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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

Thirty-first Session of the Assembly
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Item **3.4.2** of the Provisional Agenda

PROPOSAL TO ESTABLISH THE IOC OCEAN DATA AND INFORMATION SYSTEM (ODIS)

Summary

Purpose of the document: This Document has been prepared in response to Decision IOC-XXX/7.2.2 (Ocean Data and Information System – ODIS) by which the Assembly invited the IODE Committee to prepare a fully detailed and costed project proposal for the IOC Ocean Data and Information System (ODIS) for submission to the IOC Executive Council at its 53rd session in 2020. Due to the postponement of the 53rd session of the Executive Council with a reduced agenda, the discussion of the proposal is on this Assembly's agenda.

Financial and administrative implications are covered in paragraphs 28 to 31 and Table 3.

The proposed decision(s) is referenced Dec. A-31/3.4.2(II) in the Action Paper (document IOC/A-31/AP Rev.)

1. A more comprehensive version of this document is available from the IODE-XXVI web site as Document IOC/IODE-XXVI/6.1.1. The related recommendation adopted by IODE-XXVI (20–23 April 2021) is available as Recommendation IODE-XXVI/6.1.1: Establishment of the IOC Ocean Data and Information System Project (ODIS).

Introduction

2. The IOC Assembly, at its 29th Session (June 2017) expressed its support for the proposed development of an Ocean Data and Information System (ODIS) concept paper and stressed that ODIS should focus on leveraging existing efforts. The concept paper states "*The IOC Ocean Data and Information System (ODIS) will be an e-environment where users can discover coastal and ocean data, information and associated products or services provided by IOC Member States, projects and other partners of IOC. The system will aim to align itself with accepted community data management principles, such as the FAIR (Findable, Accessible, Interoperable and Reusable) principles (Wilkinson et al[1].) and, where feasible, interoperate with existing data solutions*".

3. The IOC Assembly at its 30th Session, through Decision IOC-XXX/7.2.2 (Ocean Data and Information System (ODIS)):

> *"Endorsed the ODIS Concept, Implementation Plan and Cost Benefit Analysis;*
>
> *Invited the IODE Committee to prepare a fully detailed and costed project proposal for the IOC Ocean Data and Information System (ODIS) for submission to the IOC Executive Council at its 53rd session in 2020."*

4. This Document provides the "fully detailed and costed project proposal for the IOC Ocean Data and Information System (ODIS)". While this document should have been submitted to the Executive Council at its 53rd session in June 2020, this was not possible due to the COVID-19 pandemic. (see also IOC/EC-53/4.3.Doc for reference).

The ODIS vision

5. The overarching vision for ODIS has evolved since its inception in 2017 and is currently summarized as follows:

> The IOC Ocean Data and Information System (ODIS) will be an e-environment where users can discover data, data products, data services, information, information products and services provided by Member States, projects and other partners associated with IOC(*).
>
> *(*) while ODIS will initially focus on "partners associated with IOC" this can be expanded, taking into account the partnership established under the UN Decade of Ocean Science for Sustainable Development"*

Core components of the ODIS digital ecosystem

6. ODIS will be an open-ended system of systems, where components interoperate through ODIS-Arch. However, the components of the ODIS ecosystem will provide anchor points for the community. These either have been established or are in active development.

ODIS "digital ecosystem"

7. ODIS will interlink distributed, independent, systems (within and outside of the IOC) through a decentralized interoperability architecture (ODIS-Arch), to form a digital ecosystem. As with natural ecosystems, ODIS will be resilient to the gain or loss of parts, and accommodate high diversity of products and services, while maintaining its core functions. In this way, ODIS will provide a comprehensive and global "e-environment where users can discover data, data products, data

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1 Wilkinson, M. D, et al (2016) The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data, 3:160018 , DOI: 10.1038/sdata.2016.18

services, information, information products and services provided by Member States, projects and other partners associated with IOC." The ecosystem diagramme is shown in Figure 1.

