



IMPLEMENTATION STRATEGY
FOR THE
SECOND INTERNATIONAL
INDIAN OCEAN EXPEDITION
2015-20

4 December 2015



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I Executive Summary

This Implementation Strategy for IIOE-2 plays a key role in supporting the IIOE-2's mission: to advance our understanding of the Indian Ocean and its role in the Earth System in order to enable informed decisions in support of sustainable development and the well-being of humankind.

It builds on the four years of consultations, planning and institutional advocacy that have been undertaken for the IIOE-2 involving the Indian Ocean's regional constituency as well as complementary global stakeholders. It forms the final link in the series of three seminal documents developed to precede the IIOE-2 launch in India on 4 December 2015, the other two being: the SCOR Science Plan Development Committee's IIOE-2 Science Plan (Hood et al, 2015), which is the science framework for the IIOE-2; and the IOC Interim Planning Committee (Group of Experts) Strategic Framework for the Implementation of IIOE-2 (IPC, 2015). It is further underpinned by a vast amount of material having derived from a series of planning workshops, meetings and institutional deliberations by the co-sponsors IOC, IOGOOS and SCOR, available at www.iocperth.org and to be consolidated into the soon to be established IIOE-2 website at ESSO-INCOIS, Hyderabad, India.

This document is designed to provide a guiding strategy rather than a detailed operational procedure for the Expedition. Full operational details will be developed under the auspices of the Steering Committee, through its associate elements including the science theme leaders and the Working Groups, and will be established as a priority after the IIOE-2 is launched. This Implementation Strategy therefore focusses on providing motivations and related objectives with associated recommended actions (in some cases committed actions) in response to the major elements of the IIOE-2 portfolio. It thereby suggests and recommends ways in which the Steering Committee's and its Working Groups' aspirational frameworks can be best achieved.

The major sections cover the structure of the IIOE-2 Steering Committee, its associated Governance, its elemental membership and the functions of the seven Working Groups to be formed under it. The Joint Project Office, currently established with two key Nodes in Australia and India, is also addressed in terms of its structure and functions, and its role in organising sustained sponsorship and resourcing support over the five-year term of the Expedition.

A strong emphasis is placed on ensuring that the IIOE-2 is efficiently and professionally run, administered and resourced. Another key emphasis is ensuring that the science to be undertaken is of contemporary relevance, of a high standard and is integrated within the thematic elements of the Science Plan. Priority is also given to ensuring that the data and information management thereof supports the optimal utilisation of the science effort that will be assigned to IIOE-2.

Another key aspiration is to leave a lasting legacy throughout the Indian Ocean region, as did the original IIOE of fifty years ago, by establishing the basis for improved scientific knowledge transfer to wider segments of society and regional governments, and to enable educational and capacity development opportunities in support of regional and early career scientists. The importance of these objectives is reflected in the establishment of two special IIOE-2 Working Groups for Capacity Development and Translating Science for Society.

The Implementation Strategy will be reviewed and updated if and as required on an annual basis, with the review process to be informed by input from the annual IIOE-2 symposia and planning meetings.

2 Introduction

The IIOE-2's mission is: to advance our understanding of the Indian Ocean and its role in the Earth System in order to enable informed decisions in support of sustainable development and the well-being of humankind.

In support of this mission, the Implementation Strategy aligns with a number of key preceding IIOE-2 documents, including: the SCOR Science Plan Development Committee's (SPDC) IIOE-2 Science Plan (Hood et al, 2015), which is the underpinning framework for the science of IIOE-2; and the Strategic Framework for the Implementation of IIOE-2 (IPC, 2015). It is written to act as a succinct 'guide' for the implementation of IIOE-2, with the specification and Implementation of further detail to be overseen by the IIOE-2 Steering Committee.

The Implementation Strategy has been structured to include nine key chapters: one for Governance; one for each of the respective IIOE-2 Working Group themes of Science and Research, Data and Information Management, Capacity Development, Operational Coordination, Outreach and Communication, Translating Science for Society, Resourcing and Sponsorship; plus one for the Joint Project Office.

For many of the key issues there are specific objectives and associated actions which provide descriptors that can be used to guide 'what is to be done' in an implementation context, and have been so designed in order to facilitate the IIOE-2 achieve its mission.

