

GOOS Ship Observations Team (SOT)

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Executive Summary: In *major advancement*, as a WMO/IOC capacity development, the SOT conducted a successful VOS training program in the observation-sparse Pacific region via the 7th PMO Workshop, and the VOS network is being expanded in that region as a result of that workshop and the VOS Donation Program. Observation restriction over the Indian water was resolved by international and bi-lateral communications. The XBT Best Practice was endorsed by GOOS endorsement and published, as well as a newly released blended/synthesized marine surface meteorological and oceanographic dataset – the ICOADS Daily. Globally, up to 20 ships perform upper air soundings, but the trend is declining. Metadata is successfully managed via GitHub. Most VOS operators have started using the new persistent unique IDs (SOT-IDs) and WIGOS-compliant metadata submission to OceanOPS. SOT teams published updated brochures and observation Best Practices. VOS GDACs received nearly 2.4 million observations in 2023.

SOT faces several *challenges that WMO/IOC/OCG could potentially help to mitigate*. The 1st one is the declining financial contribution from member countries; this directly impact SOT actives through reduced funds allocated to both SOT and the OceanOps which serves as a central hub for SOT and other OCG networks. The 2nd challenge is finding a solution for the coming end-of-life support for the widely used VOS observation software, Turbowin. Important as it is, not all member countries/teams are on the same page on finding a solution: some countries/team are focusing on the software itself, while others want a high level (WMO/IOC/OCG level) statement on the requirements for future VOS observations as a whole, together with a software solution. The 3rd challenge is the trend of declining participation of network observations from member countries, particularly triggered by COVID19 event (New Zealand for VOS, and declining ASAP participation are two examples); observation requirements from high level (WMO/IOC) are needed. The 4th challenge is the difficulty that some scientific riders on ship of opportunities encountered (liability waivers) – IOC/GOOS can potentially help with a template letter but issues case by case basis.

1. Highlight the key network successes
 - a. For the VOS Panel (Joel Cabrie):
 - i. Through international collaborations and bi-lateral communications, the VOSP achieved a written resolution to resolved the ban on the use of Iridium within Indian waters which threatened to cause major disruptions to the VOS program. VOS ships are now exempt from this ban with a formal letter provided by the Directorate General of Shipping in India.
 - ii. A new VOS Brochure was published.
 - iii. With all masking schemes terminated, most VOS operators have begun or even finished the migration to persistent unique IDs (SOT-IDs) and WIGOS-compliant metadata submission to OceanOPS, from where metadata are pushed into OSCAR (95%, with remaining 5% not yet fulfilling minimum metadata requirement
 - b. For SOOPIP (Tamaryn Morris and Justine Park)

- i. Re-invigoration of additional networks involved with the SOOP (CPR, TSG and PCO2) and potential inclusion of new instruments (underway ADCP).
 - ii. Publication and GOOS endorsement of the XBT Best Practices, and GOOS endorsement of the Vessel Recruitment Best Practice.
 - iii. Migration to SOT-ID by Australia's CSIRO.
 - iv. Solution to XBT purchasing access for Italian institutions.
 - v. Resolution of most OceanOps metadata inputs for XBT.
 - c. For ASAPP (Rudolf Krockauer)
 - i. Globally, up to 20 ships perform upper air soundings. 80-90% of around 4000 annual soundings are provided by the 16 ships of the European ASAP fleet (E-ASAP), mainly by merchant container vessels in regular service in the North Atlantic.
 - d. For the Task Team on Recruitment, Promotion and Training (TT-RPT) (Joel Cabrie)
 - i. As part of the VOS capacity development in the vast observation-sparse regions in the Pacific Ocean, the 7th International Port Meteorological Officers Training Workshop was hosted by SPC in Fiji from 31 Oct – 02 Nov 2023. Thirty-seven (37) participants from 24 countries attended this training. As a result, a few countries/regions requested from the VOS donation program to start VOS observations.
 - e. Task Team on VOS Delayed Mode Data (TT-VOS DM) (Axel Andersson)
 - i. Annual Report of the VOS GDACs is currently finalized. VOS GDACs received nearly 2.4 million observations in 2023; however, the number of submitting members was just eleven.
 - ii. DWD has a pilot project underway with WMO which makes VOS-DM data available through WIS2.0.
 - f. Task Team on Key Performance Indicators (TT-KPI) (Elizabeth Kent)
 - i. Progress has been slow since the development of KPI for the SOOP XBT program.
 - g. Task Team on Metadata (TT-Metadata) (Emma Steventon)
 - i. Issues and requests for OceanOps/reference table updates were successfully managed via GitHub.
 - ii. The SOOP metadata is still a work in progress, but metadata reference tables have been optimized for SOOP, and in addition to XBT stations first underway stations are now in OceanOPS.
2. How has the network advanced across the OCG Network Attribute areas¹
- a. SOOPIP (Tamaryn Morris, Justine Park)
 - i. SOOP XBT and pCO2 are mature components of the network meeting all feasible OCG Network Attribute Areas (pCO2 data is a challenge for real-time posting), so advancement is focused on increasing participation and improved communication within the group.
 - ii. For the developing sub networks of SOOP, (CPR, TSG, ADCP, etc), the current focus is on: Global in Scale: continuing to grow coverage. Developing, updating and following Standards and Best Practices.
 - b. ASAPP (Rudolf Krockauer)