8. The initial implementation of ODIS-Arch—upon which the digital ecosystem will rely—will be supported through the Ocean InfoHub (OIH) Project (see below) and will provide an interoperability layer and supporting technology to allow existing and emerging ocean data and information systems, from any stakeholder, to interoperate with one another. This will enable and accelerate more effective development and dissemination of digital technology and sharing of ocean data, information, and knowledge. As such, ODIS will not be a new portal or centralised system but will provide a collaborative solution to interlink distributed systems for common goals.

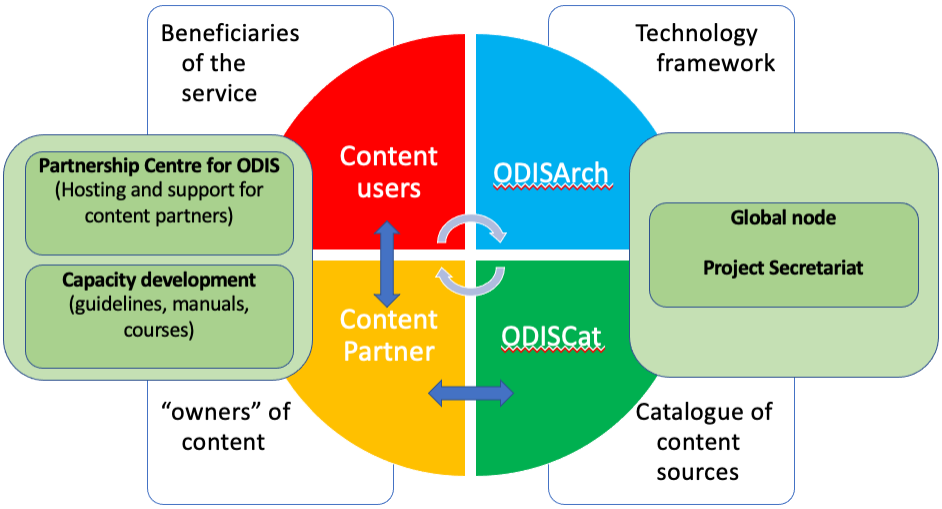

Figure 1: the ODIS digital ecosystem *(English only)*

ODISCat (https://catalogue.odis.org/)

9. The ODIS "Catalogue of Sources" is the initial demonstration of an online, browsable and searchable catalogue of existing ocean related web-based sources/systems of data and information, products, and services. Services such as ODISCat will provide an index and backbone for technologies navigating the ODIS ecosystem. ODISCat serves as a base source of information for planning regional and thematic nodes while acting as a discovery tool for users.

10. As the broader ODIS ecosystem develops, ODISCat will begin to use more intelligent and standardised mechanisms to extend and update its holdings.

Ocean InfoHub (OIH) (https://oceaninfohub.org/)

11. The Ocean InfoHub (OIH) Project aims to improve access to global ocean information, data and digitised knowledge products for management and sustainable development. Leveraging ODIS-Arch and the contributions from partners in ODIS, the OIH will link and anchor a network of regional and thematic nodes that will improve online access to and synthesis of existing global, regional and national data, information and knowledge resources, including existing clearinghouse mechanisms. The project will not establish a new centralized database but will support discovery and interoperability of existing information systems over the Web. The OIH Project is a three-year project (2020–2023) funded by the Government of Flanders (Kingdom of Belgium), and implemented by the IODE Project Office of the IOC/UNESCO.

Partnership Centre for ODIS

12. Multilateral partnership is at the core of both OIH and ODIS. These efforts will develop and support multi-way digital exchange: within each region, the partners who interoperate through ODIS-Arch will simultaneously contribute data and information to a digital commons and have access to the contributions of others, either directly or through hubs such as OIH.

13. Within the International Oceanographic Data and Information Exchange Programme (IODE), it has been widely recognized that many of the 150 IOC Member States currently do not have the required human and technical capacity to host online data and information services even when an National Oceanographic Data Centre (NODC) or IODE Associate Data Unit (ADU) is present. As the stakeholder focus of OIH goes beyond the "traditional" IODE community it is fair to assume that the number of potential data and information sources that cannot host their own online services will be substantially higher than those we are aware of today. As such, we risk a huge amount of data and information being effectively invisible and unable to help us face humanity's common challenges and meet our shared opportunities.