3 Governance

Introduction

A governance structure is required in order to provide the strategy, leadership and stakeholder relationships that underpin the delivery of IIOE-2. The guiding principles of governance are based on fairness, consistency, transparency, cohesiveness and ensuring 'fitness-for-purpose' in the structures, strategies and delivery of IIOE-2. Effective governance is also required to ensure proper oversight and accountability for public resources. IIOE-2 structures and delivery mechanisms are intended to be science-driven and outcome-focused.

The principles underlying the structure and representativeness of the IIOE-2 Steering Committee were first specified in Strategic Framework for the Implementation of IIOE-2 (IPC, 2015), endorsed by IOC and published as IOC/INF-1324.

Sponsors

The sponsors of IIOE-2 are IOGOOS, SCOR and UNESCO IOC. Collectively these autonomous international bodies, each involved in science in the Indian Ocean, take responsibility for facilitating funding of the infrastructure of IIOE-2 including facilitating resourcing of the Joint Project Office, with major initial nodes in India and Australia. In practice, this is likely to involve calls to countries for resourcing (see below).

Steering Committee

Role: The over-arching role of the IIOE-2 Steering Committee (SC) is to set the high-level policies and take responsibility for the delivery of the project over the 2015–2020 period.

Structure: The IIOE-2 SC framework was laid out in IPC (2015). The IPC's recommended SC structure, as slightly modified with respect to IPC (2015), is shown in Figure 1.

Chairing: The IIOE-2 SC will be chaired by the sponsors: IOGOOS, SCOR and UNESCO IOC. The chairing mechanism will be decided by the sponsors at or before the first meeting of the IIOE-2 SC. The three sponsors may co-chair or the chairing may rotate among the three sponsors, with a Chair and two Vice-Chairs. Irrespective of the chairing procedure, the sponsors have equal rights, and share responsibilities in appointing the science theme leaders and the operational division (Working Group) leaders.

	Co-Chairs (IOGOOS, SCOR, UNESCO IOC)	
core group	<p style="text-align: center;">Strategic Executive Level</p> <p style="text-align: center;">One representative (leader) per each of the six science themes from the SCOR SPDC IIOE-2 Science Plan</p> <p style="text-align: center;">+</p> <p style="text-align: center;">One representative (leader) per each of the seven operational divisions to be established as IIOE-2 Working Groups</p> <p style="text-align: center;">+</p> <p style="text-align: center;">One representative per each major IOC regional body/committee (e.g. IOC AFRICA, IOCINDIO, IOC WESTPAC)</p>	Joint Project Office (JPO)
stakeholder group	<p style="text-align: center;">Regional Coordination Level</p> <p style="text-align: center;">One representative per each IIOE-2 ‘national committee’</p> <hr/> <p style="text-align: center;">Science Delivery Level</p> <p style="text-align: center;">One representative (i.e. Principal Investigator) per each ‘major’ IIOE-2 scientific research initiative, including a representative of the Early Career Scientists Network from the Capacity Development Working Group</p>	Leading personnel represented on Steering Committee as ex-officio

Figure 1: The IIOE-2 Steering Committee structure

Main groupings within SC: As shown in Figure 1, the SC comprises a ‘core group’, being the Strategic Executive Level (the ‘Executive’) and a broader more operationally orientated ‘stakeholder group’ including the respective Regional Coordination and Science Delivery levels.

Core group

The Executive will include one representative for each of the six over-arching science themes derived from the IIOE-2 Science Plan. The six themes are: 1) Human impacts; 2) Boundary current dynamics, upwelling variability and ecosystem impacts; 3) Monsoon variability and ecosystem response; 4) Circulation, climate variability and change; 5) Extreme events and their impacts on ecosystems and human populations; and 6) Unique geological, physical, biogeochemical, and ecological features of the Indian Ocean. These over-arching themes provide scientific areas for interested parties to engage in IIOE-2 and to identify and select scientific relevancies for their respective interests. The Executive will also include one member from each of the seven recommended operational divisions

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(Working Groups), namely: Science and Research; Data and Information Management; Capacity Development; Operational Coordination; Outreach and Communication; Translating Science for Society; and Resources and Sponsorship.

