with data from other observational platforms such as Argo floats, satellite altimetry, surface drifters, etc.

9.1.3.5 Highlights of the meeting and suggested action items by the XBT Science Team were presented and include:

- Contributions to the first draft of an XBT review paper
- Recommendations on which FRE to use for the science community
- Input of recommendations on intelligent metadata and uncertainties and FRE corrections to IQuOD in the "adjusted" fields of the IQuODv0.1 data set release
- Set up task teams from within the XBT Science team to work on producing an updated and improved, with reduced error FRE. This effort will include;-
  - collection of side-by-side pairs data and recommend future pairs collections, do the comparisons and work with international programs to perform the tests (Bec Cowley, Francis Bringas, John Abrahams, Marlos Goes, Franco Reseghetti, Mauro Cirano)
  - Storage/curation and retrieval of side-by-side data (Bec Cowley/Tim Boyer/Thierry Carval/Viktor Gourestki/Franco Reseghetti to co-ordinate with all)
  - co-ordinate assessment of pure temperature biases, pure depth biases and offsets (Viktor Gourestki, Franco Reseghetti, Lijing Cheng, Gustavo Goni, Francis Bringas, Catia Domingues, Ishii Masayoshi)
- Provide a global XBT transect 'product' for users. This would include assessing existing products and then extending the most useful format to all global transects. This could potentially be provided through WOD. Discuss application of CH14 correction. Bec Cowley/Janet Sprintall/Gustavo Goni

- Next Ocean Science meeting propose a session dedicated to 50 years of XBT measurements - Janet Sprintall, Gustavo Goni
- Next XBT Science Meeting would be joint with IQuOD, given significant overlap of communities, perhaps at the IAPSO meeting to be held in Capetown, South Africa in September 2017. An XBT Science meeting might also be coordinated with the Argo Science meeting or with modelling community for XBT-model applications workshop

9.1.3.6 It is mentioned that a global XBT transect product of heat content and transport will be developed.

9.2 Development and plans for the SOOP and interaction with other networks

9.2.1 pCO2 systems

9.2.1.1 The observational core of the nascent surface ocean carbon dioxide (CO2) observing network relies on in situ measurements of surface water partial pressure of CO2 (pCO2) and air-sea partial pressure difference (ΔpCO2) using both ships of opportunity (SOOP-CO2) and moorings at broad spatial and high temporal resolution, respectively. These efforts have an overriding goal to quantify the rate and magnitude of global uptake of CO2 by the ocean. As such the data also are used to improve understanding of the processes responsible for this uptake. The data increasingly contribute to determining the change in surface water inorganic carbon chemistry referred to as ocean acidification. The network has contributed significantly to reducing the uncertainty in air-sea CO2 flux by 50% over the last 15-years and quantification of its temporal and spatial variability. The network has also made it possible to determine seasonal to inter-annual variability in ocean CO2 flux over the last three decades and its overall impact on atmospheric CO2 levels. Implementation of the SOOP-CO2 network should occur in close cooperation with JCOMMOPS, and in particular with the SOOP components of SOT due to synergistic scientific goals and infrastructure needs. The surface CO2 network design should take advantage of rapid advances in observations and modeling in order to address future surface ocean changes, the impacts of possible global CO2 emission reductions, and carbon accounting. The network must be augmented utilizing new technology and platforms with integrated data synthesis and modeling components to become a true surface ocean CO2 observing system.

9.2.1.2 The network of automated underway CO2 systems of ≈50 cargo ships, cruise liners, icebreakers and research ships are operated independently by a variety of researchers worldwide. There has been a significant advance in a community effort to collate all data following uniform data reduction and quality control approaches in the Surface Ocean Carbon Atlas (SOCAT) with a current holdings of over 15 million data points. The uniform data is released annually with an increase in data holding of about 1 million data points a year.

9.2.1.3 Within countries and regions there a robust sustained efforts to maintain the SOOP-CO2 network. In the USA the NOAA Ocean Observation and Monitoring Division (OOMD) has a sustained effort that maintain 12 SOOP-CO2 ships, The NIES of Japan has a long running efforts of Cross Pacific Lines, Australia's CSIRO maintains several ships in the Southern Ocean, and the recently formed Integrated Carbon Observing System for the ocean (ICOS-Ocean) in Europe (Norway lead) will maintain a half a dozen ships in the North Atlantic and adjacent marginal seas.

9.2.1.4 There has been a focus on underway pCO2 systems on research ships and improved TSG documentation and quality from these platforms. The latter is occurring in programs such as the Rolling Deck to Repository (R2R) effort in the USA and GOSUD. On programs such as GO-SHIP, the underway pCO2 data is used in conjunction with the bottle data to get a process understanding of the controls of pCO2. More recently the pCO2 data serve as a means to validate data obtained from biogeochemical sensors on ARGO floats (BGC Argo) that are frequently deployed from research ships.

9.2.1.5 The data is increasingly used to address overarching scientific and societal needs pertaining to carbon sequestration by the ocean and the impact of surface ocean acidification

on vulnerable ecosystems. The data is critical for annual assessments such as provided by the Global Carbon Project and the annual State of the Climate bulletin put out by NOAA. The interpretation of the surface ocean CO2 data will play an important role in the IPCC special report on Climate Change and Oceans and the Cryosphere.

9.2.1.6 Recruiting of ships remains a challenge, in particular because of frequent changes of ship routes.

9.2.1.7 The lack of dedicated resources to track assets remain a challenge. The hope is that funding can be acquired to for part-time engagement of JCOMMOPS personnel to coordinate, track assets and expand the network, including novel deployments on platforms such as sailing yachts, and autonomous platforms such as ASVs floats and drifters. The new platforms are particularly needed to increase observations in data sparse regions such as the Southern Ocean.

9.2.1.8 The SOOP-CO2 effort will continue to evolve into a surface water CO2 network with seamless operations between platforms. Continued efforts will be devoted to real-time tracking and real-time data display and dissemination with as goal to have a single location where all information can be obtained. This effort will benefit greatly from closer coordination through JCOMMOPS and SOT.

9.2.1.9 Additional autonomous observations on ships are desired to address broader scientific and societal goals of surface water biogeochemistry and ecosystems. Air measurements of CO2 that are routine on most systems will be better calibrated for better tracking of fossil fuel derived CO2 over the ocean. Other autonomous instruments are becoming available for SOOP use Oxygen measurements can provide a key indicator of biological processes. Ocean color can be used to estimate phytoplankton growth and ocean health. Other carbon parameters will improve understanding of the changing ocean carbon cycle. pH measurements can provide a direct assessment of ocean acidification.

9.2.1.10 Continued development of robust and accurate autonomous instrumentation to measure other parameters on SOOP will continue. Development of improved CO2 sensors will continue to facilitate ease of installation, smaller footprints and lower maintenance requirements.

9.2.1.11 Group decided to have pCO2 as a part of SOOPIP and inform the OCG-8 on the decision.

Actions;

9.2.1/1 Investigate opportunities to assist in coordination and collection of data and metadata tracking of SOOP-CO2.(SOOP Panel, SOT-10)

9.2.2 Thermosalinograph Network

9.2.2.1 Thermosalinographs (TSG) measure Sea Surface Temperature and Sea surface Salinity along ship tracks. Some of the applications of these observations are: 1) the determination of boundary regions in ocean currents; 2) data are used for climate and Ocean Dynamic research; 3) also used as input for climate and weather forecast models; 4) TSG operations are conducted in support of efforts to globally inventory carbon dioxide in the ocean.

9.2.2.2 TSG operations are often carried in support of the pCO2 operations to provide critical information to determine frontal regions and mixed layer depths for ocean acidification assessments and pCO2 inventories. TSG observations are also key for Sea Surface Salinity satellite mission calibration and NASA led ocean experiments such as SPURS.

9.2.2.3 The TSG operation has been carried during the last 20 years. These observations are critical for understanding long-term changes in the marine environment.

9.2.2.4 Approximately 70 ships reported TSG data globally during the last two years. TSG data is distributed in near real-time and delay mode trough the GTS and different data centers including NOAA/NCEI SAMOS and GOSUD.

9.2.2.5 For US-SOOP and the NOAA fleet TSG operations, all the data received at AOML is quality controlled through several steps based on the GOSUD (Global Ocean Surface Underway Data Pilot Project) real-time control tests. Among other parameters, the quality control procedures check the data for errors in date, location, platform identification, ship speed, global and regional temperature and salinity ranges compatibility, gradient and the presence of spikes. The TSG data is also compared with a monthly climatology The whole data set is distributed by NOAA/NCEI, SAMOS and GOSUD/Coriolis. This system is currently fully functional in real-time, providing important tools to automatically detect problems in data transmission, equipment calibration and marine operations.

9.2.3 Relationship with other networks such as Argo, gliders, VOS, TPOS

9.2.3.1 Strengths of the high-density repeat in-situ observations;

- Local high-resolution repeat sampling (XBT resolution 10-20 km; SSS 1-5 km; repeat ~months)
- Long time series providing seasonal and interannual observations, often over 20-30 years (ie unique repeat time series of upper ocean ocean variations in the pre-Argo era)
- High spatial resolution allows detection of fronts, frontal movements, boundary currents, high latitude regions, that are not well resolved with Argo (3°x3°)
- Ship Hydrographic T,S observations often coupled with other underway data : ADCP currents, PCO2 - biochemistry & surface fluxes, allowing multi-disciplinary fine-scale process studies with all variables collocated in space and time
- Rapid quality control – near real-time visualization, rapid interventions, regular bottle samples for accurate salinity calibration

9.2.3.2 Weaknesses of high-density repeat in-situ observations;

- Local high-resolution sampling provides snapshots of small, rapid ocean processes at one location but not their evolution in time, or over a wider region
- Statistical composites often needed to reveal mean fronts, currents or eddy structures
- Difficulty to separate rapid energetic structures (internal waves, internal tides) from balanced upper ocean dynamics

9.2.3.3 Synergy with other in-situ observations;

- Argo : Provides global space-time coverage of larger scales (> 300 km > 10 days) since 2005. Sets the larger-scale ocean variability, to help interpret the space-time evolution between SOOP observations
- Moorings : Point observations at higher frequency (hours) with precise vertical structure. Can help separate the high-frequency and ageostrophic components from the lower-frequency balanced flow
- Gliders : Slower than ships, well-suited to moderate energy regions. Can complement the SOOP sampling in key ocean regions between shipping lines
- Marine mammals : Provide complementary sampling close to fronts & sea-ice, rapid sampling of mixed layer and upper-ocean

9.2.3.4 Group recommended that it is important for the SOOP representative to attend the Glider network meetings and represent the XBT at glider community.

10 MONITORING, CODING AND DATA MANAGEMENT

10.1 KPI definition and targets

10.1.1 The SOT TC reported on progress with an integrated monitoring and performance measurement system across all observing networks which are technically coordinated by JCOMMOPS, and stressed that such an integrated system requires harmonized metrics, indicators, and targets.

10.1.2 The meeting noted that the JCOMMOPS system was designed around 6 themes: i) Implementation, ii) Data Flow, iii) Instrumentation, iv) Operations, v) Data Uptake and vi) International Cooperation. The networks can use different methods to measure their performance in these domains, but the design nevertheless allows a measurement across all networks.

10.1.3 The meeting also noted that these indicators are calculated like the network maps automatically, and on a monthly and yearly basis, and that the JCOMMOPS system provides tools to view indicators for e.g. individual ocean basins, or pre-defined sub-networks.

10.1.4 The meeting also noted that the existing SOT KPIs have been integrated in the proposed domains, but that i) the full implementation of quality-related indicators still requires some adjustments on RTMC and E-Surfmar side, and that ii) further KPIs should be developed to cover all domains appropriately. This is in particular true for spatial resolution of VOS observations.

10.1.5 The meeting encouraged JCOMMOPS to also progress with a parameter based performance measurement, taking into account data for the same variable obtained by platforms from different networks (e.g. DBCP and SOT).

10.1.6 Group agreed to create a new task team to work on the KIPs.. Paul Poli agreed to be the chairperson of the TT.

10.1.7 ToR for the new TT-KPI and membership was reviewed and approved by the Team and are available in Annex VII

Actions;

10.1/1 New KPI Task Team to develop broader SOT KPI set (with targets) which matches with the requirements of a JCOMM integrated performance measurement and covers the following themes: i) Implementation, ii) Data Flow, iii) Instrumentation, iv) Operations, v) Data Uptake and vi) International Cooperation.(TT-KPI, SOT-10)

10.2 Monitoring and data centre reports

10.2.1 Monitoring Report from the Regional Specialized Meteorological Centre (RSMC) and Real-Time Monitoring Centre (RTMC) for VOSClim data

Regional Specialized Meteorological Centre (RSMC) Exeter VOS monitoring report

10.2.1.1 Ms Sarah North and Miss Emma Steventon (United Kingdom) reported on the activities of the Regional Specialized Meteorological Centre (RSMC) Exeter, acting as CBS Lead Centre for monitoring the quality of surface marine observations. The RSMC routinely produces monthly quality reports and provides feedback to VOS operators regarding the quality of the data delivered by VOS ships. The impact of the planned move to automation of observation monitoring in light of personnel changes at the Met Office was brought to the group's attention.

10.2.1.2 The Met Office (RSMC Exeter) continues to compile lists of ships that have produced 'suspect' observations each month (e.g. see Appendix A of SOT-9-Doc-10.2.1) which are available via the Met Office web site1 and are also sent to the WMO Secretariat.

10.2.1.3 The Team noted that the Met Office had contacted other monitoring centres regarding the new monitoring criteria for labelling ships as 'suspect' and obtained agreement on implementing them in their monthly monitoring reports.

10.2.1.4 The new monitoring criteria (shown in Appendix B of SOT-9-Doc-10.2.1) started to be used from January 2015 in monthly monitoring reports. These criteria are substantially tighter for ships that report with automatic observing systems, because these systems are seen to be more reliable and less prone to errors than manual observing systems. Some of the criteria for ships with manual observing systems were also tightened slightly. Consequently, there are now more ships on the suspect lists than in previous months and years.

10.2.1.5 The Team noted that the RSMC now also produce separate tables for suspect manual and automatic ships on the Met Office marine monitoring website.

10.2.1.6 The Met Office also produces monthly lists of monitoring statistics for all VOS, which are sent to the VOS focal points and are also available from the Met Office website. To maintain up to date lists of ships, the Met Office advised that it continues to use the latest data downloaded from the online E-SURFMAR metadata database, rather than from the WMO Pub47 database. In addition, the Met Office uses the masked call sign data available from the JCOMMOPS FTP site.

10.2.1.7 It was noted that the 'SHIP' masking scheme implemented by JMA in 2007 continues to prevent the Met Office from monitoring data from individual Japanese and some US and Canadian ships. There has been a slight increase in the number of these reports over the last two years, with 27199 reports of pressure received in January 2015 from VOS with call-sign "SHIP", compared to 23457 reports in January 2013 (automatic reports account for 85% of these). It is hoped that use of the proposed new SOT ID system will help to reduce the number of SHIP reports in future.

10.2.1.8 Timeliness information for VOS reports received at the Met Office is also made available from the observation monitoring web site2 (see Appendices C, D and E of SOT-9-Doc-10.2.1). This information shows that the majority of ship reports continue to be received promptly, with more than 86% received within 60 minutes of the observation time. Action 107 (SOT-7) on the RSMC to separate timeliness information for automatic and manual ships had been completed with stats issued monthly.

10.2.1.9 The Met Office continues to make monthly VOS ranking scheme results available on their website for all VOS and for the national VOS fleets. Separate monthly lists of scores are produced for automatic and manual ships. An example from the January 2017 monthly scores and national fleet rankings are shown in Appendix F for manned and automatic ships. It was suggested that VOS operators may wish to consider the use of these performance rankings for their national ship award schemes. The RSMC invited VOS Focal Points to provide feedback on their value.

Real-Time Monitoring Centre (RTMC) for the VOSClim data monitoring report

10.2.1.11 Ms Sarah North and Miss Emma Steventon reported on the activities of the Real-Time Monitoring Centre (RTMC) for the VOS Climate (VOSClim) data, which is operated by the Met Office, United Kingdom. The RTMC produces monthly suspect lists and monitoring statistics for all VOS Climate class ships, using the active VOSClim ship list which is now maintained on the E-SURFMAR ftp site (previously on the VOSClim website). It was noted that when the E-SURFMAR database is migrated to JCOMMOPS the RTMC would in future need to extract the VOSClim ship list from the JCOMMOPS database. An example of the suspect lists for manned and automatic VOSClim ships for January 2017 can be seen in Appendix G of SOT-9-Doc-10.2.1.

10.2.1.12. Following agreement at the last session, the suspect criteria for VOSClim ships were tightened in January 2015 to the new values for manual and automated ships shown in Appendix H of SOT-9-Doc-10.2.1.

10.2.1.13. The Team noted that the Met Office continues to send the VOSClim suspect lists and the lists of statistics to the JCOMMOPS mailing lists (PMO and VOS).

10.2.1.14 The Team noted that there were 16 ships on the VOSClim suspect list in January 2017, which is 1.8% of the 335 VOSClim ships reporting pressure. Moreover the KPI for less than 3% of VOSClim class ships to be flagged on the suspect list for air pressure has been met in each month over the last 3 years, as shown in Appendix I of SOT-9-Doc-10.2.1.

10.2.1.15. In February 2017 there were 335 VOSClim ships out of a total of 1526 VOS ships reporting at least 5 pressure values during the month in real time (within about 6 hours of 00, 06, 12 or 18 UTC). As a consequence 22% of VOS ships are reporting to VOSClim standards by this measure. This is therefore within the KPI for 25% of the global active VOS to be upgraded to VOSClim and similar to the value 2 years ago; although it was noted that delayed-mode reports are not included in this percentage. (However it was pointed out that the number of active VOSClim ships listed on the E-SURFMAR database in February 2017 was 491, compared to 3073 active VOS, i.e. just 16.0% of VOS ships are VOSClim by this measure.).

10.2.1.16. In January 2017, 97.1% of VOSClim reports were received within 120 minutes, which exceeded the KPI for at least 95% to be received within 120 minutes.

10.2.1.17. The Team also noted that the Met Office continues to send all VOSClim ship reports and their co-located model field values to the Data Assembly Centre (DAC) and puts a backup copy of the daily BUFR data onto their FTP server, so that it is available for the DAC to access in case of problems with the GTS data. The BUFR data was upgraded in May 2014 to include some extra variables (e.g. wave height) and the BUFR version was upgraded from 3 to version 4.

10.2.1.18 In considering the RSMC and RTMC reports the Team noted in 2016 the Met Office had decided that the marine observation monitoring system that had been used to generate monitoring statistics had reached 'end-of-life' and would be replaced by a new automatic system. This was coincident with the retirement of Mr Colin Parrett, who had administered the system for many years and who had manually collected and sorted statistics for SOT members for many years. The Team thanked Mr Parrett for his long standing contribution to ensuring the quality of VOS observations.

10.2.1.19 It was noted that the new automatic system is being developed from the 'ground up'. As it currently stands (as of February 2017), the new system is being trialled and results are being compared to the existing system to ensure consistency and future continuity for the international marine community. In the meantime, on the timescale of the next 4-6 months, the existing system will continue to operate in a 'frozen' state with no further development planned.

10.2.1.20 It is envisaged that the new automatic monitoring system will deliver marine statistics in a simple but more flexible way such that, for example, monthly statistics may be fetched via a simple Ftp retrieval, and individual ship statistics may be queried via a web interface. Further news and accompanying examples of the new system (e.g. graphs, screenshots and sample files) will be published in due course.

10.2.1.21 The Team requested the Met Office RSMC to advise SOT members and VOS operators when their new automatic monitoring system will become operational by sending information to the JCOMMOPS SOT mailing list.