¹ <https://oceanexpert.org/downloadFile/45372>

- i. No advancements but reduction of E-ASAP fleet from 18 to 16 ships as of 2024 due to budget constraints.
 - c. Task Team on VOS Delayed Mode Data (TT-VOS DM) (Axel Andersson)
 - i. Global in Scale / Sustained Observation: Due to more automated systems (AWS) the number of submitted observations in delayed mode is on a high level. In contrast to that the number of active members remains low.
 - ii. Delivers data that are free: Delayed mode data is routinely provided and discoverable through WMO/GISC. Efforts are ongoing for data discoverable through WIS 2.0.
 - d. Task Team on Instrument Standards and Satellite Communications Systems (TT-ISSC) (Jean-Baptiste Cohuet, Martin Kramp)
 - i. Chair and TC support GBON (marine) spec working group and review of WMO 8.
 - e. Task Team on Recruitment, Promotion and Training (TT-RPT) (Joel Cabrie)
 - i. Undertaking capacity development and technology transfer: The VOS Donation Program, regular webinars and PMO Training Workshops have been helping the VOS Network to advance across this OCG Network Attribute.
 - ii. Global in Scale: Working with Vanuatu and the Solomon Islands to implement new national VOS programs. Working with Chile to further develop their VOS program.
- 3. Future Plans² and Opportunities - at network and/or cross-network OCG level
 - a. VOSP (Joel Cabrie, acting Chair)

Provide technical expertise and support to the development of the Next Generation Turbowin software for use on VOS ships.
 - b. SOOPIP (Tamaryn Morris, Justine Park, Martin Kramp)
 - i. Increase observations as widely as possible by removing barriers to access the equipment from the manufacturer.
 - ii. pCO₂ working towards increasing the implementation of “super SOOP” installations.
 - iii. Foster metadata availability for underway stations, with potential focus on surface CO₂ through Soconet initiative.
 - iv. Continue to assist the growth of the other subnetworks (ADCP, CPR, TSG, Ferrybox, etc). Promote the use of SOT-IDs for all.
 - v. Recruitment of panel volunteers for TTs: KPI, ISSC, Metadata.
 - c. ASAPP (Rudolf Krockauer)

Implement descent profiles (additional to standard ascent profiles) on board all ships of the European E-ASAP fleet.
 - d. Task Team on VOS Delayed Mode Data (TT-VOS DM) (Axel Andersson)
 - i. Review of data exchange format, replacement of IMMT to overcome format limitations and adopt to new metadata standards.
 - ii. Review of MQCS (Minimum Quality Controls Standards).
 - iii. Undertake efforts for DM data submissions from more members.
 - e. Task Team on Recruitment, Promotion and Training (TT-RPT) (Joel Cabrie)
 - i. Conduct capacity development webinars (Metadata, Ship recruitment best practices).

² Future plans on implementation, instrumentation, data management, test, new sensors, plan for new EO/ECV observations, capacity development, etc.