The Executive will also comprise representatives of key Indian Ocean related IOC regional bodies and committees and ex-officio members from the JPO, as appropriate. It is expected that the regional bodies and committees will be represented by their Chairs.

Each of the seven recommended IIOE-2 operational divisions will be established as IIOE-2 Working Groups, with their own leadership and participatory membership structures, formed under the oversight of the SC. IIOE-2's steering 'community', of science themes, Working Groups and others as described by this proposed structure, will work collaboratively and through annual IIOE-2 wide symposia that will constitute essential sessions at which assessment, exchange of information, review and forward planning take place. The science themes and Working Groups could also allow for their own inter-sessional gatherings to address issues specific to individual themes or Working Groups or that cut across two or more themes and/or Working Groups, as might be required and as feasible.

Stakeholder group

Membership of the 'stakeholder group' of the SC will derive from two supporting groups of IIOE-2 namely: (i) representatives (typically the Chairs) of IIOE-2 'national committees', noting that each country that has an effective IIOE-2 national committee involved in the delivery of IIOE-2 may provide a single member of the SC; and (ii) a leading scientist (typically the Chair or Principal Investigator) from each respective major science initiative established, approved and implemented under the IIOE-2's science framework. Since these stakeholder groups are self-contained and will choose their own Chairs/Leaders, representation at the SC will evolve naturally within each group. The JPO will communicate with and advise these groups as necessary.

SC membership and renewal

The leaders of the themes and the Working Groups in the Executive will initially be chosen by the SC Co-Chairs in order to balance nationalities, genders and experience in international science activity.

All SC members should rotate once during the lifetime of the 5-year programme using a process to be defined by the Co-Chairs. Membership rotation will have to be staggered to ensure continuity.

On rotation, theme and Working Group leaders will be chosen by the members of their own theme or Working Group committee.

It is also expected that representatives of regional bodies and committees will rotate during the lifetime of IIOE-2. Such rotation would be in accordance with their own body/committee processes.

The Co-Chairs will, as an early high priority, oversee: (i) a refinement of the membership selection, appointment and rotation policy; and (ii) the implementation of that policy.

Meeting frequency: The SC will meet at least once annually (face to face) and additionally inter-sessionally by electronic communication if and as required. It will take a view of IIOE-2 over the long-term period. The Executive will be in frequent contact by electronic communication.

Annual symposia: The programme of annual IIOE-2 symposia will comprise complementary science and planning streams. Each symposium will involve a general IIOE-2 related science programme along with a SC led annual planning meeting that cuts across the entire SC constituency. The annual symposia will be developed under the auspices of the SC in close working with the JPO. Advocacy to secure hosts and sponsors, resourcing in general and logistical underpinning for the annual meetings will be coordinated through liaison between the SC, IIOE-2 sponsors and the JPO.

Reporting to Sponsor organisations: It will be the responsibility of the individual sponsors' representatives (ie the SC Co-Chairs representing IOGOOS, SCOR and IOC, respectively) to report back to their own organisations as and when required.

IIOE-2 Joint Project Office (JPO)

Earlier referred to as the International Project Office Framework (IPC, 2015), the now named 'Joint Project Office' (JPO) defines the nodal point network for IIOE-2 delivery and will have day-to-day responsibility for the co-ordination and implementation of IIOE-2. Two major nodes of the JPO are already established: respectively the IIOE-2 JPO Office in India (INCOIS, Hyderabad) and the IIOE-2 JPO Office in Australia (IOC Perth Programme Office [PPO], linking with supporting IOC HQ and regional office bases generally).

The JPO will facilitate all aspects of IIOE-2, particularly the science and associated infrastructure, as well as capacity building, operational coordination, outreach/communication, data/information management, sponsorship facilitation and knowledge transfer for societal benefit.

The JPO will draw collaborative support from established IOC Member State institutions in respect to providing infrastructure and resources, consistent with the IOC's 28th Assembly Resolution on IIOE-2 (IOC-XXVIII/DR (5.3) Rev 2). The Resources and Sponsorship and the JPO sections, below, refer to a list of key functions required for overall IIOE-2 project management.