***Actions**;*

10.2.1/1 PMOs and VOS Focal Points to contact VOS ships on monthly suspect lists to rectify any problems.(PMOs; ongoing)

10.2.1/2 VOS Focal Points to provide feedback on the value of the RSMC performance ranking lists.(VOS Focal Points; January 2018)

10.2.1/3 The Met Office RSMC to advise SOT members and VOS operators when their new automatic monitoring system becomes operational by sending information to the JCOMMOPS SOT mailing lit.(Miss. E. Steventon, July 2017)

10.2.1/4 Taking into the account to discontinue the VOSClim class the VOSP Chairperson to provide the feedback on the future requirement of VOSClim class monitoring to RTMC.(VOSP Chairperson, Aug 2017)

10.2.2 ASAP QC Monitoring report

10.2.2.1 The representative from Météo-France reported on the status of the ASAP monitoring centre, as well as on future plans. The ASAP monitoring centre was established by Météo France, as agreed at the Seventh Session of the former ASAP Co-ordination Committee in 1995. Since that time, Météo France has been routinely providing annual monitoring report on behalf of the ASAP.

10.2.2.2 The Team reviewed the monitoring reports, noting in particular the operational performance and data quality of the ASAP.

10.2.2.3 The Team noted that:

In 2016, this is the first annual report with BUFR messages instead of TEMP messages so there is no comparison with the previous year.

- During 2016, Météo-France Toulouse received 12019 upper air messages (BUFR all amendments included) from ships. The reports were received from 23 different call signs
- No particular problem was noticed concerning the European ships and the mean time before the integration of the messages in the GTS in Toulouse is good. Only DBLK has a delay but it is a vessel research and the launch time is different
- With the migration to the BUFR messages, we did not see any corrupted call signs in 2016
- Japanese ships follow a different procedure with an important shift between the sending of the message and the synoptic hour
- There is no significant degradation on the delay for the other ASAP ships

Action*;*

10.2.2/1 ASAP ship operators should try to update their transmission systems in order to be able to transmit high resolution BUFR messages.(ASAP Operators, SOT-10)

10.2.3 Global temperature and Salinity Profile Programme (GTSPP)

10.2.3.1 The GTSPP was initiated jointly by IODE and IGOSS in 1990 as a pilot project (through Recommendation IODE-XIII.4) and transformed in 1996 into a permanent operational programme under the co-sponsorship of IODE and IGOSS (IODE Recommendation IODE-XV.4. In 2001 JCOMM-I defined GTSPP as a programme jointly sponsored by JCOMM and IODE.

10.2.3.2 The objectives of the programme are: a) to provide a timely and complete data and information base of ocean temperature and salinity profile data, b) to implement data flow monitoring system for improving the capture and timeliness of real-time and delayed-mode data, c) to improve and implement agreed and uniform quality control and duplicates management systems, and d)to facilitate the development and provision of a wide variety of useful data analyses, data and information products, and data sets.

10.2.3.3 The members of the programme steering group are: 1) Charles Sun, National Centers for Environmental Information (NCEI), USA, 2) Rebecca Cowley, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, 3) Mathieu Ouellet, the Marine Environmental Data Section (MEDS), Canada, 4) Loic Petit De La Villeon, Institute Français pour la Recherche et l'Exploration de la Mer (IFREMER), France, 5) Gustavo Goni, Atlantic Oceanographic and Atmospheric Laboratory (AOML), USA, and 6) Yoshiaki Kanno, Japan Meteorological Agency (JMA), Japan.

10.2.3.4 Continued GTSPP daily operations to process and load both real-time and non-real-time temperature and salinity data into the GTSPP Continuously Managed Database (CMD).

- Maintained the project web sites at https://www.nodc.noaa.gov/GTSPP/ and http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/gtspp/index-eng.htm
- Populated the outcomes of the comparison between observed versus model-simulated temperature data for the North Pacific Region at http://ds.data.jma.go.jp/gmd/gtspp/data/index.html
- Reported to the eighth (8th) Session of the joint WMO/IOC JCOMM Ship Observations Team (SOT), 20-24 April 2015, Cape Town, South Africa
- Conducted the second IODE OceanTeacher Academy Training Course on the Use of the Global Temperature and Salinity Profile Programme Data, 8-10 December 2015, Tianjin, China
- Conducted the third (3rd) Session of the GTSPP steering group, 17-18 November 2016, Oostende, Belgium

  - Proposed work plan

	Activity (as per work plan)	Timing (month, year)	Funds already identified source)
1	Real-time data acquisition from the Global Telecommunication System.	April 2017 - March 2019	OSD
2	Submission of the delayed-mode data from the GTSPP participants	April 2017 - March 2019	AOML, BOM, CSIRO, IFREMER, RAN, and SIO
3	Providing data services by NCEI and MEDS	April 2017 - March 2019	NCEI and OSD
4	Host the GTSPP Data Product Centre for the North Pacific	April 2017 - March 2019	JMA
5	CMD System Document	April 2017 - March 2019	NCEI
6	CMD-WOD integration	April 2017 - March 2019	NCEI
7	The fourth meeting of SG-GTSPP in conjunction with SG-GOSUD-VII	June 2018	IODE (pending)

Actions;

10.2.3/1 Continue GTSPP daily operations and GTSPP participants to continue submission of the real-time and delayed-mode data to NCEI during the period April 2017 to March 2019.(GTSPP participants, Dec 2017)

10.2.4 Global Ocean Surface Underway data Pilot Project (GOSUD)

10.2.4.1 Not presented.

10.2.5 XBT Data Flow and Transmission

10.2.5.1 The near real time availability of XBT data through the Global Telecommunication System (GTS) is a key objective linked to XBT operations, and data tracking and monitoring

services have been implemented to guarantee the quality, availability and long-term archive of data. At the NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML), all the incoming XBT profiles are quality controlled and quality flags are assigned to each depth level based on the results from the series of tests being applied on the profile. Before being put on the GTS, the profile enters the encoding stage where it is converted into FM 63-XI Ext. BATHY and BUFR (using common sequence 3 15 004) formats. Both versions are inserted on the GTS. This dual delivery scheme will continue until global BUFR migration is finished and users have accommodated their decoding processes to the new format. During all the stages, copy of the inputs and outputs are kept in order to detect and report failures, assess the latency, and ensure proper transmission to the GTS.

10.2.5.2 On a biannual basis, AOML prepares reports on the XBT observing network activities based on data stored in in-house databases and other external repositories (e.g. World Ocean Database, GTSPP, Coriolis). These reports are available online in the XBT Science Team web site at http://www.aoml.noaa.gov/phod/goos/xbtscience/reportsumm.php. The reports contain a list of active transects, number of mode of deployments, probe types, location and time, as well as the agencies involved in logistics, deployments and data management and transmissions. The annual reports are also submitted to the JCOMM Ship Coordinator.

10.2.5.3 A new software package has been developed to implement effective quality control of XBT data. The quality control procedures have been updated and translated from FORTRAN to Python. The new software aims to simplify troubleshooting, performance analysis, maintenance and accessibility, while still complying with requirements to transmit BUFR files to the GTS.

10.2.5.4 The new versions of the AMVERSEAS package include additional metadata, such as Sequence Number, Ship Rider Details, Probe Manufacture Date, and SOOP Line. The new metadata fields smooth the BUFR encoding process as more descriptors can be set to non-missing values. These bulletins provide additional value to users than metadata-poor files.

10.2.5.5 As part of the action items outlined in the SG-GTSPP-III meeting report, AOML leads an effort to propose a GTSPP exchange format in netCDF-4 that solves the limitations of netCDF-3 (mostly as a result of one unlimited dimension).

10.2.5.6 The Ad-hoc Task Team on SOOP metadata made recommendations on the SOOP metadata standards. They can serve to design and implement new strategies to fully comply with those standards.

10.2.5.7 The migration to BUFR for XBT data continues. Currently USA, Australia and Japan are encoding their bulletins into BUFR. We need to determine the criteria and thresholds to consider the migration completed. This stage could require a complete list of users that should be first consulted, and later notified once the BATHY bulletins stop flowing on the GTS.

10.2.5.8 AOML is currently using THREDDS and ERDDAP to distribute satellite and in-situ products. This approach incorporates online interfaces that integrate multiple data sources into a common interoperable environment.

Actions;

10.2.5/1 Review and assess the migration to BUFR, defining deadlines, identifying stakeholders and completion criteria.(SOOP Members; SOT-10)

10.2.6 Global Coverage of XBT network

10.2.6.1 Observations with XBTs started approximately 50 years ago and most of the current repeat transects have been in place for longer than 10 years and some for longer than 30 years. All current transects have a solid scientific justification and are geared towards the monitoring of across basin heat transports, surface and subsurface currents, boundary currents, and provide approximately 15% of non-mooring upper ocean temperature

observations used for estimates of global ocean heat content and initialization/validation of numerical forecast models. Therefore, although global, XBT observations have a large impact in enhancing our knowledge of regional ocean dynamics and water properties.

10.3 Marine Climate Data System (MCDS)

10.3.1 Global Collecting Centres (GCCs) report on the VOS

10.3.1.1 The Team recalled that under the revised Marine Climatological Summaries Scheme (MCSS), adopted by the eleventh session of the Commission for Marine Meteorology (CMM) (Lisbon, Portugal, April 1993), through Recommendation 11 (CMM-XI), the two Global Collecting Centres (GCCs) were established, in Germany and the United Kingdom, to: (i) collect all marine climatological data observed worldwide; (ii) ensure that minimum quality control procedures are applied; (iii) generate complete and duplicate global data sets; and (iv) provide these data sets to the Responsible Members (RMs) under the MCSS.

10.3.1.2 The Team reviewed a consolidated 2016 report from the two GCCs. The report included a status on the volume and frequency of delayed-mode data being forwarded to the VOSClim Data Assembly Centre.

10.3.1.3 The Team also considered the role of the GCCs in processing the delayed-mode IMMT (International Maritime Meteorological Tape-format) data and the associated quality control standards.

10.3.1.4 An extract of the Annual GCC Report 2016 is supplied in Annex A of SOT-9-Doc 10.3.1. The full version[31] is available online.

10.3.1.5 The Team suggested to change the GCC reports to reflect the changes decided on VosClim discontinuation.

10.3.1.6 The Team considered the new Marine Climate Data System (MCDS) and how the roles of MCSS members will migrate to the new data flow structure when it is introduced. The GCCs will take the role of a GDAC within the MCDS.

10.3.1.7 The GCCs will continue the operational service while prepare for the new role in the MCDS as GDACs The GCCs support finalizing WMO No. 558/471 to define the GCC tasks as GDACs in the MCDS. Potential new tasks have to be aligned with the new data flow, which is foreseen to be approved by JCOMM-5.

Actions;

10.3.1/1 GCC Contributing Members (CMs) that did not submit data during 2016 should do so in 2017 or alternatively contact GCC for advice.(GCC Contributing Members, Dec. 2017)

10.3.1/2 CM should use the most recent IMMT-5 format to submit the data.(GCC Contributing Members, Dec. 2017)

10.3.2 VOSClim Data Assembly Centre (DAC) report

10.3.2.1 The US NOAA National Centers for Environmental Information (NCEI), acting as the DAC for the Voluntary Observing Ship Climate (VOSClim) fleet, reported on the present status of the DAC activities in accordance with its Terms of Reference. The DAC reported on the status of the project website, including the collection and provision of real-time and delayed-mode observation data, metadata, ship listings and other project information. In the coming years, the MCDS will replace the MCSS and at that time it is expected that the VOSClim DAC will be upgraded to the MCDS Global Data Assembly Centre (GDAC) for the VOSClim.

[31] http://www.dwd.de/EN/ourservices/gcc/gcc_jahresberichte.html

Data Assembly

10.3.2.2 NCEI maintains several archives in support of the VOSClim Fleet and hosts a web presence[32] for access to fleet information and data. The archive consists of three data streams:

- GTS - near-real time collection of ship observations
- BUFR – ship observations plus model fields
- GCC – Global Collection Centers delayed mode ship observations

10.3.2.3 VOSClim observations from all streams are captured based on the most current VOSClim ship list[33] available. GTS ship observations are transmitted over the GTS under a variety of WMO headers. BUFR ship observations are transmitted daily from the UK Met Office via the GTS under WMO abbreviated headers ISXX4* and IOXX4* (where * is equal to 0, 1, 2 or 3).

10.3.2.4 The DAC continues to report quarterly to the GCCs on the number of delayed mode VOSClim observations parsed from the delayed mode files distributed to Responsible Members (RM). This information is used in the GCC annual reports.

10.3.2.5 All observations are decoded into the International Maritime Meteorological Archive version 1 (IMMA1) format[34] and placed on the project web site[35].

VOSClim Web Page and Data Access

10.3.2.6 NCEI reported that the VOSClim DAC web pages were significantly modified in 2013 due to NCEI web operations being moved to a web content manage system. The website was streamlined and provided a new look and feel. All data and Fleet information remain as before. Screen shots of the current DAC VOSClim Fleet web pages are provided in Appendix A of SOT-9-Doc-10.3.2.

The URL for data access is:

http://www.ncdc.noaa.gov/data-access/marineocean-data/vosclim/data-management-and-access

and provides links to ftp downloads and NCEI's Marine Data Tool[36] for subsetting VOSClim Fleet observations. The Marine data tool access system provides map search functions and other subsetting options, such as call sign and temporal/spatial parameter subsetting capabilities.

10.3.2.7 For an automated download, the data is available on an anonymous FTP site ftp://ftp.ncdc.noaa.gov/pub/data/vosclim. Separate folders exist for each year beginning with 2001. Also available for download from the FTP site is award pictures, ship pictures, monthly statistics and suspect ship reports.

VOSClim Ship List

10.3.2.8 During 2014, preparations and testing were performed to transition VOSClim operational processing at the DAC from the old NCDC-maintained ship list to use the more frequently updated ESURFMAR informal Pub 47 ship list. ESURFMAR produces two VOSClim ship lists, active-only and a full VOSClim historical list containing both active and inactive ships. NCEI is archiving a daily snapshot of both lists and is using the full historical list for operational processing.

[32] http://www.ncdc.noaa.gov/data-access/marineocean-data/vosclim

[33] ftp://esurfmar.meteo.fr/pub/Pub47/

[34] http://icoads.noaa.gov/e-doc/imma/R3.0-imma1.pdf

[35] http://www.ncdc.noaa.gov/data-access/marineocean-data/vosclim/data-management-and-access

[36] https://www.ncdc.noaa.gov/cdo-web/datatools/marine

10.3.2.9 On 1 January 2015, this operational change went into effect and the DAC ship list was then abandoned and removed from the DAC website. Benefits of this change included: access to the most current VOSClim metadata when processing; and one less requirement on PMOs to provide metadata to two different locations to ensure accurate VOSClim data processing.

10.3.2.10 The Team considered whether the scope of the DAC need to be revised as a consequence of the decision to discontinue the VOSClim class, and suggested that it could be made into a data portal for all VOS data.

Actions;

10.3.2/1 As a primary source of VOSClim ship data, invite NCEI and JCOMMOPS Technical Coordinator to review the VOSClim DAC website and propose changes, including the possibility of removing extraneous information, e.g. Dutch VOS and Awards pictures.(SOT TC with NCEI, Dec 2017)

10.3.2/2 Investigate the implications of sun setting the VOSClim DAC and the potential for transforming it into a wider VOS DAC.(SOT TC,VOSP Chairperson with ETMC, SOT-10)

10.3.3 ICOADS Report

10.3.3.1 Information on ICOADS was presented by Mr. Shaun Smith on behalf of Eric Freeman. The International Comprehensive Ocean-Atmosphere Data Set (ICOADS) is the largest archive of global surface marine data in existence. The most recent version, ICOADS Release 3.0 (R3.0; Freeman et al. 2016) released in June 2016, contains over 455 million individual marine reports covering years 1662-2014, with Near-Real-Time (NRT) extensions from 2015-present. The data set contains a wide range of near-surface meteorological and oceanographic parameters stored in a common format.

10.3.3.2 In addition to many new sources of data included in R3.0, there were additional updates worth noting:

- A new NRT product[37] was developed to enhance ICOADS and continue updates after the official end R3.0. The new NRT product is based on a blend of NCEI and NCEP GTS (previously only NCEP GTS was used). Benefits of this merge include;
  - Additional 5% gain of unique reports
  - Recovery of masked call signs in the NCEP GTS stream. Recovery of up to 70% of masked call signs (generic callsign replaced with either real callsign or coded ship identifier) are recovered by adding the NCEI GTS stream

- International Maritime Meteorological Archive (IMMA) common format updates;
  - A Unique Identifier, located in the new Unique ID Attachment (Uid attm), has been added to each individual report in ICOADS to assist with record tracking and provenance, as well as user-based feedback on specific reports e.g. containing errors, etc.
  - Near-surface oceanographic data from sources such as the World Ocean Database (WOD), SAMOS, GOSUD and tropical moored buoys have been included in a new Near-surface oceanographic data attachment (Nocn attm). Although the most significantly reported element in this attachment is SST, other variables are provided where reported including the depth at which the observation was taken: temperature, salinity, oxygen, phosphate, silicate, nitrate, pH, total chlorophyll, alkalinity, partial pressure of carbon dioxide, and dissolved inorganic carbon
  - Edited Cloud Reports contain multivariate checks on clouds, including e.g. present weather and sun/moon illuminance, to assist with determining the amount and types of clouds reported from visual observations which are known to contain biases

[37] http://icoads.noaa.gov/merge.html

and inconsistencies. Estimates of non-overlapping cloud cover is calculated and supplement the original cloud variables originally reported

- The ICOADS Value-Added Database (IVAD) is a new method of linking community adjustments, uncertainty estimates, and alternate QC to individual ICOADS records, and providing them to ICOADS users in the IVAD attachment (Ivad attm). The IVAD reports are developed by experts in the marine community and have an author reference code that provides users with links to documentation on the adjustments made. While prototypes have been produced for Lindau Beaufort wind adjustments and air temperature adjustments for ship heating, they will be made available in a future release
- The Error attachment (Error attm) has been designed to help track erroneous values in the ICOADS records. When a value has been corrected, the originally erroneous, uncorrected value is stored in the Error attm so that it can be assessed again easily in the future by anyone interested
- The Reanalysis QC attachment is a new attachment (Rean-qc attm) established to provide reanalysis feedback records, including e.g. whether a specific records was used in the assimilation, co-located first guess values, and bias corrected observations values. Additional fields for metadata are also included to note the data providers and reference document links

10.3.3.3 More information on ICOADS and Release 3.0 can be found at the ICOADS website[38] . Additionally, data access options are listed on the ICOADS website in the Data and Documentation section[39].

10.3.3.4 ICOADS is working to become formally established within the JCOMM Marine Climate Data System (MCDS) as a Centre for Marine Meteorological and Oceanographic Climate Data (CMOC). The ICOADS archive is already the preferred data source for almost all surface marine data products (including sea surface temperature (SST) from NOAA, the Hadley Centre and JMA), and is assimilated into atmospheric, oceanic and coupled re-analyses (including at ECMWF, NOAA, NASA and JMA). However some aspects of ICOADS operations require modernization to enable its successful transition to becoming a CMOC.

10.3.3.5 ICOADS provides access to surface marine reports from the GTS co-ordinated and observed by SOT participants, and from other parts of JCOMM, including DBCP. ICOADS also integrates data from delayed mode data systems including those operated by GCCs, ISDM, NDBC, PMEL and NOAA WOD. Many ICOADS users require the observations to be as fully described as possible with observational metadata, including ship or platform identifiers, measurement methods and observation locations and heights. SOT progress toward resolving the call sign masking issue and embedding observational and platform metadata within transmitted reports is very welcome in this regard. In the future it is expected that ICOADS users will benefit from the availability of originator unique identifiers that if retained throughout the real time and delayed mode data systems will prove hugely beneficial when merging data streams and identifying data problems.