14. Within each region (initially Latin America, Africa and Pacific SIDS), partners without the necessary technology capacity will be able to share their data through the Partnership Centre. The Partnership Centre will service all current and future regional nodes. In some specific cases the Partnership Centre may also be requested to assist regional partners.

Cost benefit analysis

15. We refer to Document IOC-XXX/2 Annex 6 of 2019 (IOC Ocean Data and Information System (ODIS): Concept, implementation plan and cost benefit analysis) that identified Option 4: Stepwise development of ODIS leveraging existing infrastructure (ODISstep) as the preferred option with maximum benefits at a medium cost (Table 1).

16. Aside from its technical outputs, an immense benefit of Option 4 is the creation of a content development community with a common vision and shared coordination, with ODIS as its rally point. This will serve as a 'force multiplier', potentially amplifying and sustaining efforts.

	Cost	Benefits	Weaknesses
Option 4: Stepwise development of ODIS leveraging existing infrastructures (ODISstep)	Medium: $528,000[2]	Maximum use of existing infrastructure, existing systems and existing expertise. Creation of a community of developers around a common vision. Minimum duplication of effort. Multiple stakeholder communities. Pooled and distributed ability to respond to user needs across scales as defined by stakeholder communities. Gradual development allows more agile resource mobilization and proof of concept for each component.	Incremental advances may seem minor compared to 'big bang' advances by organizations working in silos (e.g. quicker delivery by short circuiting community engagement and shared ownership and management). More difficult to gain and maintain interest by organizations having much to contribute, but who wish to move more quickly.

Table 1: benefits and weaknesses of ODIS option 4 (Stepwise development of ODIS leveraging existing infrastructures (ODISstep)) *Source: IOC-XXX/2 Annex 6*

[2] This amount assumed certain staff costs would be provided as in-kind contributions and costing dated from 2017.

17. This being said, there are a number of factors that will impede the development of the system and which need to be considered:

- Highly variable (meta)data storage and exchange formats
- Highly variable quality control methods and flags
- Semantic inconsistencies including:
  - At a high-level, varied definitions of “data set”, or even “data”, “information”, and “knowledge”;
  - Inconsistently applied controlled vocabularies and semantic description resources
- Widespread duplication of effort
- Unwillingness to share data freely and openly, despite existing IOC data policy
- Insufficient provenance tracking, including machine-readable licenses and restrictions/permissions
- Lack of (sufficient) data/information management plans in projects
- Lack of expertise to manage data and information
- Lack of sustained coordination, despite notable efforts.

18. Collectively, these factors impede machine-to-machine interoperability that will allow ODIS to leverage existing infrastructures and resources. However, consistent and concerted efforts from the IOC and IODE are already stimulating a new willingness for the ocean community to coherently address these issues.

19. A number of initiatives are trying to address some of the above, some regional and some global, and some of which involve IOC and its IODE (such as the Ocean InfoHub) but substantial efforts will still be required to resolve the above issues. This will be taken into account in the workplan.

20. It is essential that IOC, through ODIS becomes closely involved in these efforts to agree on global “best practices” or “standards” facilitating a truly global ocean data and information system that allows the discovery of and access to data at the data set (or even observation) level, as well as information, products and services using a “free and open” policy.

21. It is noted that partnerships with the private sector (IT) may be considered to assist with the development of ODIS. Some of these partnerships are being discussed or starting.

Project Objectives and Workplan

Project objectives:

(i) The ODIS Project will **develop the technology** and **collaborative culture (communities)** required *to build the IOC Ocean Data and Information System (ODIS) e-environment where users can discover data, data products, data services, information, information products and services provided by Member States, projects and other partners.* Users and developers will access and build upon the resources of multiple components, through the interfaces of any single component. The project will further build upon the **“proof-of-concept reference architecture” (ODIS-Arch)**, developed by the Ocean InfoHub project that will enable multiple data systems to interoperate with IOC systems and with each other across a range of information types through machine-to-machine interactions. This will initiate a process to remedy the current lack of automated and scalable communication between the many (hundreds) of marine data and information systems, such that both developers and end-users must query and download from each online source, often expending immense resources to contend with a multitude of shifting formats and conventions.