The major JPO nodes will be respectively supported by at least one salaried full-time staff person with required administrative and hosting resources, and that person will be line-managed by their parent employing host, but with responsibilities in terms of their IIOE-2 support function to the Co-Chairs of the SC under an agreed job description and associated terms of reference between the host and SC (i.e. through the Co-Chairs). Any complementary additional IIOE-2 support staff, either under sponsorship or secondment to the JPO nodes or operating as national employees within supporting Member States, will have their normal institutional line-management respected, with due notice taken of input from the SC Co-Chairs over staff tasking and performance. There will be a formal agreement (such as a MoU) between host institutes and the sponsors and, if necessary, with the normal institute of the staff member.

The IOC node of the JPO in Perth will include one salaried full time IOC IIOE-2 Coordinator acting as a principal point of contact between the JPO and the community, and ensuring efficient coordination and dissemination of communications, with the responsibility of working closely and at required frequency with other JPO focal points. The working model for the JPO will be reviewed informally by the Steering Committee from time to time.

Research Initiatives and their endorsement under IIOE-2

The IIOE-2's research initiatives (eg EIOURI, WIOURI) form the heart of science delivery and so this constitutes the major element of IIOE-2. Each major research initiative will have its own coordinating or governing mechanism that would involve the main scientists involved in the initiative. Members of each coordinating or governing mechanism are most likely to be volunteers as they are fuelled by self-interest. Each initiative will have a representative focal point as a member of the SC (ie the 'PI', as per the Science Delivery Level of the SC structure in Figure 1). Each initiative will work and meet through modalities that its own resourcing allows, but should at least communicate regularly by cost effective modes such as web-based meetings and email. There will be a strong link between each research initiative and the JPO.

Free standing sub-projects outside research initiatives will be represented on the SC through their national committees.

PIs seeking endorsement of their projects as part of IIOE-2 should contact the JPO for guidance. In this regard, the SC will oversee the process of developing the IIOE-2 protocol for assessing and endorsing proposals under IIOE-2. This will be one of the SC's early priorities and will be undertaken in conjunction with the IIOE-2 WG network, particularly the Science and Research Working Group, in order to ensure that IIOE-2 activities adequately refer to and align with IIOE-2's integrated objectives.

IIOE-2 National Committees

As the funding for IIOE-2 activities will be principally generated within each country, each country should have an IIOE-2 'National Committee' with a Chair who is the point of contact for the SC and the JPO. Hence, IPC recommends that each participating country have an IIOE-2 National Committee representing their IOGOOS, SCOR and IOC communities. It is noted that in most countries there are already national committees or focal point groupings relating to IOGOOS, SCOR and IOC programmes and so there should be useful existing available infrastructure to facilitate the IIOE-2 National Committee objective. How National Committees are run will depend on the respective national need. Guidelines on this will be available from the JPO. These committees would be self-sustaining but would need to adhere to principles of the SC and their own respective local sponsoring organisations.

IOC regional bodies and committees

Involvement of IOC regional organizations and programmes within the IIOE-2 (e.g. IOC AFRICA, IOCINDIO, IOC WESTPAC and others) should be encouraged and facilitated. There are explicit membership positions allowed for in the Strategic Executive Level of the SC for IOC regional bodies and committees. These positions will provide an efficient and formal entre point option for their respective constituents to be represented and to engage in IIOE-2 in a regionally coherent and coordinated manner.

Partners in support of IIOE-2

Other relevant complementary organisations will be welcome to participate in the IIOE-2 and are encouraged to form alliances with the various elemental levels of the SC.

4 Science and Research

4.1 Introduction

The IIOE-2 Science Plan articulates the overarching goals and the core research themes of the Expedition, as follows. The overarching goal of IIOE-2 is to advance our understanding of interactions between geologic, oceanic and atmospheric processes that give rise to the complex physical dynamics of the Indian Ocean region, and determine how those dynamics affect climate, extreme events, marine biogeochemical cycles, ecosystems and human populations. This understanding is required to predict the impacts of climate change, pollution, and increased fish harvesting on the Indian Ocean and its surrounding nations, as well as the influence of the Indian Ocean on other components of the Earth System. New understanding is also fundamental to policy makers for the development of sustainable coastal zone, ecosystem, and fisheries management strategies for the Indian Ocean. Other goals of IIOE-2 include helping to build research capacity and improving availability and accessibility of oceanographic data from the region. The IIOE-2 Science Plan is structured around six scientific themes. Each of these include a set of questions that need to be addressed in order to improve our understanding of the physical forcing that drives variability in marine biogeochemical cycles, ecosystems and fisheries in the Indian Ocean and to develop the capacity to predict how this variability will impact human populations in the future. It is also important to emphasize that most of these questions are relevant to open-ocean, coastal and marginal sea environments.