10.3.3.6 The marine surface climate observing system requires high-quality observations to provide a reference, but also more extensive observations to provide wider sampling of variable conditions. The key is for all observations to be accompanied by extensive information describing the platforms, instruments and protocols used. This then enables a more stable climate record to be produced by, for example: adjusting observations to a common reference level, identifying platforms or instrument types making consistently biased observations, and characterizing uncertainty in the observations, and in data products constructed from those observations. The masking of ship call signs (or other identifiers enabling linkages to platform-based metadata such as that in Pub. 47), and patchy availability of historical metadata for coastal buoys from NDBC, have proved particularly problematic for the effective use of these observations in climate data products.

[38] http://icoads.noaa.gov/

[39] http://icoads.noaa.gov/products.html

Actions;

10.3.3/1 JCOMM to ensure that the Marine Climate Data System (MCDS) permits, encourages, and where appropriate requires, the association of platform and observational metadata with observations, both through transmission in real time (i.e. BUFR and TAC formats) and archival in delayed mode.(JCOMM/MCDS, SOT-10)

10.4 Operational Coding requirements

10.4.1 BUFR Template and implementation for VOS data

10.4.1.1 Noting the requirement for the migration from the Traditional Alphanumeric Code (TAC) forms to Table Driven Codes to be completed by November 2014 Dr. David Berry reported that the focus of the Task Team on Table Driven Codes (TT-TDC) has been on migrating the remaining TAC templates to BUFR equivalent. Dr. Berry reported that the final TAC template, that for Voluntary Observing Ship (VOS) observations, has now been validated and approved from operational use from November 2016 . Dr. Berry reported that, as proposed at SOT-8, the template contains extended metadata for the VOS observations, including those required in delayed mode formats, as well additional parameters proposed in the inter-sessional period to the TT-TDC. The amendments to the manual on codes and full BUFR template for VOS observations are given in Annex I of SOT-9-Doc-10.4.1.for reference.

10.4.1.2 Dr. Berry also reported that the BUFR template now contains an element for assigning a unique ID to each observation but noted that the scheme for doing this needs to be developed.

10.4.1.3 The meeting agreed with the recommendation to develop a unique ID scheme for each observation during the inter-sessional period.

10.4.1.4 Dr. Berry reported on the status of the other TAC templates and a summary of the status of these TAC templates, their BUFR equivalent and date of operational status is given in Annex II.

10.4.1.5 Dr. Berry reported that the highlight of the inter-sessional period was the validation of the VOS BUFR template and completion of the migration of the JCOMM / marine related TAC codes to BUFR.

10.4.1.6 Dr. Berry reported that the main challenge for the inter-sessional period was finding a new chairperson for the TT-TDC. Dr Berry reported that it was his under-standing that the TT-TDC would be merged with the Expert Team Data Management Practices (ET-DMP).

10.4.1.7 Dr. Berry noted that the outstanding work for the next inter sessional period was the development of unique ID scheme for each VOS observation.

10.4.1.8 Drafting team was formed with the membership of Dr. Paul Poli, Dr. David Barry and Mr. Henry Kleta, SOT TC and GCC representative to develop and document a unique ID scheme for VOS observations.

Action;

10.4.1/1 The drafting team to develop and document on a unique ID scheme for SOT observations over *the inter-sessional period.(Dr.D. Barry, June 2017)*

10.4.2 BUFR Template and implementation for XBT/XCTD/TSG data

10.4.2.1 BUFR templates for XBT data (TM315004) have been operational since mid-January 2013 and being used by the United States of America, Australia and Japan to insert XBT data on the Global Telecommunication System (GTS). Since the sequence descriptor is operational, an increasing number of profiles are found in BUFR format, an indication that the migration

process is almost complete. However, from the final user perspective, an assessment is needed to confirm they can decode the bulletins and integrate the data within their systems.
For thermosalinograph data, there is already an operational sequence descriptor (TM308010), with very limited metadata and effectiveness.

10.4.2.2 SEAS format has been updated to include additional metadata that can be used during the BUFR encoding process. The objective is to minimize the number of fields set to MISSING.

10.4.2.3 During the intersessional period, we have defined a set of essential variables that a prospective template for TSG data should include. The process started with a structured brainstorm session and continued with a refining process to generate the final list. The results are shown below;

SECTION 1

1. Initial_Date (from which this metadata section is valid)
2. Unique Ship Reference
3. Ship_Name
4. Ship_Call_Sign
5. Ship_IMO_Number

6. Internal_Sensor_Type (For temperature and salinity: SBE45, SBE21, ...)
7. Internal_Sensor_Serial_Number
8. Internal_Sensor_Calibration_Date
9. Internal_Sensor_Intake_Depth
10. Internal_Sensor_Pipe_Length

11. External_Temperature_Sensor_Type (SBE38,...)
12. External_Temperature_Sensor_Serial_Number
13. External_Temperature_Sensor_Calibration_Date
14. External_Temperature_Sensor_Intake_Depth (usually the same as the internal sensor)
15. External_Temperature_Sensor_Pipe_Length

16. SST_Additional_Temperature_Sensor_Type (for some ships, hull mounted, radiometer, etc)
17. SST_Additional_Temperature_Sensor_Serial_Number
18. SST_Additional_Temperature_Sensor_Calibration_Date
19. SST_Additional_Temperature_Sensor_Depth
20. SST_Additional_Temperature_Sensor_Length (If applies)

21. Metadata_Version
22. Cruise_ID (normally not applicable)
23. Software_Name_Data_Acquisition
24. Software_Version_Data_Acquisition
25. Software_Name_Data_Transmission
26. Software_Version_Data_Transmission
27. Telecommunication_Type (Iridium, Argos, ...)
28. Operator_Institution
29. Principal_Investigator_Name
30. Principal_Investigator_Email
31. Principal_Investigator_Phone_Number
32. Technician_Name
33. Technician_Email
34. Technician_Phone_Number

SECTION 2

1. Date

2. Time
3. Longitude
4. Latitude
5. Water_Intake_Pressure (probably unknown in most cases)
6. Pipe_Flow_Rate (probably unknown in most cases)

10.4.2.4 These fields could serve as a baseline to build new SOOP-underway BUFR & netCDF templates that meet the needs of the user community. Some additional discussion (beyond the scope of this group) is needed to determine the inclusion of additional variables (e.g. surface carbon observations and associated metadata).

Actions;

10.4.2/1 Review and assess the suitability of the TM315004 sequence for future XBT operations. The objective is to determine if there are additional metadata requirements that an XBT template must satisfy and that can lead to changes in the current template or the creation of a new sequence.(TT-SOOP Metadata, September 2017)

10.4.2/2 Support the creation of a new SOOP-underway BUFR template(including pCO2) that can address the needs and requirements of the user community and data providers.(TT-SOOP Metadata, December2017)

10.4.3 Data Submission and Formats

10.4.3.1 At SOT8, it was decided to further examine the need to record the data format used to send data from ship-to-shore.

10.4.3.2 The internal data format used is closely linked to the generation of messages (FM13 and BUFR) done by NMSs. An analysis started during the intersessionnal period with the objective to describe all the different transmission chains from ship to shore and then to the GTS. It shows that the variety of transmission chains and the complication to understand who is sending which data from which ship to the GTS.

10.4.3.3 Therefore, not only the ship to shore data format used has to be recorded but a description of the different transmission chain from the ships to the GTS has do be documented. Such description is necessary to monitor and implement TAC to BUFR migration and the coming change of BUFR template.

To describe a transmission chain, the following parameters seem to be useful;

- Recruiting Country(ies)
- Equipment (Logbook, AWS…)
- Manual/Automatic
- Telecom system
- Number of ships
- Call sign example
- Data format
- Data type Binary/ASCII
- Size /message
- Cost /message
- Centre pushing FM13 onto the GTS
- FM13 SHIP production (Y/N)
- GTS header for FM 13 SHIP
- BUFR production (Y/N)
- Centre pushing BUFR onto the GTS
- BUFR template
- GTS header for BUFR

First results of this analysis are presented in Appendix 1 of SOT-9-Doc-10.4.3.

Internal data format

10.4.3.4 According to the first results of the analysis mentioned below, most of the conventional ships still send their data in FM13. That is strongly linked to the use of Code 41 for data transmission, where only FM13 can be sent. Even if the rate of ships sending weather reports by email is growing, Code 41 remains the most used technique.

10.4.3.5 Note that only few conventional ships (less than 20) are using the E-Surfmar #101 data format implemented in TurboWin, that allows to reduce the size of the message and the cost of transmission to the half compared to SAC 41. Another advantage of that format is the possibility to generate high resolution BUFR, better than BUFR generated from FM13. However, using that format means to have a specific software decoding the data and to use another transmission technique than SAC 41 (dedicated SAC, transmission by email, transmission to a server).

10.4.3.6 A dedicated SAC is yet only used by KNMI and Hong Kong, but has to be encouraged to have a fair system of transmission payment (currently with SAC 41 the country receiving the data pays for the messages, not the recruiting country).

10.4.3.7 Contrary to conventional VOS, most of AWS use their own data format and GTS messages are then encoded by NMS.

10.4.3.8 Some works have been done to develop optimised data format for AWS. In particular E-Surfmar designed for AWS an optimised data format (data format #100) in collaboration with the JCOMM Expert Team on Marine Climatology (DMPA/ETMC) and the oceanographic community. It is made of a few optional blocks: atmospheric measurements, atmospheric visual observations, wave observations, ice observations and oceanographic measurements. It is used in particular by E-SURFMAR BAROS and EUCAWS stations.

Migration to BUFR

According to a study done on messages received at Météo-France in August 2016;

- 83 % of the messages were sent in TAC and BUFR on the GTS
- Some countries start to send BUFR only (Ireland, UK, France) for some ships, or intermediate hours
- Some data providers are still sending only TAC messages onto the GTS for all their ships (Australia, Canada, India, Russia, Brazil, Spain)
- All the BUFR messages on the GTS are currently in template TM308009. Now that TM308014 has been approved, the meteorological services should start using that new BUFR template for VOS observations
- Some issues do to multiple TAC to BUFR conversion have been solved by NOAA during intersessional period

Actions;

10.4.3/1 Continue to document all the different transmission chains for ship messages, from the ships to the GTS.(TT-ISSC, SOT-10)

10.4.3/2 Continue BUFR migration, applying the new template and taking care to avoid multiple generation of messages.(SOT members, SOT-10)

10.4.3/3 Compile a list of bulletin headers used in SOT community.(TT-ISSC; SOT-10)

10.4.3/4 ESURFMAR to provide a simple decoder for data format 100 and 101.(ESURFMAR; Dec 2017)

11 SOT IMPLEMENTATION STRATEGY

11.1 Following a brief discussion of the SOT Implementation Plan, the Team agreed to accept the changes in version 1.80 and to include that version in the SOT-9 report.

11.2 The Team agreed that the plan, in its present form, is too long and contains many details that would be better provided using links to content on the JCOMM website (e.g., TT ToR, memberships). The purpose of actions in the plan was not clear to the Team and the recommendation was to delete them.

11.3 Several suggestions for changes in format were provided to the SOT Vice-Chairperson, including a proposal to use the DBCP plan as a possible model for a new SOT plan. The Team agreed that the entire plan would be revised by the SOT Executive Board, with a focus on restructuring, shortening, and updating the content. The revised plan will be circulated to the Team for additional review.

Actions;

11/1 Compile all ongoing action items to a best practises document.(TC, Dec 2017)

11/2 Executive Committee to review the implementation strategy and distribute to the members for review.(SOT-EXG, 15 May 2017)

11/3 Review the Implementation Strategy and provide the feedback with track changes to the SOT Vice.Chairperson and Secretariat.(SOT members, June 2017)

12 ORGANIZATIONAL MATTERS

12.1 Review the Terms of Reference of the SOT, VOSP and SOOPIP

12.1.1 Participants reviewed the terms of reference for SOT, VOSP and SOOPIP. Suggested and approved changes to the terms of reference are highlighted and provided in Annex VII.

12.2 Establishment of a SOT Executive Board, and role of the SOT Technical Coordinator

12.2.1 The Team reviewed and concurred with the establishment of a SOT Executive Committee (SOT-EC). The proposal for the SOT-EC was developed during the session by the SOT vice-Chairperson, VOSP Chairperson, SOOPIP Chairperson, WMO and IOC Secretariats, and the SOT Technical Coordinator. The SOT-EC is meant to replace the current informal SOT management committee. The purpose of the SOT-EC is to ensure the SOT panel leads and TT Chairs are in communication and up to date with the activities of SOT. The SOT-EC should also facilitate succession planning, budgets, meetings, and documentation relevant to SOT.

12.2.2 It is proposed that the structure of the SOT-EC should include a core SOT Executive Board (SOT-EB) comprised of the following representatives:

- SOT Chairperson and vice-Chairperson
- VOSP Chairperson and vice-Chairperson
- SOOPIP Chairperson and vice-Chairperson
- WMO Secretariat
- IOC Secretariat
- SOT Technical Coordinator

The full SOT-EC would include members of the SOT-EXB plus the Chairpersons of all SOT Task Teams.

12.2.3 The Team also reviewed and concurred with the draft terms of reference for the SOT-EC. The draft ToR include,

The full SOT Executive Committee shall;

1. Seek guidance from the SOT Panel at its regular sessions regarding specific issues to be addressed by the Executive Board or Committee during the intersessional period

2. Review the SOT high-level documents (including operating principles), as required, to ensure currency and compliance with ongoing activities and users' requirements
3. Confer regularly by electronic communications and exploit opportunities afforded by attendance at other meetings for face-to-face collaboration
4. Help to organize and conduct regular Session every two years, following an agenda drawn up by the SOT Chairperson
5. Consult with Panel members and the SOT Task Teams during the intersessional period as required
6. Report its activities to the SOT at its regular Session, and throughout the intersessional period as appropriate
7. Conduct elections for the chairperson and vice chairpersons of SOT, VOSP, and SOOPIP at its regular sessions

The SOT Executive Board shall;

1. Act promptly to deal with any administrative, financial and planning issues and opportunities that might arise, within the guidelines established and reviewed regularly by the SOT Team
2. Authoritise the SOT Chairperson to commit any expenditure necessary for the resolution of these issues and the promotion of the Panel's aims and objectives, up to the maximum amounts that might be agreed in advance by the Team at its regular session
3. Set working priorities for the Technical Co-ordinator according to the SOT recommendations at its regular sessions, and provide further guidance during the SOT intersessional period

12.2.4.The Team reviewed the role of the JCOMMOPS ship Coordinator who is also acting as SOT Technical Coordinator (SOT TC) on a part-time basis. It recalled that SOT-4 had defined the role of the SOT TC as to provide ongoing support to meet the operational requirements of the component panels of the SOT, such as liaison and international focus, problem resolution, information exchange, quality monitoring, network monitoring and network review. The Chair of the SOT provides technical guidance and is prioritizing the tasks of the SOT TC.

12.2.5 The Team recalled the work requirements proposed by SOT-8 for the SOT TC. The SOT TC provides a valuable coordination and support service to the component programs of the SOT. The Team endorsed the working priorities of the SOT TC as listed in Annex IX.

Actions;

12.2/1 SOT-EC will act on a provisional basis pending JCOMM-5 decision. Once/if the SOT-EC is recommended by OCG and approved by JCOMM-5, the SOT-EXB will draft an operating principles document and other documents as required by the secretariat.(SOT-EXB,with WMO Secretariat assistance, following JCOMM5)

12.2/2 Secretariat to replace references on the JCOMM website to SOT "officers" and SOT Management Committee with information for the SOT-EXC.(WMO Secretariat, following JCOMM5).

12.3 Succession Planning

12.3.1 The vice-chairperson presented two proposals related to officer positions (chairperson and vice chairperson) for SOT, VOSP, and SOOPIP. The Team agreed to implement a procedure for voting to select officers using guidance from existing voting procedures from DBCP. The full procedure will be developed once the SOT-EXB is approved. The Team also agreed to implement a term limit equal to four intersessional periods for its officers. These limits will be effective starting with officers approved at SOT-9.

12.3.2 The Vice-Chairperson noted that the SOT Chairperson position remains vacant. The Team was requested to submit nominations for the SOT Chairperson to the WMO secretariat

and SOT vice-Chairperson by 10 May 2017. Positions approved by the Team at SOT-9 include the following;

- SOT vice-Chairperson – Mr. Shawn Smith
- VOSP Chairperson – Mr. Henry Kleta
- VOSP vice-Chairperson – Ms. Paula Rychtar
- SOOPIP Chairperson – Dr. Rebecca Cowley
- SOOPIP vice-Chairperson – Dr. Gustavo Goni
-

The Team agreed to Chairpersons for all Task Teams and approved Mr. Joel Cabrie to represent SOT on the ad-hoc GHRSST Task Team.

Actions;

12.3/1 To support succession planning, all SOT-Task Teams will select a vice-Chairperson internally from the TT membership.(SOT TTs, 30 Sept. 2017)

12.3/2 Members to submit nominations for the SOT Chairperson position to the Secretariat and SOT Vice. Chairperson.(SOT Members, 10 May 2017)

12.4 Financial issues (Trust Funds)

Funding of JCOMMOPS and the SOT Technical Coordinator's position

12.4.1 The Team recalled that during the last intersessional period the position of the SOT Technical Coordinator was occupied by Mr Martin Kramp (JCOMMOPS) on a part-time (30%) basis. The Team noted that the Ship Coordinator's position, including salary and missions are essentially supported by JCOMM, GO-SHIP, and the SOT through voluntary contributions made to the DBCP and JCOMM trust funds at WMO and Atlantos Project funds at IOC. Contributions to the DBCP Trust fund in 2016 are provided in Annex 3. The national contributions to the SOT and GO-SHIP are made through the DBCP and JCOMM Trust Funds at the WMO, and total of USD 110,000 from these Trust Funds was committed to the 2016 budget as detailed below;

- JCOMM Trust Fund: USD 110,000 allocated to the Ship coordinator's position (US contribution for SOT and GO-SHIP)
- DBCP Trust Fund: USD 12,000 allocated to SOT activities

12.4.2 The Team recommended that actual expenditures for the SOT Ship Coordinator's position should be balanced with the contributions from other Panels contributing to JCOMMOPS, and that the total of SOT expenditures should not exceed the national contributions to the SOT in any case.

12.4.3 The Team agreed that contributions for the SOT TC would continue to be made to the DBCP and JCOMM Trust Funds at WMO, and that expenditures related to the SOT budget line in the DBCP Trust Fund should be authorized by the SOT Chairperson, noting that all DBCP TF expenditures have to be authorized by the DBCP Chairperson in any case per WMO financial regulation.

12.4.4 The Team invited its members to contribute to the Trust Fund to support the Technical Coordinator post and thus ensure that current services are maintained while also allowing (i) to decrease the dependency on contributions of those countries contributing heavily to the SOT, and (ii) for future development and sustainability in support of the VOS, ASAP, SOOP, and GO-SHIP.

12.4.5 The meeting reviewed the final statements of account for the ASAP Trust Fund for the period 1 January 2015 to 31 December 2015, and for the period 1 January 2016 to 31 December 2016. These statements are given in Annex 1 and 2 respectively.

ASAP Trust Fund

12.4.6 The Team noted that some expenditures – approved by the SOT Chairperson – were made in support of (i) the Eighth Session of the SOT (Cape Town, South Africa,20-24 April 2015), (ii) Thirty First Session of the Data Buoy Cooperation Panel (Geneva, Switzerland, 19-23 October 2015) and (iii) Fifth Port Meteorological Officers workshop (Vina del Var, Chile, 20-24 July 2015) in 2015. In 2016 expenditures were for the (i) Thirty First Session of the Data Buoy Cooperation Panel (Geneva, Switzerland, 19-23 October 2015)(ii) SOT Brochure Publication Costs. A total of CHF 12,906 remained available in the ASAP Trust Fund as of 31 December 2016. The Team accepted both statements of accounts.