(ii) The project will **test the developed technology** through demonstrator sub-projects developed with regional data and information nodes to meet the needs of their users. Technology and capacities developed through these demonstrators will then be shared through the ODIS network, as described below.

(iii) The project will **seek to add additional data and information provider systems**, based upon information available from the ODISCat catalogue of sources.

(iv) The project will, based upon the experience gained through the Ocean InfoHub project, develop (as requested by IOC Regional Subsidiary Bodies and other groupings of Member States or partner organizations/programmes) **additional regional data and information nodes** to meet the needs of their users.

(v) The project will provide a "**node hosting service"** for Member States without the necessary infrastructure. This service will be provided by the "IODE Partnership Centre for ODIS".

(vi) The project will provide **technical and procedural guidance documentation as well as related training** to assist data/information providers as well as diverse user communities with the necessary capacity to actively and equitably participate in ODIS.

Implementation strategy:

22. The objectives listed above will be implemented through a number of work packages. It is noted that for each of the work packages performance indicators will be identified. This will be done by the Steering Group (see WP1) at its first meeting, with advice and guidance by the IODE Steering Group for the Ocean InfoHub project. The project work packages will be:

- **WP1**: Project management, coordination and evaluation
- **WP2**: Technology development
- **WP3**: Establishment and initial support of the global hub and regional nodes
- **WP4**: Training and capacity development for data providers and users
- **WP5**: Communication, user marketing and feedback

Project stakeholders: beneficiaries and partners:

23. The ODIS project will serve the following user groups:

(i) Scientists (academic and private sector)
(ii) Government agencies/policymakers
(iii) IOC global and regional programmes
(iv) IODE National Oceanographic Data Centres (NODCs), IODE Associate Data Units (ADUs) and IODE Associate Information Units (AIUs)
(v) UN agencies, International Governmental Organizations (IGOs)Non-Governmental Organizations (NGOs)
(vi) Industrial and commercial enterprises
(vii) Citizen scientists and general public

24. It is important to note that the above-mentioned user groups are also those who provide content to the system. This will enhance the self-driven nature of the system and thus ensure its sustainability beyond the lifespan of the project. Furthermore, the distributed approach will allow further expansion of the "partner network" with new content providers as well as users, thereby further enriching the content ecosystem.

25. In addition, the project will target early career scientists and aim at mainstreaming initiatives that contribute to UNESCO's global priority on gender equality, complemented by measures to reduce disparity, inequity, and underrepresentation along other axes of diversity.

Project implementation timing

26. The below table provides an overview of the project implementation planning between 2021 and 2025. In this regard it is important to note that during the period 2021–2023, a number of activities will be undertaken jointly between the ODIS project and the Ocean InfoHub project (which ends early to mid-2023). Joint activities are marked **Y** in the table.

27. At a later stage the deliverables described under work packages 1 to 5 will be associated with the timeline described below (by the launching event or the Steering Group).

Key Activities	Year 1 (2021)		Year 2 (2022)		Year 3 (2023)		Year 4 (2024)		Year 5 (2025)	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
WP1: Project Management and Coordination										
1.1 Steering Group establishment		*X*								
1.2 Meeting steering group (jointly with SG-OIH) (online or face-to-face)		***Y***	***Y***	***Y***	***Y***	*X*	*X*	*X*	*X*	*X*
1.3 Project regular evaluation						*X*				*X*
WP2: Technology development and operations										
2.1 operation of Global Hub	***Y***	***Y***	***Y***	***Y***	***Y***	*X*	*X*	*X*	*X*	*X*
2.2 further development and maintenance of Regional/Thematic Node application	***Y***	***Y***	***Y***	***Y***	*X*	*X*	*X*	*X*	*X*	*X*
2.3 continued population of ODISCat	***Y***	***Y***	***Y***	***Y***	*X*	*X*	*X*	*X*	*X*	*X*
2.4 establishment of the Partnership Centre for ODIS		***Y***								
2.5 operation of the Partnership Centre for ODIS		***Y***	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
WP3: network expansion										
3.1 implementation, testing and support necessary to establish the new/additional regional/thematic ODIS nodes and support them to the point where they are self-sustaining (1)			*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*
WP4: Capacity development										
4.1 Operations manuals (administrators, content providers, end users) (to be made available in English, French, Spanish) (1)	***Y***	***Y***	***Y***		*X*		*X*		*X*	
4.2 Online training courses (for administrators/node managers and content providers and end users) (to be made available in English, French, Spanish) (1)	***Y***	***Y***	***Y***		*X*		*X*		*X*	