- **Theme 1: Human impacts** (How are human-induced ocean stressors impacting the biogeochemistry and ecology of the Indian Ocean? How, in turn, are these impacts affecting human populations?)
- **Theme 2: Boundary current dynamics, upwelling variability and ecosystem impacts** (How are marine biogeochemical cycles, ecosystem processes and fisheries in the Indian Ocean influenced by boundary currents, eddies and upwelling? How does the interaction between local and remote forcing influence these currents and upwelling variability in the Indian Ocean? How have these processes and their influence on local weather and climate changed in the past and how will they change in the future?)
- **Theme 3: Monsoon variability and ecosystem response** (What factors control present, past and future monsoon variability? How does this variability impact ocean physics, chemistry and biogeochemistry in the Indian Ocean? What are the effects on ecosystems, fisheries and human populations?)
- **Theme 4: Circulation, climate variability and change** (How has the atmospheric and oceanic circulation of the Indian Ocean changed in the past and how will it change in the future? How do these changes relate to topography and connectivity with the Pacific, Atlantic and Southern oceans? What impact does this have on biological productivity and fisheries?)
- **Theme 5: Extreme events and their impacts on ecosystems and human populations** (How do extreme events in the Indian Ocean impact coastal and open-ocean ecosystems? How will climate change impact the frequency and/or severity of extreme weather and oceanic events, such as tropical cyclones and tsunamis in the Indian Ocean? What are the threats of extreme weather events, volcanic eruptions, tsunamis, combined with sea level rise, to human populations in low-lying coastal zones and small island nations of the Indian Ocean region?)

- **Theme 6: Unique geological, physical, biogeochemical, and ecological features of the Indian Ocean** (What processes control the present, past, and future carbon and oxygen dynamics of the Indian Ocean and how do they impact biogeochemical cycles and ecosystem dynamics? How do the physical characteristics of the southern Indian Ocean gyre system influence the biogeochemistry and ecology of the Indian Ocean? How do the complex tectonic and geologic processes, and topography of the Indian Ocean influence circulation, mixing and chemistry and therefore also biogeochemical and ecological processes?)

In order to deliver on its goals and objectives, IIOE-2 will focus on three major areas of science activity: 1) remote sensing studies; 2) modelling and assimilation studies; and 3) in situ observation and potential for leveraging existing infrastructure. All of these will require close collaboration and multidisciplinary integration of knowledge obtained by teams of researchers operating throughout the Indian Ocean.

4.2 Science and Research – Objectives and Actions

Objective 4.2.1: Ensure continued development, integration and promotion of the IIOE-2 science themes to assure effective delivery of IIOE-2 science.

Each of the IIOE-2 science themes includes a set of questions that need to be addressed in order to improve our understanding of the atmospheric, oceanic and geologic dynamics of the Indian Ocean. Addressing these questions will ensure the development of the understanding that is needed to predict how variability in these dynamics will impact human populations in the future.

Action 4.2.1.1: The Science and Research Working Group should establish chaired subcommittees for each of the IIOE-2 science themes to oversee their delivery.

Action 4.2.1.2: The Science and Research Working Group should ensure that there is communication and effective linkages with and between these science theme subcommittees.

Objective 4.2.2: Translate the research questions identified in the IIOE-2 Science Plan (and in the Science Plans of other relevant programs complementary to IIOE-2) into specific studies that should be motivated in IIOE-2.

The research themes and questions identified by the IIOE-2 Science Plan provide the motivation for a wide range of targeted IIOE-2 studies. In addition, since the finalization of the Science Plan, additional research priorities have been identified, such as in the International Ocean Discovery Programme Science Plan, that should be pursued under IIOE-2.