12.4.7 The Team agreed that no additional contributions to the ASAP Trust Fund were needed.

12.4.8 The Team recalled that the ASAP Trust Fund consists of money owed to the Bureau of Meteorology (BOM) following the termination of the WRAP project. The Team also recalled the conditions proposed by SOT-5 regarding the use of the remaining funds within the ASAP Trust Fund (i.e. SOT-5 final report, paragraphs I-7.2.3.4 and I-7.2.3.5). Since being deposited in the ASAP Trust Fund, the money had mostly been used to fund the travel of the previous Chairperson and BOM Focal Point to attend sessions of the SOT, DBCP and PMO Workshops and for the SOT brochure. As agreed at the SOT-8,the control of the spending of the ASAP Trust Fund is with the SOT Focal Point for the BOM.

Actions;

12.4/1 Members are encourage to make contributions towards SOT activities through DBCP Trust Fund.(SOT members, SOT-10)

12.4/2 Contributing members are encourage to identify the fraction of contribution towards SOT activities if they have not yet done so.(SOT members, Dec 2018)

12.4/3 Provide a complete financial report with breakdown including IOC and JCOMMOPS funds allocated to SOT activities.(WMO/IOC Secretariats, SOT-10)

12.4/4 Investigate the possibility of renaming the DBCP-TF to enhance the clarity(i.e. to include SOT).(WMO Secretariat, Dec 2017)

12.4/5 SOT Chairperson or a EXB member appointed by the SOT Chairperson to sit in DBCP EXB where financial decision are been made. SOT Chairperson to make this request to DBCP Chairperson.(SOT Chairperson, Dec 2017)

12.5 SOT annual report format

12.5.1 The Team discussed the present format of the SOT annual reports and agreed that the forms need to be updated to include new elements for tracking data transmission pathways (e.g., satellite communications) and possibly other elements needed to support automated report generation by JCOMMOPS. The review of the forms will be conducted by the SOT-EXB. The SOT-EXB will work with the SOT Technical Coordinator to ensure the automated reporting tools developed by JCOMMOPS will meet the needs for annual reports for SOT, VOSP, SOOPIP, and ASAP.

12.5.2 WMO Secretariat reminded members that automation of the annual report is to make it easy to create the report and that members still have to review and submit the report to the secretariat annually.

Actions;

12.5/1 Develop automated tools to create the SOT annual report through JCOMMOPS database.(SOT TC, Dec 2017)

13 NATIONAL REPORT

13.1 Mr. Jean-Baptiste Cohuet (France) Chaired the National Reports session. Written reports were presented by the following Members/Member States; Australia, Argentina, Brazil, Canada, Chile, Ecuador, EUMETNET, France, Germany, Hong Kong(China), India, Ireland, Israel, Japan, Kenya, Malaysia, New Zealand, Peru, Singapore, South Africa, Spain, Sweden, Thailand, United Kingdom, and USA.

13.2. These reports summarized all the relevant activities in each country for all ship-based observations, including: the national objectives, planned activities, mechanisms for coordination between participating national agencies, instrumentation, new developments, data management, associated R&D and capacity-building. Countries operating a ship-of-opportunity programme provided information regarding the status of sampling on each line.

13.3. The following national presentations were made during the meeting;

- Australia (Mr. J.Cabrie)
- China (Mr. J. Yang)
- France (Mr. J.B Cohuet)
- Germany (Mr. H. Kleta)
- Greece (Mr. J.B Cohuet on behalf of Mr. D.Kotta)
- Hong Kong, China (Mr. D. Lau)
- India (Mr. B. Kumar)
- Italy ((Mr. J.B Cohuet on behalf of Ms. F. Reseghetti)
- Japan (Ms. A. Takeuchi)
- Netherlands (Mr. H Kleta on behalf on Mr. H. Verboom)
- South Africa (Mr. M. De Villiers)
- Spain (Ms. A. Lavin)
- United Kingdom (Miss. E. Steventon)
- USA (Ms. P. Rychtar & Dr. F. Bringas)

Actions;

13/1 Consider to transfer the national report session to the beginning of the next SOT session, in order to enable better discussions between the members during the meeting.(SOT EXB, SOT-10)

14 NEXT SESSION OF THE SOT

Number of participants offered to host the next SOT-10 session. The offers were made by following countries/organizations; Monaco (hosted by IHO), Israel(place to be determined), Australia (Hobart), USA-Washington DC (NCEP), and Hong Kong(China). The Team agreed to have the next meeting in a place appropriately selected by the Secretariat in liaison with the SOT Chairperson after receiving confirmations from these respective organizations. The Team's preference was to have the next meeting in a place where SOT has never been held before in order to better engage of countries in the region. The Team also proposed to hold SOT-10 in April 2019.

15 REVIEW OF THE SOT-9 SESSION ACTION ITEMS AND RECOMMENDATIONS

Action items and recommendations from SOT-9 are available on Annex IV and Annex V respectively.

16 CLOSURE OF THE SESSION

The meeting was closed by the SOT Vice Chairperson at 2:30 PM local time on the 31st of March 2017.

Annex I

AGENDA

PROVISIONAL AGENDA

1.ORGANIZATION OF THE SESSION

- **1.1 Opening of the Session**
- **1.2 Adoption of the Agenda**
- **1.3 Working Arrangements**

2.SCIENTIFIC AND TECHNICAL WORKSHOP, NEW DEVELOPMENTS

3.REPORTS BY THE SECRETARIAT, OPA COORDINATOR, SOT CHAIRPERSON, and JCOMMOPS

- **3.1 Report from the Secretariat (incl.WIS/WIGOS requirements, and RRR)**
- **3.2 Report from the Observations Programme Area Coordinator**
- **3.3 Report from the SOT Chairperson**
- **3.4 Report from JCOMMOPS (incl. from the SOT Technical Coordinator)**

4.REVIEW OF PENDING ACTION ITEMS FROM SOT-8

5.REPORTS BY ASSOCIATED ORGANIZATIONS AND PROGRAMMES

- **5.1 Associated Organizations**
  - 5.1.1 International Maritime Organization (IMO)
  - 5.1.2 International Chamber of Shipping
  - 5.1.3 World Ocean Council
  - 5.1.4 International Hydrographic Organization (IHO)
  - 5.1.5 Others
- **5.2 Associated Programmes**
  - 5.2.1 Global Ocean Ship-Based Hydrographic Investigations Programme (GO-SHIP)
  - 5.2.2 International Ocean Carbon Coordination Project (IOCCP)
  - 5.2.3 Shipboard Automated Meteorological and Oceanographic System (SAMOS) Project
  - 5.2.4 Report on High-Resolution SST (GHRSST)
  - 5.2.5 International Quality-controlled Ocean Database (IQuOD)
  - 5.2.6 Ferrybox Project
  - 5.2.7 EUMETSAT DCS

6.RECOMMENDATIONS AND ACTIONS BY THE TASK TEAMS

- **6.1 Task Team on ASAP**
- **6.2 Recommendations of Task Team on High-Resolution Marine Meteorology**

6.3 Recommendations of Task Team on Satellite Communication Systems

6.4 Recommendations of Task Team on Instrument Standards

6.5 Recommendations of Task Team on VOS Recruitment and Programme Promotion

6.6 Recommendations of Task Team on Training

6.7 Recommendations of Ad-hoc Task Team on WIGOS / SOT-Identifiers

6.8 Recommendations of Task Team on Call Sign Masking and Encoding

6.9 Recommendations of Task Team on Metadata for WMO-No. 47

6.10 Recommendations of Ad-hoc Task Team on SOOP metadata

7. Plenary Discussion on Recommendations from Task Teams

7.1 Metadata and WIGOS Readiness

7.1.1 Unique Identifiers for SOT

7.1.2 Metadata requirements and SOT Metadata Formats

7.1.2.1 WIGOS metadata standard and OSCAR requirements

7.1.2.2 VOS

7.1.2.3 SOOP-XBT

7.1.2.4 Other Panels

7.2 Harmonized Operations with Ships across all GOOS networks

7.2.1 Cross-cutting recruiting issues

7.2.2 Opportunity to rebrand met-ocean observations from/with ships

7.2.3 Development of a common GOOS ship reference list

7.2.4 Integrated Monitoring and Performance Measurement

7.2.5 Proposal for cross-cutting Task Team Pilot Projects

7.3 Other Recommendations

7.4 Task Team structure

8.TENTH SESSION OF THE VOS PANEL (VOSP-10)

8.1 VOS Programme activity reports (including implementation status)

8.1.1 Report by the VOSP Chairperson

8.1.2 SOT Technical Coordinator report on VOS support activities

8.1.3 E-SURFMAR Expert Team on VOS status report

8.2 VOS Developments

8.2.1 Electronic logbooks

8.2.1.1 Electronic logbooks software status

8.2.1.2 Electronic logbook developments (TurboWin, TurboWeb & TurboWin+)

8.2.2 VOS automation Status

8.2.2.1 AMOS developments

8.2.2.2 EUCAWS developments

8.2.2.3 Other AWS developments

8.3 PMO Status and activities

8.3.1 PMO-5 Conference

8.3.2 Role of the PMO
8.3.3 VOS & AWS inspection reports - implications of automation

8.4 VOS Issues

8.4.1 VOS Classes
8.4.2 Future composition of the international VOS fleet
8.4.3 Upgrading to VOSClim standards
8.4.4 Capacity Building (including VOS-DP)
8.4.5 Third party data and non-VOS support ships
8.4.6 Marine WOW developments
8.4.7 Collection of delayed mode data
8.4.8 VOS website
8.4.9 Mercury replacement

9.THIRTEENTH SESSION OF THE SOOP IMPLEMENTATION PANEL (SOOPIP-12)

9.1 SOOP Programme activity reports (including implementation status)

9.1.1 Report by the SOOPIP Chairperson
9.1.2 SOT Technical Coordinator report on SOOP support activities
9.1.3 XBT Science Team

9.2 Development and plans for the SOOP and interaction with other networks

9.2.1 pCO2 systems
9.2.2 Thermosalinograph Network
9.2.3 Relation with other networks such as Argo, gliders, VOS, TPOS

10.MONITORING, CODING AND DATA MANAGEMENT

10.1 KPI definition and targets

10.2 Monitoring and data centre reports

10.2.1 Monitoring Report from the Regional Specialized Meteorological Centre (RSMC) and Real-Time Monitoring Centre (RTMC) for VOSClim data
10.2.2 ASAP QC Monitoring report
10.2.3 Global temperature and Salinity Profile Programme (GTSPP)
10.2.4 Global Ocean Surface Underway data Pilot Project (GOSUD)
10.2.5 XBT Data Flow and Transmission
10.2.6 Global Coverage of SOT networks

10.3 Marine Climate Data System (MCDS)

10.3.1 Global Collecting Centres (GCCs) report on the VOS
10.3.2 VOSClim Data Assembly Centre (DAC) report
10.3.3 ICOADS Report

10.4 Operational Coding requirements

10.4.1 BUFR Template and implementation for VOS data
10.4.2 BUFR Template and implementation for XBT/XCTD/TSG data
10.4.3 Data Submission and Formats

11.SOT IMPLEMENTATION STRATEGY

12.ORGANIZATIONAL MATTERS

12.1 Review the Terms of Reference of the SOT, VOSP and SOOPIP

12.2 Establishment of a SOT Executive Board, and role of the SOT Technical

Coordinator

12.3 Succession Planning

12.4 Financial issues (SOT Technical Coordinator, Trust Funds)

12.5 SOT annual report format

13.NATIONAL REPORTS

14.NEXT SESSION OF THE SOT

15.REVIEW OF THE SOT-9 SESSION REPORT, ACTION ITEMS AND RECOMMENDATIONS

16.CLOSURE OF THE SESSION

Annex II

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Annex III

SUBMITTED ABSTRACTS FOR THE SOT-9 SCIENTIFIC AND TECHNICAL WORKSHOP (LONDON, UNITED KINGDOM, MONDAY 27 MARCH 2017)

2.1 Current Experiments of XBT Fall Rate Equation at NOAA/AOML

Francis Bringas[1], Gustavo Goni[1], Grant Rawson[1,2], Zach Barton[1,2], Pedro Pena[1]
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[2] Cooperative Institute for Marine and Atmospheric Studies, Miami, FL, USA

Expendable bathythermographs (XBTs) are probes widely used to monitor global ocean heat content, variability of ocean currents, and meridional heat transports. In the XBT temperature profile, the depth is estimated from the time of descent in the water using a fall-rate equation. There are two main errors in these profiles: temperature and depth errors. The reduction of error in the estimates of the depth allows a corresponding reduction in the errors in the computations in which XBTs are used.

AOML has recently conducted experiments to study the effect of the deployment height on the depth estimates of Deep Blue XBT probes. During these experiments, XBTs were deployed from different heights in fresh water tanks and a swimming pool. The motion of the probes after entering the water was analyzed to determine the position and the velocity of the probes as a function of time, which was compared to that obtained using the Hanawa et al. 1995 (H95) fall-rate equation. Results showed a difference or offset between the experimentally observed depths and those derived from H95. This offset was found to be linked to the initial velocity of the XBTs in the water, which is a function of the deployment height. A methodology proposed by Bringas and Goni, 2015 (BG15) can be used to eliminate the offset in the fall-rate equation for XBTs deployed from different heights. During a research cruise, other tests were conducted by deploying XBT probes from different height simultaneous with CTD casts (with the ship at rest) and during the ship transit between stations. Preliminary results obtained from these test corroborate the previous results obtained by BG15.

Additional experiments are planned to further assess a possible effect of the ship speed in the XBT temperature profiles, as well as other possible sources of errors that may be caused by the data recording system.

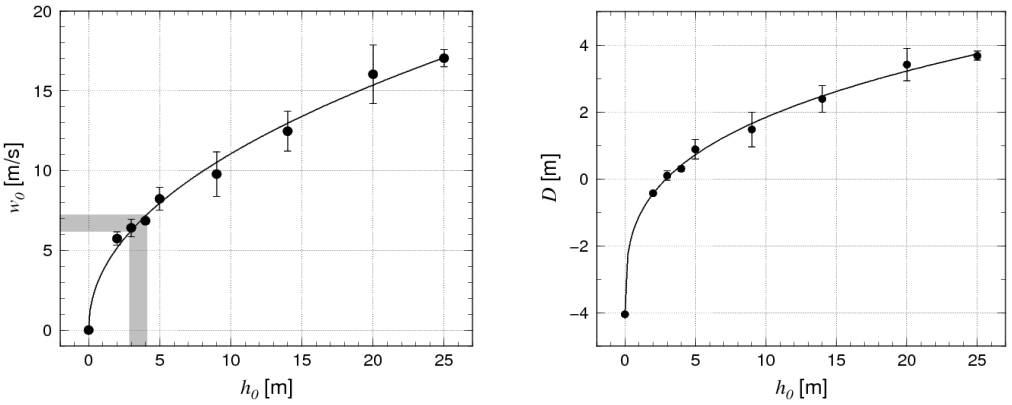

Figure. Initial velocity of the XBTs in the water (left) and maximum depth offset (right) as a function of the deployment height. XBTs deployed from a height within the gray area will have initial velocity in the water close to the terminal velocity and a maximum depth offset $D \approx 0$.

H95: Hanawa et al. *Deep-Sea Res.,* 42, 1423–1451 (1995)

BG15: Bringas, F. and G. Goni. *J Atmos. Oceanic Technol*., 32, 2253–2263 (2015)

2.2 50 Years of XBT Observations, More than 30 Years of Repeat XBT transects: Helping the Oceanographic Community Assess the State of the Ocean.

Gustavo Goni , Janet Sprintall

The XBT network with its logistical and data management components have now been operational for decades, and its Science Team has well-established protocols for obtaining and delivering a high-quality data set in a timely fashion. Technical and logistical support used in the XBT network is also provided for Argo float and surface drifter deployments and other ancillary programs. One of the major strengths of this project is its maturity as it has been in place for many years providing a unique time series along fixed, repeated transects for scientific research of changes in ocean heat content, mass and heat transport. Although the XBT technology is not new this observational platform still maintains key advantages such as easy deployment, a unique sampling capability and low cost.

The Global XBT network produces unique and high quality upper ocean temperature data across fixed repeat transects (mostly across ocean basins) that allow monitoring the variability of key ocean currents (boundary currents, surface and subsurface currents) and basin-wide heat transports. Several of these transects have been in place for longer than thirty years, providing some of the longest observational time series of trans-basin temperature and transports. The XBT network is at present the main element of the global observing system to provide systematically repeating observations to resolve the western boundary currents (WBCs). The time series have contributed to hundreds of scientific papers and to multiple Masters and Doctoral dissertations. XBT data are included in ocean state estimate models that contribute to our knowledge and assessments of long term ocean variability. XBTs are now deployed in High Density/High Resolution (HD/HR) or Frequently Repeated (FR) modes along repeated coast-to-coast (~200 m isobath) sections to monitor the major ocean fronts/boundary currents. In HD/HR mode, XBT transects are carried out at least 4 times per year along near-exactly repeating transects, with XBTs typically deployed every 20 to 30 km to capture mesoscale features and every 10 km in regions of narrow ocean fronts and boundary regions. The aim of this mode of sampling is to obtain high spatial resolution in one single realization to resolve the spatial structure of mesoscale eddies, fronts and currents. In FR sampling, ~12 transects are carried out per year with XBT deployments every 100 to 150 km. The goal of this sampling is to obtain reasonably high spatial resolution in consecutive realizations in regions where temporal variability is strong. Moving forward, the goal of the XBT network is to maintain the longest repeat time series using the current temporal and spatial sampling strategy. For each transect, the sampling strategy is optimized based the current knowledge of the characteristics of those fronts/currents being monitored. XBT data have and will continue to provide critical information to advance our knowledge of the state of the ocean and to better understand its link with long-term ocean and atmospheric variability. A comprehensive boundary current observing system has not yet been designed, but components are likely to include gliders, moorings, HD/HR XBT transects, and Argo. Until this strategy is fully designed and implemented, it is especially important to sustain the one element of the system (HD/HR XBT sampling) that is presently observing all of the mid-latitude WBCs as well as the Antarctic Circumpolar Current (ACC), some of the low-latitude WBCs and some EBCs as well.

2.3 Satellite services and products for ocean weather observation programmes

Sophie Baudel

The presentation will be an overview of the main satellite services dedicated to ocean & weather data collection at the CLS Group, more specifically of their application within the VOS programme. The coupled {EUCAWS, SBD Iridium telemetry} solution being used in Europe and other innovative solutions currently being developed in the United States will be presented.

The presentation will highlight new CLS Group Iridium SBD products (all-in-one, ruggedized global satellite tablet), as well as value-added services (such as web-display, data decoding, GTS feeding).

Last, we will explore potential synergies between WMO/VOS programme and the International Maritime Organization (IMO) concerns, such as pollution monitoring and maritime security applications. CLS SAT-AIS new products and services will be overviewed and link will be made on potential benefit to the VOS programme.

2.4 A simple way to explain the data flow into the GTS

Joaquine Trinanes- AOML

The generic in-situ data life cycle can be divided into different stages that start with the acquisition of the measurement and finish with its archival or disposal, if the conditions apply. This presentation will focus on the procedures and methods in place at AOML to guarantee the integrity and quality of the XBT data from collection to their transmission on the GTS. It will present and discuss the various improvements made at each stage of this workflow, and how they align with an increasingly more robust data governance policy.