- ii. VOS Donation Program – Candidates from Vanuatu and Solomon Islands to receive multiple barometers and transfer standards to assist with commencement of new VOS programs.
 - iii. Use the PMO-Buddies to support VOS Donation Program recipients to develop their national VOS programs.
 - iv. Review IMO MSC 1293, with ref to 2024 IMO-WMO symposium at IMO HQ; SOT to play a role there.
 - f. Task Team on Metadata (TT-Metadata) (Emma Steventon)
 - i. Arrange further training webinars for the wider SOT user community.
 - ii. Provide documentation to guide users on how to view, extract and export relevant information in addition to how to submit it.
 - iii. Continue to review new feature/functionality requests from members.
 - iv. Retire the OceanOps to Pub47 export.
 - v. Work with members to ensure their migration in using the new SOT metadata format.
 - g. Task Team on Key Performance Indicators (TT-KPI) (Elizabeth Kent)

The development of KPI for VOS that relate to the requirements for the WMP Rolling Review will be challenging in the absence of detailed information on data quality for each of the variables needed. Moving beyond simple counts of platforms and observations will be required, and plans are at a preliminary stage.
 - h. Task Team on Expansion of Independent Class Observations (TT-EICO) (Darin Figurskey)

Develop a basic guidance document to further community engagement in third-party observations and to assist interested parties in providing those types of observations.
4. Challenges and Concerns - at network and/or cross-network OCG level
- a. VOSP (Joel Cabrie)
 - i. Lengthy outage of OceanOPS portal during migration. Network operators unable to access new SOT-IDs or register new ships during this time.
 - ii. Development of Next Generation Turbwin software for the VOS network.
 - b. SOOPIP (Tamaryn Morris, Justine Park)
 - i. Lengthy outage of OceanOPS portal during migration. Network operators unable to access new SOT-IDs or register new ships during this time.
 - ii. Lack of participation and direct contact with IOC.
 - c. ASAPP (Rudolf Krockauer - Chair; Martin Kramp – OceanOPS TC)

Budget cuts and declining performance, no progress: ASAP is aside the eASAP program in N-Atlantic far from good/global coverage and national support, and eASAP is also reducing efforts in terms of funding for program management, recruited ships and number of launches. Unclear how next GBON steps (requiring Members to perform ASAP launches) can be implemented in such circumstances.
 - d. Task Team on VOS Delayed Mode Data (TT-VOS DM) (Axel Andersson, Martin Kramp):

Most data from VOS which goes to GTS is not submitted afterwards to one of the two VOS GDACs; the UK GDAC undergoes an IT update which presently leads to some inconsistencies, but work is in progress with German GDAC to overcome the issue.
 - e. Task Team on Key Performance Indicators (TT-KPI) (Elizabeth Kent)

Current funding issues at OceanOps poses a risk to implementation of new SOT KPIs.

- f. Task Team on Metadata (TT-Metadata) (Emma Steventon)
Current funding issues at OceanOps pose a risk to long term support and management of metadata across the networks.
5. Asks from OCG (Exec, networks, OceanOPS, and/or GOOS), perhaps related to the responses to parts 3 and 4 and how OCG can support your network
 - a. SOT (John/Huai-Min Zhang, Martin Kramp):
Discussions with shipping companies should be lifted to very high/exec level with the aim to achieve strong partnerships across the full OCG portfolio and potentially including contributions that go beyond deployment opportunities (e.g. also funding instrumentation, or in-kind support for software developments).
 - b. VOSP (Joel Cabrie)
Sustained funding solution for OceanOPS.
 - c. SOOPIP (Tamaryn Morris, Justine Park)
 - i. Letter from IOC/GOOS in support of ships riders to undertake SOOP observations on vessels of opportunity.
 - ii. More direct interaction with IOC/GOOS
 - iii. Increase fundraising activities for OceanOps from network member states.
 - iv. Engage industry partners at their forums. Commercial shipping concerns should be aware of these robust science activities and why they should participate.
 6. Recent publications, articles, etc. (if you want to share)
 - a. VOSP (Joel Cabrie)
 - i. New VOS Brochure published.
 - b. SOOPIP (Tamaryn Morris, Justine Park)
 - i. The XBT Best Practice was endorsed by GOOS endorsement and published
 - c. Synthesized datasets (Huai-Min Zhang & Elizabeth Kent, SOT Chair & Vice Chair):
 - i. A Daily version for the International Comprehensive Ocean Atmosphere Data Set (ICOADS) was released. The dataset combines ocean surface meteorological and oceanographic observations from ships, surface drifters, moored buoys, ice buoys, lightships, C-MAN and Costal stations, Rig platforms and Tide gauges.
<https://www.ncei.noaa.gov/data/international-comprehensive-ocean-atmosphere/v3/archive/nrt/>