Key Activities	Year 1 (2021)		Year 2 (2022)		Year 3 (2023)		Year 4 (2024)		Year 5 (2025)	
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
4.3 Coordinated staffing, professional development, and other strategies for increasing base of skilled workers to undertake required support activities (1)			X		X		X		X	
4.4 Communication skills course (for administrators/node managers)			X	X		X		X		X
WP5: Communication, users marketing and feedback:										
5.1 development and implementation of the ODIS communication plan					X					
5.2 Presentations about the ODIS at the IOC Governing Bodies, Regional and other subsidiary body meetings, and other relevant venues		Y	Y	X	X	X	X	X	X	X
5.3 News releases, success stories, and reusable presentation/communication materials (presentations, posters, flyers, etc.).		Y	Y	X	X	X	X	X	X	X
5.4 Global, regional and thematic mailing lists			Y	X	X	X	X	X	X	X
5.5 Contributor and user feedback/satisfaction surveys.				X		X		X		X
5.6 Updated needs assessment and comparison with previous engagement			X		X		X		X	

Table 2: ODIS project implementation timing

Financial implications (costing)

28. A preliminary costing estimate was prepared in Document IOC-XXX/2 Annex 6 (IOC Ocean Data and Information System (ODIS): Concept, implementation plan and cost benefit analysis) and has been updated in terms of detail and for a period of five years (2021–2025).

29. As the establishment of additional regular UNESCO positions is extremely difficult (possibly impossible until 2024), Member States are invited to consider long-term secondments to either the IOC Project Office for IODE in Ostend (Belgium) or as “virtual secondments” whereby the seconded staff works from his/her usual place of work.

30. It is furthermore important to note that the project costing as shown below covers only the project coordination and central services. Member States participating in ODIS will need to allocate their own staff and additional resources (e.g. infrastructure) to participate in the ODIS activities and network. These are NOT included in the cost estimates below. It is noted further that the costing estimates have been prepared on a “best estimate” basis and may change as project implementation proceeds. The IODE Steering Group for the ODIS Project will be responsible for continuously monitoring progress and to update resource requirements.

Cost components:

31. The cost components of the project are as follow (provisional and at best estimate basis):

- Component 1: ODIS Secretariat operations
- Component 2: Capacity Development (through Ocean InfoHub Phase 1 and beyond)
  - Sub-component 2.1: Partnership Centre for ODIS
  - Sub-component 2.2: Assistance to Member States to join the network
  - Sub-component 2.3: Assistance to Member States and individual users to use the services
- Component 3: Further development and maintenance of ODISCat
- Component 4: National activities related to ODIS participation

Overall costing table:

Year → **Cost item** ↓	2021 (in US$)	2022 (in US$)	2023 (in US$)	2024 (in US$)	2025 (in US$)	Total (in US$)
COMPONENT 1	30,000	419,000	419,000	419,000	419,000	1,706,000
COMPONENT 2	0	60,000	60,000	60,000	60,000	240,000
COMPONENT 3	30,000	80,000	80,000	80,000	80,000	350,000
COMPONENT 4	0	0	0	0	0	0
TOTALS	**60,000**	**559,000**	**559,000**	**559,000**	**559,000**	**2,296,000**

Table 3: provisional (best estimate) budget of the ODIS project (2021–2025)

Proposed decision

32. In view of the above, the proposed decision is referenced Dec. A-31/3.4.2(II) in the Action Paper (document IOC/A-31/AP Rev.)