2.5 Integrated coordination and monitoring tools demonstration

Martin Kramp – JCOMMOPS

The new JCOMMOPS website; JCOMMOPS will make a presentation/demonstration on the structure of the new system, which tools exist and how synergies between networks can be easier exploited, taking into account SOT, Argo, DBCP, GO-SHIP and Ocean-SITES networks, with a look-out to other networks which could also benefit from the structure.

2.6 Sterela – Introduction: objectives and functionalities

Christophe Marquet

STERELA has been selected by EUMETNET to develop a new product in the context of the EUCAWS project. This new marine automatic weather station, called Neptune, is now available on the market. We will present you a technical description of this equipment (objectives, functionalities,) as well as commercial details of our offer.

2.7 NCEI- ICOADS new release highlights

Eric Freeman

ICOADS Release 3.0: Data Characteristics and Future Priorities

Eric Freeman[1,2], William Angel[1], Philip Brohan[3], Lydia Gates[4], Elizabeth C. Kent[5], and Shawn R. Smith[6], Steve Worley[7]

1) NOAA National Centers for Environmental Information, Asheville, USA

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3) Met Office, Exeter, UK

4) Deutscher Wetterdienst, Hamburg, Germany

5) National Oceanography Centre, Southampton,

6) Center for Ocean-Atmospheric Prediction Studies, Florida State University, Tallahassee, USA

7) National Center for Atmospheric Research, Boulder, USA

The latest update of the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), Release 3.0 (R3.0), provides major coverage expansions on the previous version (R2.5) for 1662-2014, followed by improved monthly near-real-time (NRT) extensions, e.g. partly addressing the impacts of many masked Global Telecommunication System (GTS) ship call signs since late 2007. This presentation will describe the data and metadata characteristics of R3.0, and provide details on new data sources and on extensive observational format updates. New or improved data sources cover various time periods, from the late 18th Century all the way into the modern period. These sources include newly digitized historical observations from collections such as the English East India Company and the German Maury collections, and updated external archives such as the Global Tropical Moored Buoy Array (GTMBA) and World Ocean Database (WOD). A major observational format update is an extension to include near-surface oceanographic data elements such as salinity, nutrients and carbon cycle parameters. These parameters, with associated depths, have been populated from the WOD and other near-surface oceanographic sources. The new inclusion of a unique identifier (*UID*) to each individual marine report will help to improve traceability and facilitate collaboration between ICOADS users.

Future plans for ICOADS will be described in the second part of the presentation. The longstanding MARCDAT/CLIMAR user community will continue to actively help shape the database and improve data management to meet future needs and continue to make ICOADS a valuable resource for global climate research well into the future. The SOT is also a highly valuable and integral source of feedback and collaboration to ICOADS in keeping the dataset in tune with current observational procedures and instrumentation, as well as new sources of marine climate data. Decisions in the SOT have direct impacts on the Near-Real-Time product as well as other aspects of data collection and processing.

Finally, we will also report on progress towards establishment of ICOADS as a Centre for Marine-Meteorological and Oceanographic Climate Data (CMOC), within the new WMO-IOC Marine Climate Data System (MCDS), which is anticipated to facilitate further longer-term improvements in the effective management and stewardship of marine and near-surface oceanographic data internationally.

2.8 Sailing meets science - Innovative Ocean Monitoring

Stefan Raimund – SubCtech GmbH Germany

The world ocean is a major sink for anthropogenic carbon dioxide (CO2). The ocean has taken up nearly 50% of all man made CO2 since the beginning of the industrial revolution. This number is only a rough estimate derived from CO2 measurements in the ocean and the atmosphere. Models and predictions depends strongly on precise and frequent measurements of representative areas of the world ocean. However, measurements of ocean CO2 are for large areas scarce, especially for the southern ocean.

Ocean races as the Vendee Globe, the Barcelona Ocean Race or the Volvo Ocean Race, take place nearly every year. During those sailing events, boats crossing the southern

ocean and are therefore interesting platforms for ocean surface observations. SubCtech developed a compact, robust and light weighed underway system, especially designed for the harsh conditions on board small sailing vessels. The underway system can be equipped with a large number of sensors, including conductivity, temperature, pCO2 and fluorescence. Currently, a consortium of scientists – lead by T. Tanhua from GEOMAR – attempt to launch a measurement campaign on board v.o.65 racing yachts during the upcoming Volvo Ocean Race. We will present the latest developments of this innovative undertaking.

2.9 / 2.10 KPI-integrated assessment of the surface marine obs system

Elizabeth Kent

Progress toward an integrated assessment of the surface marine observing system.

Elizabeth C. Kent and David I. Berry
National Oceanography Centre

Observations from ships make up most of the historical marine climate record. Ship observations remain important today for climate applications as well as a wide range of other applications including weather forecasting, operational oceanography, assessment of satellite retrievals and the production of reanalyses. Each application has different data requirements so there are competing, and sometimes conflicting, demands placed on the ship and observing network operators.

This talk will discuss some of the different requirements for the ship-based observing system and also how assessments of whether the observing system is meeting the needs of different applications and users might be approached.

2.11 The Autonomous eXpendable Instrument System (AXIS)

T. Rossby, C. Flagg, G. Reverdin

In response to a growing need for automated XBT deployment capabilities, a novel XBT/XCTD deployment system AXIS has been developed for use on merchant marine vessels in repeat and regular service. Built around the standard Sippican MK-21 data acquisition system, AXIS provides complete autonomy to deploy up to 12 XBTs and/or XCTDs in any combination. The launcher can be reloaded at intervals by the ship's crew or additional launchers can be daisy-chained to provide additional capability. Probes can be released according to a pre-set plan, either by time or location, or upon command. The system uses Iridium for all command, control and data transfer functions. After a very brief review of the technology, we will show examples of how AXIS has strengthened two what might be called super-SOOP sections: the CMV Oleander that operates between Hamilton, Bermuda and Port Elizabeth, New Jersey (AX-32), and the MF Norröna, a high-seas ferry that operates out of the Faroes, to Denmark and to Iceland (AX-90). We use these examples to set the stage for some pressing needs in the North Atlantic.

The first example where an AXIS system is needed is AX-1 between Greenland and Scotland. XBTs have been taken here quarterly since late 2000. This vessel, the Nuka Arctica and its eventual successor, badly needs an AXIS for two reasons: i) so XBTs can be deployed from a lower, much less exposed site to improve performance, especially during the winter months, and ii) so XCTDs could be deployed on westbound transects when the ship often cuts across the East Greenland Current north of Cape Farewell. This would allow us to monitor its full T/S/density structure far more effectively than can the occasional Argo floats that pass

through the area. The same approach can be applied to the Irminger Current along the Reykjanes Ridge, which the Nuka Arctica crosses at two different latitudes. The other example we highlight here is AX-2 between Iceland and Labrador. It cuts across the Irminger Current just south of Iceland, it traverses (as does AX-1) the famous cold spot in the Subpolar Gyre (which some think is a signal of AMOC slow-down), and it slices across the Labrador Current with its highly variable T/S properties. Many other SOOP lines would benefit greatly from having this autonomous instrument system since it would allow the SOOP community to put more of its resources into increased sampling. Other investigators can of course use these AXIS installations for additional sampling as needed.

Annex IV

ACTION LIST/WORK PLAN

SOT WORKPLAN FOR THE NEXT INTERSESSIONAL PERIOD (2017-19)

NO.	Ref. Item	Action Item	By	Deadline	Update
	SOT-9				
1	3.1/8	Request members to facilitate standardization of Automatic Weather Station (AWS) systems and their observations installed on ships as well as the maintenance of such systems by Port Meteorological Officers	SOT members	SOT-10	
2	3.1/9	Member states that wish to contribute to the global ASAP by implementing and financing ASAP stations are encouraged to consult the ASAP Task Team for guidance and advice	SOT Members	SOT-10	
3	3.2/1	Review the action items from OCG-7 in Annex I of session report 3.2and report back at the OCG-8	SOT Vice-Chairperson,	OCG-8	
4	3.4/1	Stabilize the position of the SOT Coordinator at WMO	Secretariat	asap	
5	3.4/3	General JCOMMOPS mailing lists for SOT, VOS, SOOPIP and PMO: While the Task Team mailing lists are manually synchronized with the reference information at jcomm.info, the general mailing lists are open and comprise numerous outdated records; SOT TC, with assistance from SOT Executive Group, to conduct a clean-up	SOT TC/EXB	July 2017	
6	3.4/4	SOT Executive Group to discuss more efficient management of condensed action item list, with improved reporting and regular reviews in the intersessional period, and possibly larger focus, e.g. PMO, OCG, JCOMM, TT meetings	SOT TC with EXB advice	SOT-10	
7	3.4/5	AIS tracking; Investigate further how (in terms of costs, procedures, regulations) AIS information could be better used to i) identify inactive platforms (lack of motivation or technical issues) and ii) identify non-recruited ships which repeatedly sail in undersampled ocean areas and could thus be beneficial for SOT and other observing panels	JCOMMOPS	SOT-10	
8	3.4/6	TT KPI to also make recommendations on criteria for VOS to be considered as inactive, or closed with the aim to have more representative statistics of the operational networks, which currently take into account hundreds of outdated records	TT-KPI	Sept 2017	
9	3.4/7	Investigate how WIGOS metadata fields and reference tables are governed, with the aim of achieving a higher flexibility and speed for structural changes in SOT metadata than currently the case with	TT-VOS Metadata/Secretariat	JCOMM 5	

		Pub47			
10	3.4/8	The role of PMOs includes the support of other observing panels to some extent, but more harmonized and cross-cutting operations could increase these needs; the SOT should investigate if this creates issues with regard to resources, competences and funding	EXB	PMO 6	
11	3.4/9	The recommended new SOT ID-Scheme does not comprise any ship or country reference and basically works like a global Mask-to-Real list, maintained by JCOMMOPS; given that encode/decode will require a complex procedure with the setting up of a corresponding JCOMM focal point for the management and regular submission of keys, the meeting agreed to recommend discontinuation of the encode/decode and SHIP masking schemes, A corresponding new resolution must be prepared for WMO validation	TT-Masking	15 May 2017	
12	3.4/11	Ad-hoc TT on WIGOS IDs to continue its work until next OCG meeting, to develop a decision tree for assigning new IDs (e.g. change of operator, change of system, change of ship	TT WIGOS ID	June 2017	
13	3.4/12	Review LES list, and in particular incorporate information on acceptance of compressed data and corresponding SAC by LES, and accepted observing hours	TT-ISSC,with support from Mr. John Dodd, INMARSAT	SOT-10	
14	3.4/13	As part of Pub47 to WIGOS migration, review current telecom reference table with the aim to i) harmonize with the JCOMMOPS standards and ii) better represent dependence of the SOT from individual Satcom providers, in particular for observations sent by e-Mail	TT-ISSC	SOT-10	
15	3.4/14	Working group on KPIs and targets to also review JCOMMOPS QC relay tool and corresponding procedures/targets, taking into account the new Météo-France QC synthesis list and upcoming changes at the MetOffice RTMC	TT KPI	Dec. 2017	
16	3.4/15	With the aim to better coordinate and measure ship operations across networks, JCOMM panels to refer to a shared ship list with ICES ship codes as primary unique identifiers in all ship related operations (onboard installations, float and drifter deployments or recoveries, mooring maintenance, etc) and JCOMMOPS to host this list and lead a discussion regarding the governance over ship metadata, which ideally would be synchronized with a formal ship register like Lloyds	JCOMMOPS	Nov. 2017	
17	3.4/16	OCG to promote the use of the JCOMM Ship list across all networks	OCG	JCOMM-5	
18	3.4/17	Many VOS stations are already connected with the ship's navigation unit to obtain in particular true heading data, with depth information often available from the same data stream; IHO and VOS should therefore investigate how to exploit synergies	VOS Chairperson, IHO SG, TT-HRMM	Oct. 2017	

19	3.4/18	Investigate if partnerships could be achieved with e.g. sailing marinas in critical locations like Panama, or sailing NGOs, aiming to promote the work of the observing programs and recruit ships, and to facilitate logistics with ships that can carry only a small number of instruments	TT-RPT	SOT-10	
20	3.4/19	Based on a recommendation from the DMCG, investigate if QC flags should be incorporated in to the VOS BUFR template, and/or if "third party platform" should be added as value for sequence 003022	TT-TDC, TT-VOS Metadata	SOT-10	
21	5.1.4/1	Consider including in its doctrine the measurement, recording and rendering of depth data as a routine environmental observing activity to be undertaken at all times when vessels are at sea and where no restrictions apply	EXG	SOT-10	
22	5.1.4/2	Declare the existence of bathymetric data to the IHO DCDB; and wherever possible SOT Members should (1) submit the data to the DCDB, or (2) provide metadata and access availability information	SOT Members	SOT-10	
23	5.2.4/1	SOT Chairperson to propose to the OCG-8 to add the SRN network as part of SOT	SOT Chairperson	OCG-8	
24	6.2/1	TT-HRMM to engage with the TT-VOS Metadata to ensure that future metadata standards support requirements for HRMM from AWS	TT-HRMM	SOT-10	
25	6.3/1	Include fields to capture which satellite system is used when ships send observations by email in the new structure of metadata	TT-ISSC and TT-VOS Metadata	SOT-10	
26	6.3/2	Closely monitor any relevant developments within IMO Maritime Safety Committee and the IMO Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) concerning the future changes to the Global Maritime Distress and Safety System and proposals to incorporate Iridium as a future mobile satellite GMDSS service provider	TT-ISSC	SOT-10	
27	6.3/3	Pub 47 should offer multiple data input for prST to accommodate ships with multiple telecommunication systems	TT-Pub47	SOT-10	
28	6.3/4	To work with satellite providers(Inmarsat)to clarify how the Fleet broadband system could be used in place of Code 41	TT-ISCC	SOT-10	
29	6.4/1	Consider the use of online questionnaires to collect information on instrument standards guidelines (see Annex A of SOT-9-Doc-6.4) and instrument standard equipment (see Annex B of SOT-9-Doc-6.4)	SOT TC, TT-ISSC	SOT-10	
30	6.4/2	Encourage members to contribute to the compilation of JCOMM TR 63 and follow the recommendations from that TR (see Annex E of SOT-9-Doc-6.4)	SOT members	SOT-10	
31	6.5/1	All references to the VOSClim should be archived and removed from literature and websites where relevant once the new VOS classes are approved	SOT TC	SOT-10	
32	6.5/2	Following the migration of the E-SURFMAR database to	VOSClim	Dec.2017	

		JCOMMOPS, the JCOMMOPS database should be considered as the main repository for listing VOS Climate standard ships and relevant literature and websites amended accordingly	DAC, SOT TC		
33	6.5/3	The VOS Flyer is no longer necessary to promote ship participation, accordingly should be removed from the VOS website and archived	SOT TC	Dec.2017	
34	6.5/8	The media section of the JCOMMOPS website should be the main access point for VOS related articles and publications and articles held elsewhere (e.g. on the E-SURFMAR or VOS website) should be transferred accordingly	SOT TC	SOT-10	
35	6.5/10	Consider the need for a questionnaire to survey the views of shipowner's and managers on ship based observing. The survey would encompass more than just the VOS community and could be used to provide input into the proposed Ship Forum	EXB	Dec. 2017	
36	6.6/1	Develop and maintain Best Practices (SOT, SOOP, ASAP) resources and reference material and provide these resources globally by placing them on the Ocean data practices website hosted by IODE	TT-RPT	SOT-10	
37	6.6/2	Develop a new JCOMM guidance document to address, as is practicable, the full scope of PMO work instructions, duties and responsibilities	TT-RPT	Aug.2017	
38	6.6/3	Prepare a workplan to initiate a PMO exchange program between countries	TT-RPT	SOT-10	
39	6.6/4	Set up a drafting committee group to revise text on the handbook for marine observations and place that on TurboWin software	TT-RPT	Aug.2017	
40	6.6/5	Arrange intersessional WebEx or Webinars for PMOs to inform/discuss/train PMOs on evolving program developments and changes (i.e. BUFR, WIGOS, OSCAR, JCOMMOPS, PUB47, etc.,)	TT-RPT	SOT-10	
41	6.6/6	TT Chairperson to identify the outdated training requirements derived from IMO Conventions for possible revision	TT-RPT	Dec.2017	
42	6.7/1	JCOMMOPS should allocate SOT Station Identifiers, on behalf of JCOMM and Member States	SOT TC , JCOMMOPS	inline with WIGOS implementation	
43	6.8/1	SOT developed ToRs (see SOT-8 FR 7.6.2, with Annex 14) for the management of encode/decode keys and related masking issues, require a focal point, but that this must be reviewed and submitted to JCOMM co-presidents. No focal point has been announced yet and should be nominated (See also decision 3.4/9 under paragraph 3.4.6 about the discontinuation of the encode/decode scheme.)	TT-Masking	May 2017	
44	6.9/1	VOS operators to consider moving over to the direct use of the JCOMMOPS database in future i.e. in lieu of their national VOS databases	VOS Focal points	SOT-10	

45	6.9/2	Copies of the latest version (4.2) of the guidance document for WMO Pub 47 metadata to be uploaded to the SOT-VOS website (http://sot.jcommops.org/vos/resources.html) and to the WMO website (http://www.wmo.int/pages/prog/www/ois/pub47/pub47-home.htm) until such time as this document can be archived in favor of the new composite WIGOS compatible metadata requirements when finalized	SOT TC, WMO Secretariat	April 2017	
46	6.9/3	Technical Coordinator to inform VOS Operators and PMOs via the JCOMMOPS mailing lists when migration to the JCOMMOPS integrated database has been completed	SOT TC	Dec.2017	
47	6.9/4	Metadata management and associated training for VOS Operators and Port Met Officers in the collection of metadata should considered in liaison with the new Task Team on Recruitment, Promotion and Training	TT-RPT, TT-VOS Metadata	SOT-10	
48	6.9/5	Proposals for Quality Controlling metadata submissions should be developed by the metadata Task Team and that this issue should be added to their Terms of Reference	TT-VOS Metadata	SOT-10	
49	6.9/6	VOS operating members and PMOs should be invited to review the proposed composite new metadata requirements and to notify the Task Team if they identify any gaps in the metadata requirements or consider that further amendments are needed	VOS operators/PMOs	Aug. 2017	
50	6.9/7	Llinks to official ship data repositories (e.g. Lloyd's Register information) should be considered in order to ensure consistency of ship related metadata. Technical Coordinator to investigate feasibility and costs and make recommendations as appropriate	SOT TC	Aug. 2017	
51	6.9/8	A new composite metadata document should continue to be drafted for the VOS based on WIGOS requirements, with a view to eventually replacing WMO Pub 47	TT-VOS Metadata	Aug.2017	
52	7.1.1/1	Prepare documents on the new proposed ID scheme to provide to the OCG and to JCOMM-5	TT-WIGOS ID	May 2017	
53	7.1.1/2	Establish criteria (e.g. a decision tree)for issuing new platform IDs	TT-WIGOS ID	June 2017	
54	7.1.1/3	Develop a document on the tasks and responsibilities that JCOMMOPS will need to perform as a platform ID issuing body delegated by WMO	JCOMMOPS with assistance from Secretariat	June 2017	
55	7.1.2/1	TT-ASAP to map their metadata to OSCAR requirements	Chairperson of TT-ASAP	Dec.2017	
56	7.1.2/2	TT-SOOP to map their metadata to OSCAR requirements	Chairperson of TT-SOOP	Dec.2017	
57	7.1.2/3	SOT chairperson to contact the DBCP Chairperson requesting nominations from the DBCP panel to participate in the TT-VOS	SOT Chairperson	Aug.2017	

		metadata			
58	7.2.1/1	Prepare an amendment to the IMO Circular MSC.1/Circ.1293	TT-RPT, SOT EXB with Secretariat	Oct.2017	
59	7.3/1	Mr. Eric Freeman was proposed as the Chairperson of TT-Masking. Mr. Shawn Smithto confir with Eric Freeman	SOT Vice .Chairperson	End April 2017	
60	8.1.1/1	Technical Coordinator to ensure that an online VOS reporting system linked to the new metadata fields is developed in time to allow compilation of the 2017 annual national reports. Under the new system VOS Focal Points will need to proactively confirm the accuracy of their metadata records and the system will need to be able to generate graphics to show trends e.g. in the use of automated systems, electronic logbooks, PMO activity etc.	SOT TC, VOS Focal points	Dec.2017	
61	8.1.2/2	Create an advanced version of the simplified TurboWin instructions, with support from the TT-RPT	SOT TC, TT-RPT	SOT-10	
62	8.2.1/1	TurboWin/Web; Perform a risk analysis with regard to dependency of the VOS Panel on new TurboWin/Web developments, in particular related to the transition to a new ID Scheme and the impact on AMVER reporting	VOS Chairperson	E-Surfmar ET-14	
63	8.2.2/1	VOS operators that have installed other types of AWS systems on their VOS (i.e. other than AMOS or EUCAWS systems) are invited to share basic information on such systems and developments at the next session	VOS Operators	SOT-10	
64	8.3/1	PMO training to increasingly be offered globally via video conferencing (e.g. WebEx) and by Webinar sessions	TT-VRPP	Dec.2017	
65	8.3/2	Technical Coordinator to take into account the need to collect information on the percentage of PMO time actually spent on PMO related activities and VOS ship inspections when developing web based capabilities for compiling National Reports	SOT TC	Nov.2017	
66	8.3/3	JCOMM PMO listings to include PMO contact email addresses	WMO Secretariat	Nov.2017	
67	8.3/4	Technical Coordinator to ensure that Find-a-PMO facility exists and remains updated	SOT TC	Nov.2017	
68	8.3/5	Technical Coordinator to liaise with the TT-VRPP and the TT on Metadata with a view to developing common JCOMMOPS web based inspection forms for manned and automated VOS	SOT TC, TT-VRPP, TT-VOS Metadata	SOT-10	
69	8.3/6	Planning should start for the next International PMO Workshop to be held in 2020	VOS Chairperson, SOT TC, WMO Secretariat, TT-VRPP	2019	

70	8.3/7	Technical skills training on the use and maintenance of AWS systems should be included on the agenda for the next International PMO workshop	VOSP Chairperson, SOT TC, WMO Secretariat	Dec. 2018	
71	8.3/8	TC together with TT on training to arrange regular (quarterly) webinars with PMOs to	SOT TC, TT-RPT	Dec.2017	
72	8.3/9	Develop a common web based PMO inspection report	SOT TC	SOT-10	
73	8.4.1/1	Task Team on metadata should include new VOS classes in their work on the development of new WIGOS compliant metadata	TT-VOS Metadata	SOT-10	
74	8.4.2/1	Use of the metadata field 'Other' currently used for field vsslM in WMO Pub 47 should be discontinued in the new metadata requirements, and that ships considered as contributing to the VOS Scheme should in future be restricted to one of the proposed three new classes	TT-VOS Metadata	Aug.2017	
75	8.4.2/2	Develop more precise definitions for the three new classes and make proposals on how the new third party ships should be administered in the future	TT-RPT, TT-VOS Metadata	June 2017	
76	8.4.2/3	Prepare a short document to define the potential scope of future SOT – AECO collaboration, and thereafter convene a further meeting with AECO to discuss the way forward, considering the possibilities offered by YOPP	SOT TC, SOT Vice Chairperson	May 2017	
77	8.4.2/4	Prepare necessary documents proposing the changes to the VOS classes to forward to OCG, JCOMM, CBS and EC for approval	TT-VOS Metadata	15 May 2017	
78	8.4.2/5	E-SURFMAR Expert Team on VOS to consider, in liaison with the Norwegian Meteorological Institute, the potential to recruit, and provide PMO support for, AECO tourist vessels operating in the Arctic at its forthcoming meeting in May	E-SURFMAR ET, VOS Chairperson	May 2017	
79	8.4.2/6	E-SURFMAR Expert Team requested to investigate the potential to equip a suitable AECO vessel with a EUCAWS system	E-SURFMAR ET, VOS Chairperson	May 2017	
80	8.4.3/1	Investigate how to use national logos on SOT certification would be acceptable to WMO and IOC	WMO Secretariat	SOT-10	
81	8.4.3/2	Task Team on Recruitment, Promotion and Training, in liaison with the DAC focal point, to consider the need for, and scope of, changes to the DAC website to reflect changes to the VOS classes	Chairperson of TT-RTPP & VOSClim DAC	SOT-10	
82	8.4.3/3	Investigate the implications of the proposed changes to VOS classes for the JCOMMOPS database, and to ensure that accurate VOS Climate information can continue to be extracted	SOT TC	SOT-10	
83	8.4.3/4	Dr. D Berry to report to the next session on new assessments of the quality of ship data (including VOSClim data) within ICOADS	Dr. D Berry	SOT-10	
84	8.4.4/1	TT-RPT to formulate a schedule of regular (ideally monthly) training	SOT TC &	May 2017	

		Webinars and/or teleconferences for PMOs with support from the TC	TT-RPT		
85	8.4.4/2	The VOS Panel Chairperson to advise the Argentinian Meteorological Service of the outcome of discussions on the VOS-DP and to offer them support with re-establishing their VOS network through NOAA US state department signed letter of agreement for cooperation in ocean or meteorological science as a solution	VOSP Chairperson with Dr. Goni	April 2017	
86	8.4.4/3	Information regarding the VOS-DP to be removed from the SOT-VOS website and archived	SOT TC	May 2017	
87	8.4.4/4	Take up the capacity building activities of SOT at OCG-8	SOT Vice Chairperson	May 2017	
88	8.4.5/1	Circulate instructions to members detailing how the WIGOS and SOT IDs will apply to support ships and how such ships should in future be registered for inclusion in the JCOMMOPS database	SOT TC	Aug.2017	
89	8.4.5/2	Include the new third party support ship class with the remit of the VOS Scheme	VOSP Chairperson	SOT-10	
90	8.4.5/3	Further discuss and decide on using ZZ country code in vessel registration	TT-RPT , and TT-VOS Metadata, SOT TC	SOT-10	
91	8.4.6/1	Investigate potential linkages between WOW and JCOMMOPS	SOT TC, JCOMMOPS	Dec.2017	
92	8.4.6/2	Take the positive message from SOT back to MetOffice to the continue the good work of WOW	Miss E. Steventon	April 2017	
93	8.4.7/1	There is an ongoing requirement for delayed mode IMMT data and that efforts should be made to increase availability from AWS systems	ETMC	SOT-10	
94	8.4.7/2	Metadata format should be amended to include a descriptor for when associated IMMT format available	TT-VOS Metadata	Dec.2017	
95	8.4.7/3	Provide a wish list for TurboWin to EUMETNET who manages and to prioritize the list	TT-VOS Metadata	10 May 2017	
96	8.4.8/1	With JCOMMOPS, all SOT Task Teams and the SOT Management Team work on simplified and better synchronized website information system, including in particular member contact information	SOT TC	SOT-10	
97	8.4.8/2	Centralize Standards and Best Practices documents at (IODE, ocean data practices repository and to replace files in other repositories by permanent links to the centralized master files	SOT TC	SOT-10	
98	8.4.9/1	VOS Operators to urgently remove and safely dispose all mercury instruments from all VOS vessels by the 2020 Minamata convention deadline	VOS Operators	Before 2020	
99	8.4.9/2	VOS Operators to urgently cooperate with other VOS countries to remove the current mercury instruments from the ships that do not return to their respective VOS country	VOS	Before 2020	

			Operators		
100	8.4.9/3	VOS Operators to communicate with each other and with SOT when the changes are been made (metadata)and on how the mercury replacement products are performing both current and those in testing	VOS Operators	Before 2020	
101	8.4.9/4	Members are invited to provide any comparison studies done on the different type of air temperature sensors to the TC to post on the JCOMMOPS document repository	VOS Operators	SOT-10	
102	9.1.2/1	TC and SOOPIP to work together to improve the labeling and layout on the XBT line maps indicating sampling rate for the year	SOT TC , SOOP Panel	Aug.2017	
103	9.2.1/1	Investigate opportunities to assist in coordination and collection of data and metadata tracking of SOOP-CO2	SOOP Panel	SOT-10	
104	10.1/1	New KPI Task Team to develop broader SOT KPI set (with targets) which matches with the requirements of a JCOMM integrated performance measurement and covers the following themes: i) Implementation, ii) Data Flow, iii) Instrumentation, iv) Operations, v) Data Uptake and vi) International Cooperation	TT-KPI	SOT-10	
105	10.2.1/2	VOS Focal Points to provide feedback on the value of the RSMC performance ranking lists	VOS focal points	Jan.2018	
106	10.2.1/3	The Met Office RSMC to advise SOT members and VOS operators when their new automatic monitoring system becomes operational by sending information to the JCOMMOPS SOT mailing list	Miss E.Steventon	July 2017	
107	10.2.1/4	Taking into the account to discontinue the VOSClim class the VOSP Chairperson to provide the feedback on the future requirement of VOSClim class monitoring to RTMC	VOSP Chairperson	Aug.2017	
108	10.2.2/1	ASAP ship operators should try to update their transmission systems in order to be able to transmit high resolution BUFR messages	ASAP Operators	SOT-10	
109	10.2.3/1	Continue GTSPP daily operations and GTSPP participants to continue submission of the real-time and delayed-mode data to NCEI during the period April 2017 to March 2019	GTSPP participants	Dec.2017	
110	10.2.5/1	Review and assess the migration to BUFR, defining deadlines, identifying stakeholders and completion criteria	SOOP Members	SOT-10	
111	10.3.1/1	GCC Contributing Members (CMs) that did not submit data during 2016 should do so in 2017 or alternatively contact GCC for advice	GCC Contributing Members	Dec.2017	
112	10.3.1/2	CM should use the most recent IMMT-5 format to submit the data	GCC Contributing Members	Dec.2017	
113	10.3.2/1	As a primary source of VOSClim ship data, invite NCEI and JCOMMOPS Technical Coordinator to review the VOSClim DAC website and propose changes, including the possibility of removing extraneous information, e.g. Dutch VOS and Awards pictures	SOT TC with NCEI	Dec.2017	

114	10.3.2/2	Investigate the implications of sun setting the VOSClim DAC and the potential for transforming it into a wider VOS DAC	SOT TC,VOSP Chairperson with ETMC	SOT-10	
115	10.3.3/1	JCOMM to ensure that the Marine Climate Data System (MCDS) permits, encourages, and where appropriate requires, the association of platform and observational metadata with observations, both through transmission in real time (i.e. BUFR and TAC formats) and archival in delayed mode	JCOMM/MCDS	SOT-10	
116	10.4.1/1	The drafting team to develop and document on a unique ID scheme for SOT observations over the inter-sessional period	Dr. D.Barry	June 201710.4.1/1	
117	10.4.2/1	Review and assess the suitability of the TM315004 sequence for future XBT operations. The objective is to determine if there are additional metadata requirements that an XBT template must satisfy and that can lead to changes in the current template or the creation of a new sequence	TT-SOOP Metadata	Sept.2017	
118	10.4.2/2	Support the creation of a new SOOP-underway BUFR template(including pCO2) that can address the needs and requirements of the user community and data providers	TT-SOOP Metadata	Dec.2017	
119	10.4.3/1	Continue to document all the different transmission chains for ship messages, from the ships to the GTS	TT-ISS	SOT-10	
120	10.4.3/2	Continue BUFR migration, applying the new template and taking care to avoid multiple generation of messages	SOT Members	SOT-10	
121	10.4.3/3	Compile a list of bulletin headers used in SOT community	TT-ISSC	SOT-10	
122	10.4.3/4	ESURFMAR to provide a simple decoder for data format 100 and 101	ESURFMAR	Dec.2017	
123	11/1	Compile all ongoing action items to a best practices document	SOT TC	Dec.2017	
124	11/2	Executive Committee to review the implementation strategy and distribute to the members for review	SOT-EXG	15 May 2017	
125	11/3	Review the Implementation Strategy and provide the feedback with track changes to the SOT Vice Chairperson and Secretariat	SOT Members	June 2017	
126	12.2/1	SOT-EC will act on a provisional basis pending JCOMM-5 decision. Once/if the SOT-EC is recommended by OCG and approved by JCOMM-5, the SOT-EXB will draft an operating principles document and other documents as required by the secretariat	SOT-EXB with WMO Secretariat assistance	Following JCOMM-5	
127	12.2/2	Secretariat to replace references on the JCOMM website to SOT "officers" and SOT Management Committee with information for the SOT-EC	WMO Secretariat	Following JCOMM-5	
128	12.3/1	To support succession planning, all SOT-Task Teams will select a vice-Chairperson internally from the TT membership	SOT-TTs	Sept.2017	
129	12.3/2	Members to submit nominations for the SOT Chairperson position to the Secretariat and SOT Vice. Chairperson	SOT Members	10 May 2017	

130	12.4/1	Members are encourage to make contributions towards SOT activities through DBCP Trust Fund	SOT Members	SOT-10	
131	12.4/2	Contributing members are encourage to identify the fraction of contribution towards SOT activities if they have not yet done so	SOT Members	Dec.2018	
132	12.4/3	Secretariat to provide a complete financial report with breakdown including IOC and JCOMMOPS funds allocated to SOT activities	WMO/IOC Secretariats	SOT-10	
133	12.4/4	Investigate the possibility of renaming the DBCP-TF to enhance the clarity(i.e. to include SOT)	WMO Secretariat	Dec.2017	
134	12.4/5	SOT Chairperson or a EXB member appointed by the SOT Chairperson to sit in DBCP EXB where financial decision are been made. SOT Chairperson to make this request to DBCP Chairperson	SOT Chairperson	Dec.2017	
135	12.5/1	Develop automated tools to create the SOT annual report through JCOMMOPS database	SOT TC	Dec.2017	
136	13/1	Consider to transfer the national report session to the beginning of the next SOT session, in order to enable better discussions between the members during the meeting	SOT-EXB	SOT-10	

Ongoing action items

NO.	***Ref. Item***	***Action Item***	***By***	***Update***
	SOT-9			
1	3.1/1	Improve the coordination of activities on observations from ships in the JCOMM framework and in particular. strengthen the connections between biogeochemical observations and coordinated networks, such as underway pCO2 observations with SOT	SOT TC with SOT Members	
2	3.1/2	SOT members to make use of initial version of the "Guide to WIGOS" in the implementation of WIGOS in national/regional levels	SOT Members	
3	3.1/3	Members are requested to maintain and enhance their essential marine meteorological and oceanographic observation systems and to make available in real-time of the data collected by the systems, including ship-based sounding system	SOT Members	
4	3.1/4	Members should encourage all research vessels, supply vessels and tourist ships operating in the polar regions make regular surface observations and transmit these data preferably in real time and/or delayed mode	SOT Members	
5	3.1/5	Members should submit complete metadata from ships, stations and cruises to JCOMMOPS which is the primary entry point of marine platform metadata to OSCAR system	SOT Members	
6	3.1/6	Members are requested to transition from Traditional Alphanumeric Codes to Table Driven Code for data dissemination to the Global telecommunication System at their earliest	SOT Members	
7	3.1/7	Requested improved support of members to the implementation of marine	SOT Members	

		meteorological and oceanographic observing systems		
8	3.4/2	Strengthen support for JCOMMOPS infrastructure so that challenges with SOT metadata and identifier developments can be properly addressed	SOT Members	
9	3.4/10	Members to submit cruise plans to JCOMMOPS whenever possible and with the biggest possible lead time, aiming to achieve a better view on upcoming operations, and to exploit more synergies, e.g. by deploying autonomous instruments from SOT ships in data sparse areas	SOT Members	
	6.5/4	Technical Coordinator to monitor the content of the VOS brochure to ensure that it is maintained up to date, liaising with the VRPP Task Team when any major modifications are needed	SOT TC, TT-RPT	
	6.5/5	VOS Operators to submit copies of promotional videos related to the VOS scheme VOS operations for inclusion on the YouTube VOS Channel	VOS members & S Bond	
	6.5/6	Technical Coordinator to monitor the VOS Poster to ensure that it is maintained up to date, liaising with the VRPP Task Team when any major modifications are needed	SOT TC, TT-RPT	
	6.5/7	VRPP Task Team to update the quick reference guides, in liaison with the Technical Coordinator, to reflect decisions taken during the SOT-9 session	SOT TC, TT-RPT	
	6.5/9	VOS Operators to provide the Technical Coordinator with copies of their national PMO Work instructions, checklists and associated flow diagrams for uploading to the JCOMMOPS website as appropriate	VOS Members, SOT TC	
	6.9/4	Metadata management and associated training for VOS Operators and Port Met Officers in the collection of metadata should considered in liaison with the new Task Team on Recruitment, Promotion and Training	TT-RPT TT-VOS Metadata	
	6.10/1	Technical Coordinator should keep an updated list of active SOOP agencies and programs, including contact information	SOT TC	
	6.10/2	SOOP-XBT platform operators (or partner agencies) to submit delayed mode deployment metadata in the format required yearly to the JCOMMOPS SOT TC	SOOP Operators	
	8.1.1/2	National focal points to provide complete and timely national reports to the secretariat	SOT Members	
	8.1.2/1	Continue with innovative and in particular third party partnerships with the aim to recruit more vessels particularly in data sparse areas, and promote the work of the SOT	SOT TC	
	8.4.4/5	Develop partnership between developed and developing nations to realize the socio-economic benefits of ocean observing systems at global and regional scales	SOT Chairperson, OCG	
	10.2/1	PMOs and VOS Focal Points to contact VOS ships on monthly suspect lists to rectify any problems	PMOs	

ANNEX V

RECOMMENDATIONS

NO.	Ref.	Recommendation	By
1	SOT-9/3.1	SOT members to make use of initial version of the "Guide to WIGOS" in the implementation of WIGOS in national/regional levels	Secretariat
2	SOT-9/3.2	Review SOT priorities following OCG guidance and in line with the OCG workplan[40]	OCG
3	SOT-9/5.1.1	consider recommending JCOMM (WMO and UNESCO) to jointly submit a document to an IMO technical body with the aim of raising awareness of the IMO Member States and international shipping community on the subject	IMO
4	SOT-9/5.1.2	Coordinates the efforts of international organizations requesting participation of ships in meteorological, hydrographic and oceanographic data collection schemes	ICS
5	SOT-9/5.1.2	Consider a single "black box" solution for collection of meteorological, hydrographic and oceanographic data needs where data would be pulled from ships on demand , rather than pushed.	ICS
6	SOT-9/5.1.4	IHO invites the SOT to consider including in its doctrine the measurement, recording and rendering of depth data as a routine environmental observing activity to be undertaken at all times when vessels are at sea and where no restrictions apply.	IHO
7	SOT-9/5.2.5	Share the best practices documents with JCOMMOPS to make them available for wider community	IQuOD
8	SOT-9/6.2	Recommend that the DBCP be invited to join the TT-HRMM and appoint a representative to the TT-HRMM to ensure the two communities are leveraging standards, methodologies, and techniques being developed for automated observing systems in the VOS and DBCP communities	TT-HRMM
9	SOT-9/6.2	The TT-HRMM invites any interested National Meteorological Service/modelling centre to collaborate with the TT-HRMM to test the impact of HRMM data in numerical weather models. The scope of this task is beyond the capabilities and resources of the TT	TT-HRMM
10	SOT-9/6.3	TT-SatCom feels that efforts to engage in preliminary plans for using Fleet Broadband for conventional VOS messages should move forward.	TT-SatCom
11	SOT-9/6.3	Consider the need to propose revisions to IMO Resolution 707 (17) to reflect changes in the way that meteorological messages will be transmitted in the future	TT-SatCom
12	SOT-9/6.3	Follow the recommendations given in JCOMM TR 63 when implementing own software to compute marine meteorological variables	TT- IS
13	SOT-9/6.5	OCG should be invited to consider the need for a cross cutting JCOMM-wide recruiting and promotion Task Team	TT-VRPP
14	SOT-9/6.5	NCEI to review the content of the VOSClim DAC website to ensure that support information is up to date	TT-VOSClim
15	SOT-9/6.5	KNMI to formally release the latest version of TurboWin (V5.5) for manually reporting VOS as soon as possible, in order to encourage the real time collection of VOS Climate parameters.	TT-VOSClim
16	SOT-9/6.5	KNMI to ensure that up to date softcopies of the VOS Brochure included in the TurboWin software	TT-VOSClim
17	SOT-9/6.9	OCG to consider the need to establish a cross cutting working group to oversee and ensure consistency in the way that JCOMM observing networks are collecting metadata, and to benefit from synergies	TT-PUB47
18	SOT-9/6.9	WMO Pub 47 should be frozen in its current (V4.2) status, and should be archived for historical records when the new composite metadata structure for VOS becomes operational	TT-PUB47
19	SOT-9/6.9	JCOMMOPS database should in future be regarded as the main metadata repository i.e. when the E-SURFMAR	TT-PUB47

[40] http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=18049

		metadata database has been fully migrated to JCOMMOPS	
20	SOT-9/6.9	JCOMMOPS should continue to submit only the mandatory Pub47 fields to OSCAR (as already developed and successfully tested between OSCAR and JCOMMOPS) until such time as the proposed new metadata structure has been validated	TT-PUB47
21	SOT-9/6.10	Keep the Ad-hoc Task Team on SOOP Metadata active during the next intersessional period to work with other metadata task teams on a common and WIGOS compliant format	Ad-hoc TT SOOP MD
22	SOT-9/8.1.3	The meeting recognized the value of the quality control monitoring tools for surface marine observations maintained by E SURFMAR and Météo-France (so-called QC Tools), and asked for the service to be continued.	E-SURFMAR
23	SOT-9/8.1.3	The meeting approved the VOS metadata migration plan towards JCOMMOPS and supported the merge (in a second phase) of the WMO Pub.47 metadata into WIGOS, allowing for sufficient time to consider the climate continuity of all metadata	E-SURFMAR
24	SOT-9/8.2.1	KNMI, in liaison with E-SURFMAR, to consider strategies to ensure the on-going continuity and development of the TurboWin Software avoiding reliance on single points of failure	VOS Pannel
25	SOT-9/8.2.1	KNMI, in liaison with E-SURFMAR, to outline its plans for the future functionality of TurboWin versions	VOS Pannel
26	SOT-9/8.2.1	Turbowin software upgrade to not allow a double correction if automated correction already applied	VOS Pannel
27	SOT-9/8.3	Invitations are invited from members to host the next Workshop.	VOS Pannel
28	SOT-9/8.3	That International PMO workshops should be convened more frequently and ideally at two yearly intervals.	VOS Pannel
29	SOT-9/8.4.2	E-SURFMAR Expert Team on VOS to consider, in liaison with the Norwegian Meteorological Institute, the potential to recruit, and provide PMO support for, AECO tourist vessels operating in the Arctic	VOS Pannel
30	SOT-9/8.4.2	E-SURFMAR Expert Team on VOS investigate the potential to equip a suitable AECO vessel with a EUCAWS system	VOS Pannel
31	SOT-9/8.4.4	The VOS - DP to be discontinued. Recognizing that the VOS-DP was established as a joint DBCP/SOT initiative the DBCP Chairperson and OCG are invited to endorse this recommendation	VOS Pannel
32	SOT-9/8.4.4	Regular workshops to be convened as a means to help realise the JCOMM PANGEA Concept41 and to help developing nations to become engaged in ship-based observational activities	VOS Pannel
33	SOT-9/8.4.5	The Support Fleet to continue to be recognized as a distinct component within the remit of the VOS Scheme	VOS Pannel
34	SOT-9/8.4.5	Met Office RSMC to take the new VOS classes into account in the new automatic system they are currently developing for monitoring the quality of VOS data	VOS Pannel
35	SOT-9/8.4.6	That KNMI should put forward API requirements that would enable a direct upload to WOW from TurboWin	WOW & KNMI
36	SOT-9/8.4.7	That the latest version of TurboWin software should be updated to include further enhancements to real-time QC of VOS data	KNMI
37	SOT-9/9.1.3	Recommend IQuOD to use Cheng etal for correction of XBT	SOOPIP
38	SOT-9/10.1	RTMC to provide JCOMMOPS with monthly VOS monitoring statistics in csv format in order to facilitate the implementation of quality-based KPIs	VOS pannel
39	SOT-9/10.1	Monitoring centers (RTMC) to facilitate QC information exchange with JCOMMOPS	VOS panel
40	SOT-9/10.3.1	GCC to further investigate the possibility of directly transmitting IMMT data from TurboWin	VOS panel
41	SOT-9/10.3.1	The GCC should proactively contact CMs that have not submitted data for a number of years to offer assistance and encourage submission of data	GCC
42	SOT-9/10.2.3	Collaborate with the staff of the WOD (World Ocean Database) Project to continue the integration of the GTSPP and WOD databases	GTSPP
43	SOT-9/10.3.2	In view of proposed changes to VOS classes, review the need for continuing the VOSClim DAC services at NCEI. It	VOSClim DAC

[41] Ht43tp://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=6386

		is not apparent that the data is being extensively used, however from recent journal searches, the data are possibly being used for ship speed studies. Inquiries on these data are very rarely received at NCEI, and NCEI does not have a good way to track usage due to free and open data policies requiring no registration. This prevents tracking who is using the data and how much is being downloaded.	
44	SOT-9/10.3.2	Consider expanding the VOSClim DAC to include all VOS ships. NCEI has been receiving all VOS and buoy reports, with appended co-located model fields, similar to the original VOSClim transmissions, and provides those monthly to ICOADS. Should the DAC website be expanded?	VOSClim DAC
45	SOT-9/10.3.2	Coordinate with JCOMMOPS to retrieve the VOSClim Ship list, containing active and non-active VOSClim ships, when it is formally transitioned from MeteoFrance to JCOMMOPS.	VOSClim DAC

Annex VI

TERMS OF REFERENCE AND MEMBERSHIP OF TASK TEAMS

Task Team on ASAP(TT-ASAP)

Terms of Reference

1. Coordinate the overall implementation of the ASAP, including recommending routes and monitoring the overall performance of the programme, both operationally and in respect of the quality of the ASAP system data processing.
2. As may be required by some members, arrange for and use funds and contributions in kind needed for the procurement, implementation and operation of ASAP systems and for the promotion and expansion of the programme.
3. Coordinate the exchange of technical information on relevant meteorological equipment and expendables, development, functionality, reliability and accuracy, and survey new developments in instrumentation technology and recommended practices.
4. Review all relevant JCOMM Publications to make sure they are kept up to date and comply with Quality Management terminology.
5. Prepare annually a report on the status of ASAP operations, data availability and data quality.

Membership

- Rudolf Krockauer (Chairperson, Germany)
- Henry Kleta (Vice-chairperson Germany)
- Mardené De Villiers (South Africa)
- Ayako Takeuchi (Japan)
- Paula Rychtar (United States)
- Martin Kramp (SOT TC, ex officio)

Task Team on High-Resolution Marine Meteorology (TT-HRMM)

Terms of Reference

1. Review existing requirements (including WMO Rolling Review of Requirements, and other satellite data requirements not covered by WMO Application Areas) for marine meteorological observations sampled at sub-hourly intervals (defined as high-resolution; HR).
2. Develop new requirements for HR marine meteorology in coordination with the ETMC and relevant operational and research communities.
3. Identify and recommend requirements for sampling rates, data formats, data averaging, minimum metadata, calibration, etc. using existing standards (e.g., WIGOS) whenever possible for AWS on VOS to collect HR marine meteorological observations.
4. Define processes to collect HR marine meteorological data on AWS from vessels with an initial focus on delayed-mode data acquisition, and recommend potential data assembly centers to receive and distribute these observations in a timely manner. The team will consider real-time acquisition and dissemination if required in the future.
5. Discuss technical implications of recommendations for HRMM using AWS on VOS and assess their impact on operators and user communities.

Membership

- Shawn Smith (Chairperson, United States)
- David Berry (United Kingdom)
- Jean-Baptiste Cohuet (France)
- Henry Kleta (Germany)
- Peter Minnett (United States)

- Paula Rychtar (United States)
- Mardené De Villiers (South Africa)
- Fraser Cunningham (United Kingdom)
- Martin Kramp (SOT TC, ex officio)

Task Team on Instrument Standards and Satellite Communication Systems (TT-ISSC)

Terms of Reference;

1. Compile information and provide guidance on existing activities, procedures and practices within JCOMM relating to instrument testing, standardization and intercalibration, as well as the standardization of observation practices and procedures.
2. Using guidance contained in existing guides including the WMO Guides on Instruments and Methods of Observation (WMO-No.8) communicate with manufactures regarding new technologies and recognized equipment problems when requested.
3. Prepare dedicated Webpages containing this information, to be made widely available through the JCOMM web site and linked from other relevant websites (JCOMMOPS, VOS, DBCP, SOOP, and SOT).
4. Perform inter-comparisons as required by SOT sessions.
5. Review and comment relevant JCOMM Publications when requested to make sure they are kept up to date.
6. Evaluate the operational and cost-effective use of satellite data telecommunication systems for the real-time collection of VOS and SOOP data in support of the World Weather Watch, GOOS, and GCOS.
7. Evaluate and propose new communication systems for conventional VOS to substitute Code 41 and continue to monitor the cost implications of Code 41.
8. 8. Liaise with international organizations (IMO, IMSO) and with telecom providers to take into account expected evolutions.

Membership

- Jean-Baptiste Cohuet (Chairperson, France)
- Jan Rozema (Netherlands)
- Frits Koek (Netherlands)
- Annina Kroll (Germany)
- Michail Myrsilidis (Greece)
- Hiroshi Ohno (Japan)
- Steven Pritchett (United States)
- Derrick Snowden (United States)
- Johan Stander (South Africa)
- Martin Kramp (SOT TC, ex officio)

Task Team on Recruitment, Promotion and Training (TT-RPT)

Terms of Reference

1. Review existing promotional material including

- Certificates (e.g. SOT & VOSClim certificates) and Awards
- The VOS Poster, brochure and flyer,
- Relevant news and articles for use in SOT or VOS publications, national newsletters or publications
- VOS website content
- SOT 'Recruitment Presentation' and promotional videos
- and recommend new promotional aids or initiatives (e.g. social media), where appropriate

2. Analyze replies to the VOS Scheme Questionnaire and identify issues that need to be addressed by SOT to improve the performance of the VOS Scheme. Review the need for and content of future questionnaires
3. Monitor and review the suitability of the current VOS and Third Party VOS Classes and ensure as many ships as possible report to VOS Climate standards
4. Monitor and develop global standards, practices and instructions for Port Meteorological Officers and assist with the coordination international or regional PMO Training Workshops
5. Maintain relevant training documents, videos, instructions and guidance material for VOS Operators, PMOs and observers and propose new documents where appropriate.
6. Provide advice to Nautical Colleges about training syllabuses for observers
7. Encourage initiatives to increase VOS recruitment, particularly in data sparse areas such as the Polar regions
8. Propose initiatives to assist member countries seeking to establish new national VOS networks
9. Review relevant JCOMM publications to ensure they are up to date with respect to VOS Classes, recruitment, promotion and training.
10. Liaise with other JCOMM Networks (e.g. DBCP) and SOT Task Teams (e.g. ASAP and SOOP), as appropriate, regarding the development of common promotional material and training manuals (e.g. reference guides for ship riders collecting XBT data)
11. Assist the SOT executive board by developing and providing necessary input to the proposed Ship Forum (e.g. generic ship design standards)

Membership

- Paula Rychtar (Chairperson, United States)
- Francis Bringas (United States)
- Henry Kleta (Germany)
- Rusty Albaral (United States)
- Steven Bond (United Kingdom)
- Joel Cabrie (Australia)
- Matthew Thompson (United States)
- Jean-Baptiste Cohuet (France)
- Mardene de Villiers (South Africa)
- Ross Bannister (New Zealand)
- David Dellinger (United States)
- Maria Jose Guerrero (Spain)
- Emma Stevenson (United Kingdom)
- Lilach Lavin (Spain)
- Ayako Takeuchi(Japan)
- Martin Kramp (SOT TC, ex officio)

Task Team on Call Sign Masking and Encoding (TT-Masking)

Terms of Reference

1. Oversee the implementation of MASK, SHIP and ENCODE and develop guidelines as necessary.
2. Review and approve national MASK schemes to ensure they remain unique and do not impinge on (1) the ITU call sign series allocated to a country, or (2) any other marine or oceanographic identification scheme used by WMO, e.g. buoy identification numbers.
3. Ensure the MASK v REAL database is kept up-to-date by NMSs implementing MASK.
4. Develop the ENCODE encryption strategy, as well as develop the encoding and decoding keys.

Membership

- Mr. Eric Freeman(Chairperson, United States)

- Dr. David Barry (United Kingdom)
- Ms. Lily Fung (Canada)
- Ms. Ayako Takeuchi (Japan)
- Mr. Simon Thompson (United Kingdom)
- Ms. Emma Steventon (United Kingdom)
- Mr. Martin Kramp(SOT TC)

Task Team on VOS Metadata (TT-VOS Metadata)

Terms of Reference

1. Develop a new composite metadata structure for the VOS based upon new WIGOS metadata standards in WMO Pub No 1160 and existing WMO Pub No 47 metadata requirements.
2. Liaise closely with the SOOP Panel and with the ASAP Task Team with a view to developing harmonized metadata requirements and collection wherever possible, particularly with respect to ship related metadata.
3. Ensure the efficient transfer of the E-SURFMAR metadata database to JCOMMOPS and confirm that at least the same level of functionality is maintained.
4. Regularly review metadata requirements for SOT observing networks and propose amendments or recommendations where considered appropriate.
5. Ensure that required WIGOS metadata is routinely transferred to the OSCAR database and review the compliance of SOT networks with WIGOS requirements. Liaise with OSCAR Working Groups where required.
6. Monitor the receipt of metadata submissions from participating VOS members to ensure that the JCOMMOPS metadata is maintained as up to date.
7. Review all relevant metadata content in JCOMM Publications to ensure they are up to date, and comply with Quality Management terminology.
8. Propose methods/procedures to quality control the metadata submitted by SOT members.
9. Monitor related work undertaken by other JCOMM observing networks to ensure that, where appropriate, consistent harmonised metadata provisions are developed.
10. Make proposals for the governance of ship related metadata and fields, and consider the need for national focal points for metadata standards.
11. Liaise with the Task Team on Recruitment, Promotion and Training concerning metadata training for VOS operators, Focal Points and PMOs.
12. Liaise with TT- HRMM with regards to modifying metadata to accommodate high resolution data from AWS.
13. Determine the minimum metadata requirements for support class ships to be aligned with OSCAR mandatory metadata.
14. Liaise with KNMI regarding the implementation of the new composite WIGOS metadata structure within TurboWin software.

Membership

- Emma Steventon (Chairperson, United Kingdom)
- Paul Poli (E-SURFMAR & France)
- Jean-Baptiste Cohuet (France)
- Henry Kleta (Germany)
- Rebecca Cowley (ustralia)
- Paula Rychtar (United States)
- Rudolf Krockauer (Germany)
- Representative from India (India)
- Martin Kramp (SOT TC, ex officio)

Task Team on SOOP Metadata (TT-SOOP Metadata)

Terms of Reference:

1. Explore and review metadata requirements for SOT platforms operating under the SOOP panel (in particular XBT, TSG and pCO2)
2. Mapping into WIGOS metadata structure.

Membership:

- Joaquin A. Trinanes (Chairperson, United States)
- Francis Bringas (United States)
- Martin Kramp(SOT TC)
- Shawn Smith (United States)
- Rebecca Cowley (Australia)
- Loic Petit de la Villeon (France)
- Rik Wanninkhof (United States)

Ad-hoc Task Team on Key Performance Indicators (TT-KPI)

Terms of Reference;

1. Considering the User requirements for observations (OSCAR/Requirements).
2. Considering the existing leading programs in each panel of the SOT, with their existing Key Performance Indicators.
3. The task team shall derive Key Performance Indicators for the various panels of the SOT, noting that,
4. Such Key Performance Indicators shall inform about current situation and progress regarding i) Implementation, ii) Data Flow, iii) Instrumentation, iv) Operations, v) Data Uptake and vi) International Cooperation (as relevant).
5. Such Key Performance Indicators shall be implemented on JCOMMOPS website.

Initial proposed membership :

- Paul Poli for VOS (Chairperson, France)
- Fraser Cunningham (United Kingdom)
- Rudolf Krockauer for (Germany)
- Janet Sprintall for (United States)
- Rik Wanninkhof for SOOP-CO2 and (United States)
- Martin Kramp (SOT TC)

Ad-hoc Task Team on Unique Observation ID Scheme (TT-UID VOS Obs)

Terms of Reference;

1. Set up to develop and document a unique ID scheme for VOS observations over the inter-sessional period.

Membership:

- David Berry (United Kingdom)
- Paul Poli (France)
- Fraser Cunningham, (United Kingdom)
- Eric Freeman (United States)
- Martin Kramp (SOT TC, ex officio)

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Annex VII

DRAFT TERMS OF REFERENCE OF THE SHIP OBSERVATIONS TEAM

(on the basis of excerpt of Annex to Resolution 3 (JCOMM-4), Terms of Reference and General Membership of the Coordination Group and Teams of the Observation Programme Area)

Note: The proposed changes at SOT-8 are identified as follows; suggested insertions are highlighted in yellow and proposed deletions are ~~stroked through~~.

TERMS OF REFERENCE

SHIP OBSERVATIONS TEAM (SOT)

The Ship Observations Team shall:

(a) Respond to requirements for ship-based observational data(metadata) expressed by relevant international programmes and/or systems in support of marine services, and coordinate actions to implement and maintain the networks to satisfy these requirements;
(b) Provide continuing assessment of the extent to which those requirements are being met;
(c) Oversee and monitor the implementation of methodologies as determined by the scientific and operational communities for constantly controlling and improving the quality of data;
(d) Review marine telecommunication facilities and procedures for observational data collection, as well as technology and techniques for data processing and transmission, and propose actions as necessary for improvements and enhanced application;
(e) Coordinate Port Meteorological Officer (PMO)/ operations globally, propose actions to enhance PMO standards and operations, and organize PMO and observers training, and greater PMO collaboration;
(f) Review, maintain and update as necessary technical guidance material relating to ship observations and Port Meteorological Officers;
(g) Liaise and coordinate as necessary with JCOMM programme areas and expert teams, relevant Technical Commissions, executive bodies working groups, and GCOS, GOOS, as well as with other interested parties, such as the International Maritime Organization (IMO) and other relevant international organizations;
(h) Participate in the planning activities of the appropriate observing system experiments and major international research programmes as the specialist group on meteorological and oceanographic observations based onboard ships;
(i) Seek new opportunities for deploying and/or recovering various kinds of measuring devices as recommended by the relevant panels and widely publicise those opportunities;
(j) Develop as necessary new pilot projects and/or operational activities and establish new specialized panels as required;
(k) Carry out outreach, capacity building and other activities as agreed by participating Members/Member States to implement and operate the SOT programme and to promote and expand it internationally, seek collection of third party data from ships, and collaborate with the industry in the view to enhance the collection of data from ships;
(l) Develop improved real-time feedback to volunteer ships regarding the quantity and quality of the observations that they submit and that are inserted on the GTS.

GENERAL MEMBERSHIP

- Chairperson and vice-Chairperson of the Ship Observations Team, selected by the Commission
- Chairpersons and vice-Chairpersons of the SOOPIP and Voluntary Observing Ship Panel, selected by the Commission
- Open membership, comprising operators of VOS and SOOP, representatives of monitoring centres, data management centres and bodies, representatives of the International Mobile Satellite Organization and other communications satellite

systems, representatives of manufacturers, representatives of science advisory bodies and users as appropriate.

The JCOMM *in situ* Observing Platform Support Centre will participate in the work and the meetings of the Ship Observations Team.

TERMS OF REFERENCE OF COMPONENT PANELS

VOLUNTARY OBSERVING SHIP (VOS)

The Voluntary Observing Ship (VOS) Panel shall:

(a) Review, recommend and coordinate the implementation of new and improved specialized shipboard meteorological instrumentation, siting and observing practices, as well as of associated software;
(b) Support the development and maintenance of new pilot projects;
(c) Oversee the upgrade of ships to VOSClim standard, and encourage other new ships to be recruited to the VOSClim class;
(d) Develop and implement activities to optimize ship inspections and recruitment, including promotional brochures and training videos;
(e) Prepare annually a report on the status of VOS operations, data availability and data quality.

SHIP-OF-OPPORTUNITY IMPLEMENTATION PANEL (SOOPIP)

The Ship-of-Opportunity Implementation Panel (SOOPIP) coordinates the installation and deployment of instrumentation from Ships of Opportunity that travel in fixed transects, and in particular coordinates the implementation of regional and basin-wide instrumentation that measure physical, chemical and biological parameters, such as XBTs, TSGs, and CPR. Its terms of reference are to:

(a) Implement, maintain, and monitor specialized shipboard instrumentation and observing practices ~~dedicated, but not limited, to temperature and salinity measurements~~ relevant to the SOOPIP;
(b) Coordinate the exchange of ~~technical information on relevant oceanographic equipment and expendables, development, functionality, reliability and accuracy, and survey new developments in instrumentation technology and recommended practices~~ recommended practices, and technical and developmental information about oceanographic instrumentation relevant to the SOOPIP;
(c) Ensure the distribution of available programme resources to ships to meet the recommended sampling network in the most efficient way;
(d) Ensure the transmission of SOOP data to the GTS and relevant data centres is ~~are~~ carried out ~~to the GTS and relevant data centres~~ according to operational and scientific requirements;
(e) ~~Maintain through~~ Provide guidance and assistance to the SOT chairperson and SOT Technical Coordinator to produce, appropriate inventories, monitoring reports and analyses, performance indicators, implementation plans and information exchange facilities;
(f) Where relevant, serve as a platform for other observational programmes;
(g) Maintain close communications with the scientific community and periodically meet and discuss ongoing research performed with observations relevant to SOOPIP;

~~Facilitate the formation of SOOP related Science Teams dedicated to meet and discuss on a periodic basis results and ongoing research performed with shipboard observations~~.

Annex VIII

SHIP FORUM DISCUSSIONS

Panel Discussion on more harmonized operations with volunteer ships, held as side meeting of the 9th session of the JCOMM Ship Observations Team
27 March 2017 at IMO in London, UK

From left to right: Shawn Smith (acting SOT Chair and Moderator, not on picture) ,Henry Kleta (incoming VOS chair; Albert Fischer (IOC-UNESCO, Head OOS Section)); John Murray (ICS, Marine Director / Head of the Marine Department); Robert Ward (IHO, Secretary General); Paul Holthus (WOC, CEO and President); Nick Ashton (JCOMM SCG Chair); Martin Kramp (JCOMMOPS Ship Coordinator); Osamu Marumoto (IMO Technical Officer); Sarah North (Outgoing VOS Chair)

Summary of Notes from Session

The panel discussed the need for a roadmap towards the common goal of recruiting additional vessels to support meteorological and oceanographic (met/ocean) observations. Although the panel specifically addressed the needs of SOT, the recruiting effort would benefit other panels within JCOMM (e.g., DBCP, etc.). The panel addressed the need for a top-down approach to vessel recruiting (as opposed to the present bottom-up approach) whereby SOT would approach various vessel operators including, but not limited to, merchant fleet owners, fishing fleets, cruise lines, etc. The Panel noted that all parties should be interested in contributing based on needs/requirements to support safety of life at sea (SOLAS) – more/better data will result in more accurate marine met/ocean forecasts.

The panel agreed that better communications are needed and that these efforts should be sustained (in the past SOT has not been able to follow through with top down recruiting efforts). Once a roadmap has been developed, the panel agreed there is a need for a rebranding of this effort to have broader reach than just VOS or SOOP. Creating brochures, flyers, and introductory presentations will be helpful; however, the panel agreed that we are not ready for this rebranding yet. Need to get a plan in place first.

Reaching out may be accomplished leveraging existing panels/activities. For example, The World Ocean Council is well positioned to reach out to shipping companies and other operator communities. Discussions at lunch/dinner meetings outside of the initial panel confirmed

WOC's interest in being a broker between SOT and the marine industry and that SOT should consider developing an initial pilot project with an industry partner with vessels in a high-priority observing region. One potential pilot project was discussed - working with a 'friendly' sustainability orientated NZ fishing group, with assistance from WOC, to improve coverage in the Southern Ocean.

Resources will always be an issue. NMS are limited in what they can provide to vessels and the shipping industry is not flush with funds and has limited personnel. Ideally systems placed on vessels would be (1) practical, (2) limit the impact on vessel operations and crew, and (3) take advantage of automation (e.g., using AWS, XBT auto-launchers, etc.). There is a need to explore multiple options to get instrumentation onto vessels. Suggestions included working more with vessel-owned instrumentation, asking those supplying ships to help with logistics to get sensors or expendable systems (floats, drifters) onto vessels, having operators purchase some sensors for their own vessels. Additionally, SOT needs to be more proactive within the scientific and technical communities developing new sensor systems. There is generally funding for innovation and technology development and may provide a mechanism to advance automation in a manner that would be applicable to wide vessel deployments.

Additional challenges, beyond funding, were also raised and including the following:

- How to balance vessel security with data collection/transmission when interfacing scientific instruments with vessel/bridge systems?
- How to manage installation/removal of systems (both permanent vs. transient) as vessels change routing or ownership?
- Working with regulatory restrictions (e.g., measurements within EEZs)

The panel noted that there is a need to "sell" the idea to vessel operators, NMS upper management, and the scientific funding communities. SOT needs to show the operators why they should help us in this effort. On the science side, developing two or three key scientific questions that can be addressed by increasing met/ocean observations may help sell the concept. In addition, there is a need to show the importance of the shipping and other vessel operator communities as key contributors to the global ocean observing system. The public at large and potential funding agencies (both governmental and private sector) need to be aware of why met/ocean observations are useful within a wide user community.

To begin to sell the idea, the panel recommended the development of a "shopping list" to inform potential recruits of the various needs and requirements of SOT. The list should address (1) observational needs, (2) instrumentation costs, (3) information/support vessels can provide with little or no up-front investment (e.g., leveraging satellite communications systems), and (4) who is responsible for what activities (e.g., sensor installs, calibration, maintenance, who can use the data, metadata, data quality evaluation). Side discussions following the initial panel began to develop the list as follows:

- Requested information from vessel
    - Where does vessel operate? E.g., cruise plans, nominal routes
    - When will vessel be in a given region?
    - Can we leverage ship-owned satellite transmission systems (e.g., email data transfer)?
- Requested parameters
    - VOS: Pressure, SST, Airtemperature, Humidity, Wind, Visual Observations (via TurboWin such as Waves, Vis, Clouds…)
- Requested instruments
    - VOS: Automated Weather System (from NMS), TurboWin, ship owned instruments
    - SOOP, DBCP: Floats, drifters, XBTs, other systems that are deployable from ships

Under the discussion of selling the idea, a brief dialogue addressed the idea of making some observations mandatory on vessels. The panel quickly agreed that this was not recommended. A better approach would be to review and possibly revise some of the IMO circulars (e.g., MSC circular1293) or other relevant documents (e.g., Polar Code) to make stronger

recommendations to the operator communities. It would also be good to investigate incentives for owners/operators to contribute to the met/ocean observing systems (e.g., lower costs via better ship routing, connecting SOLAS benefits of weather observing with insurance for vessels). Additionally, outlining best practices for met/ocean observing would be better than a mandatory approach, but these best practices should be easily understood (e.g., very brief technical documents, not long reports).

The panel also agreed that this effort needs to be led by a small working group that can (1) create the shopping list, (2) develop the roadmap for action, (3) identify key science questions and benefits to vessel operators, (4) work on promoting the idea, and (5) begin making connections with the vessel/ship owner communities. The proposed composition of the panel included the following:

- Shawn Smith (acting SOT Chair): smith@coaps.fsu.edu
- Henry Kleta (VOS chair): henry.kleta@dwd.de
- Rebecca Cowley (SOOP chair): rebecca.cowley@csiro.au
- Albert Fischer (IOC-UNESCO, Head OOS Section)): a.fischer@unesco.org
- John Murray (ICS, Marine Director / Head of the Marine Department): john.murray@ics-shipping.org
- Robert Ward (IHO, Secretary General): sg@iho.int
- Paul Holthus (WOC, CEO and President): paul.holthus@oceancouncil.org
- Nick Ashton (JCOMM SCG Chair): nick.ashton@metoffice.gov.uk
- Martin Kramp (JCOMMOPS Ship Coordinator): mkramp@jcommops.org
- Osamu Marumoto (IMO Technical Officer): OMarumot@imo.org
- Champika Gallage (WMO Secretariat): cgallage@wmo.int

In summary, the general consensus was that a top-down recruiting approach is a good idea! There is considerable interest and support towards making this happen from all the external parties (e.g., IMO, WOC, IHO) and there seems to be momentum that JCOMM can leverage. The next step would be to schedule an electronic meeting of the working group (after OCG-8) to discuss/agree on the key objectives for a 'full/global' project (plus mission, guiding principles, etc.) and the role of WOC in representing the JCOMM OGC interests to industry.

Actions

1. Formulate proposed working group and hold first group webex.
2. Develop "shopping list".
3. Develop roadmap for project and establish short- and long-term objectives.
4. Present overview of panel discussion and recommendations at OCG-8.
5. Consider other meetings, etc. to present overall concept (e.g., Halifax Ship Conference, fall 2017).
6. Identify a vessel group for a pilot project in a priority observation area (e.g., Southern Ocean).

Annex IX
WORKING PRIORITIES OF THE SOT TECHNICAL COORDINATOR

(as agreed by SOT-9, London, United Kingdom, 27-31 March 2017)

Work plan item	**Frequency**	**Priority (1 highest)**
Monitoring of performance of VOS, ASAP and SOOP status, analysis tools	monthly	1
SOOP monitoring based on operational metadata provided by SOOP agencies	yearly	1
Metadata management: Control flow into JCOMMOPS, control external sources (Pub47, GTS,...) and relay issues to operators	ongoing	1
Maintain SOT websites and mailing lists, and facilitate information exchange in general	ongoing	2
Provide problem solution, in particular on GTS issues	as appropriate	2
Gather, compile and provide Mask2Real information for authentified users (VOS, ASAP)	ongoing	3
Maintain or develop QC tools, such as VOS QC relay	ongoing	3
Promote SOT activities whenever and wherever possible inside and outside the community (Outreach)	ad hoc	3
Focal point: SOT community, GOOS community, and outside the observing community, in SOT related matters	ongoing	3
(Self) training on SOT related matters (instrumentation, ...)	ongoing	3
Report to governance	SOT, OCG	3
Support JCOMMOPS infrastructure	ongoing	3
Support DMCG	DMCG	3
Missions	as appropriate	3
Secretariat/communication	ongoing	3
Create and maintain platform metadata database for SOOP and ASAP	ongoing	4
Support the SOT implementation, in particular through ancillary project and VOS DP	ongoing	4
Review and update promotion material	ad hoc	4

Annex X

LIST OF ACRONYMS

ADCP	Acoustic Doppler Current Profiler
AECO	Arctic Expedition Cruise Operators
AIS	Automatic Identification System
AMOS	Autonomous Marine Observing System
AOML	NOAA Atlantic Oceanographic and Meteorological Laboratory (USA)
ASAP	Automated Shipboard Aerological Programme
AWS	Automatic Weather Station
AXIS	Autonomous eXpendable Instrument System
BGC	Biogeochemical
BoM	Bureau of Meteorology (Australia)
BUFR	Binary Universal Form for Representation of meteorological data
CBS	Commission for Basic Systems
CEOS	Committee on Earth Observation Satellites
Cg	WMO Congress
CIMO	Commission on Instruments and Methods of Observation (WMO)
CLS	Collecte Localisation Satellites (France)
CMD	Continuously Managed Database
CMEMS	European Copernicus Marine Environment Monitoring Service
CMM	Commission for Marine Meteorology
CO2	Carbon dioxide
COP	Conference of the Parties
CSB	Crowd-Sourced Bathymetry
CSBWG	Crowd-Sourced Bathymetry Working Group
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSV	Comma Separated Values format
DAC	Data Assembly Centre
DBCP	Data Buoy Co-operation Panel (WMO-IOC)
DCDB	Data Centre for Digital Bathymetry
DCS	Data Collection Systems
DOM	Dissolved Organic Matter
DRR	Disaster Risk Reduction
DWD	Deutscher WetterDienst
E-ASAP	European ASAP
EXB	Executive Board
EXC	Executive Council
ECMWF	European Centre for Medium Range Weather Forecast
EC-PHORS	Experts on Polar and High Mountain Observations, Research and Services
ECVs	Essential Climate Variable
ERDDAP	Environmental Research Division's Data Access Program
E-SURFMAR	Surface Marine programme of the Network of European Meteorological Services,
ETMC	Expert Team on Marine Climatology (JCOMM)
EUCAWS	EUropean common Automatic Weather Station
EUMETNET	Network of European Meteorological Services
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EVOs	Essential Ocean Variables
EXB	Executive Board (SOT)
EXC	Executive Committee (SOT)
FEC	Forward Error Correction
FTE	Full Time Employee
FTP	File Transfer Protocol
FUS	Florida State University
GCC	Global Collecting Centre (of MCSS)
GCOS	Global Climate Observing System
GCW	Global Cryosphere Watch
GDAC	Global Data Assembly / Acquisition Centre
GDP	Global Drifter Program

GEBCO	General Bathymetric Chart of the Oceans
GHRSST	Group of High-Resolution Sea Surface Temperature
GMDSS	Global Maritime Distress and Safety System
GO2NE	Scientific working group on Deoxygenation (IOC)
GOOS	Global Ocean Observing System
GO-SHIP	Global Ocean Ship-Based Hydrographic Investigations Programme
GOSUD	Global Ocean Surface Underway Data Pilot Project
GTS	Global Telecommunication System
GTSPP	Global Temperature and Salinity Profile Programme
GTSPP	Global temperature and Salinity Profile Programme
HRDCP	High Data Rate DCP
HRMM	High Resolution Marine Meteorology
ICAO	International Civil Aviation Organization
ICES	International Council for the Exploration of the Sea
ICOADS	International Comprehensive Ocean-Atmosphere Data Set (USA)
ICOS-Ocean	Integrated Carbon Observing System for the ocean
ICS	International Chamber of Shipping
ICSU	International Council for Science
IFREMER	Institute Français pour la Recherche et l'Exploration de la Mer
IGOSS	Integrated Global Ocean Services System
IHO	International Hydrographic Organization
IMMT	International Maritime Meteorological Tape
IMO	International Maritime Organization
IMSO	International Mobile Satellite Organization
IOC	International Oceanographic Commission
IOCCP	International Ocean Carbon Coordination Project
IODE	International Oceanographic Data and Information Exchange (IOC)
IPCC	Intergovernmental Panel on Climate Change
IQuOD	International Quality-controlled Ocean Database
ITU	International Telecommunication Union
IVAD	ICOADS Value-Added Database
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JCOMM MAN	JCOMM Management meeting
JCOMMOPS	JCOMM in situ Observations Programme Support Centre
JMA	Japan Meteorological Agency
KNMI	The Royal Netherlands Meteorological Institute
KPI	Key Performance Indicators
LRIT	Long-Range Identification and Tracking of ships
MCDS	Marine Climate Data System
MCSS	Marine Climatological Summaries Scheme
MEDS	Marine Environmental Data Section
MHT	Meridional Heat Transport
MMOP	Meteorology and Oceanography Program
MODIS	MODerate-resolution Imaging Spectroradiometers
MoU	Memorandum of Understanding
MQCS	Minimum Quality Control Standards
MSDS	Maritime Safety Data Service
MSI	Maritime Safety Information
NASA	National Aeronautics and Space Administration (USA)
NCEI	National Centers for Environmental Information (NOAA-USA)
NCEP	National Centres Environmental Prediction
NCP	National Contact Point
NCSR	Navigation, Communications, Search & Rescue
NFPs	National Focal Points
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	IODE National Oceanographic Data Centre
NWP	Numerical Weather Prediction
NWS	NOAA National Weather Service (USA)
NZ	New Zealand

OCG	JCOMM Observation Coordination Group
OOMD	Ocean Observation and Monitoring Division(NOAA-USA)
OOPC	Ocean Observations Panel for Climate (GCOS-GOOS-WCRP)
OPA	Observations Programme Area
OPC	Ocean Prediction Center
OSCAR	Observing System Capability Analysis and Review
PEC	Programme Evaluation Committee
PMEL	NOAA Pacific Marine Environmental Laboratory (USA)
PMO	Port meteorological Office
QC	Quality Control
R2R	Rolling Deck to Repository
RRR	Rolling Review of Requirements(WMO)
RSMC	Regional Specialized Meteorological Centre
RTMC	Real-Time Monitoring Centre
SAC	Special Access Code
SAMOS	Shipboard Automated Meteorological and Oceanographic System
SBD	Short-Burst Data
SCAR	Scientific Community on Antarctic Research
SCOR	Scientific Committee on Oceanic Research
SFSPA	Forecasting Systems Services Programme Area
SGDs	Sustainable Development Goals
SIDS	Small Island Developing States
SLSTRs	Sea and Land Surface Radiometers
SOCAT	Surface Ocean Carbon Atlas
SoG	Statement of Guidance
SOOP	Ship Of Opportunity Program
SOOPIP	SOOP Implementation Panel
SOS	Sustainable Ocean Summit
SRN	Ship infrared Radiometer Network
SSA	WMO Special Service Agreement
SSS	Sea Surface Salinity
SST	Sea Surface Temperature
TAC	Traditional Alphanumeric Codes
TC	Technical Coordinator
TDC	Table Driven Code
THREDDS	Thematic Real-time Environmental Distributed Data Services
ToR	Terms of Reference
TPOS	Tropical Pacific Observing System
TSG	Thermosalinograph
TT	Task Team
TT-HRMM	Task Team on High Resolution Marine Meteorology
TT-IS	Task Team on Instrument Standards
TT-ISSC	Task Team on Instrument Standards and Satellite Communications
TT-KPI	Task Team on Key performance indicators
TT-RPT	Task Team on Recruitment, Program Promotion and Training
TT-Satcom	Task Team on Satellite Communication Systems
TT-TDC	Task Team on Table driven Code
TT-VRPP	Task Team on VOS Recruitment and Programme Promotion
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United National Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
VIIRS	Visible Infrared Imager Radiometer Suite
VOS	Voluntary Observing Ship
VOS-DP	VOS Donation Programme
VOSP	Voluntary Observing Ship Panel
WCRP	World Climate Research Programme
WIGOS	WMO Integrated Global Observing System
WOC	World Ocean Council
WOW	Weather Observations Website

XBT	Expendable Bathy Thermograph
XCTD	Expendable Conductivity/Temperature/Depth
XML	Extensible Markup Language