Action 4.2.2.1: The Science and Research Working Group should implement a process to identify and advocate for specific targeted oceanographic, atmospheric, geologic and human impact studies that need to be pursued as part of IIOE-2 derived from the Science Plan and other relevant programs complementary to IIOE-2.

Objective 4.2.3: Promote and incorporate new research initiatives that align with the IIOE-2 Science Plan.

In addition to coordinating ongoing research, the IIOE-2 is working to initiate new research projects and programmes that are designed to address the core IIOE-2 research themes. These will include both national and international efforts, across planned and prospective initiatives.

Action 4.2.3.1: The Science and Research Working Group should promote the development and implementation of:

- The Eastern Indian Ocean Upwelling Research Initiative (EIOURI);
- The Western Indian Ocean Upwelling Research Initiative (WIOURI);
- The Year of the Maritime Continent; and
- Any other existing or planned initiatives that align with the IIOE-2 Science Plan

It is important to emphasize that these are just examples of research initiatives that are already emerging under IIOE-2. Indeed, the scope of the Expedition is much broader than these initiatives and embraces many other aspects of physical, chemical and biological oceanography and also geology and atmospheric science. Efforts should be undertaken to promote additional interdisciplinary research initiatives under IIOE-2. These could include initiatives dedicated to any of the six core themes articulated above.

Objective 4.2.4: Effectively integrate the IIOE-2 with the remote sensing research community in order to maximize use of remote sensing data in the Expedition.

IIOE-2 studies in the Indian Ocean should take full advantage of remote sensing to support their scientific objectives. The IIOE-2 framework requires a coordinated approach to address this issue and therefore a dedicated task team is recommended.

Action 4.2.4.1: The Science and Research Working Group should establish an IIOE-2 Remote Sensing Task Team. This Task Team should work to establish strong ties with scientists and agencies that are actively involved in remote sensing-oriented research, motivate the use of available remote sensing tools, information and related studies as required, and thereby maximise the benefits that remote sensing can bring to the science and research objectives of IIOE-2.

Objective 4.2.5: Promote modelling and data assimilation studies in IIOE-2.

IIOE-2 studies in the Indian Ocean should take full advantage of advanced scientific modelling and related data assimilation methods to study and understand oceanic, atmospheric and geologic variability.

Action 4.2.5.1: The Science and Research Working Group should develop effective engagement mechanisms between the IIOE-2 and the modelling research community and promote studies of:

- Ocean and atmosphere circulation, variability and change;
- Biogeochemical processes and variability;
- Tectonic processes;
- Impacts of riverine and atmospheric inputs;
- Higher trophic level modelling; and
- Data assimilation for modelling

Objective 4.2.6: Leverage existing research infrastructure in the Indian Ocean.

Long-term in situ observing and monitoring efforts are ongoing in several coastal and open ocean locations in the Indian Ocean. Studies motivated as a part of IIOE-2 should target, leverage and build upon this existing research infrastructure.

Action 4.2.6.1: The Science and Research Working Group should promote and facilitate leveraging of:

- Coastal monitoring and observation programs;
- Open ocean monitoring and observation programs;
- National marine and related observing systems;
- GO-SHIP;
- Ships of Opportunity programs;
- Citizen science initiatives;
- The International Ocean Discovery Programme (IODP);
- InterRidge (International Cooperation in Ridge-Crest Studies);
- The EAF-Nansen Project;
- Large Marine Ecosystem Programs; and
- Any other identified existing or emerging programmes that align with this objective

Objective 4.2.7: Establish the scientific criteria for determining whether or not a research initiative or project qualifies as IIOE-2 research.

The IIOE-2 Steering Committee will develop criteria for determining whether or not a particular research initiative or project qualifies as IIOE-2 research. The Science and Research Working Group will have to facilitate the SC's work in this regard by helping to develop the scientific criteria for making this judgement.

Action 4.2.7.1: The Science and Research Working Group should provide input to the SC Executive to assist in the development of the IIOE-2 Research Project endorsement criteria.

Objective 4.2.8: Insure that data collected by different research groups and countries that are participating in IIOE-2 adopt common methods and standards so that ultimately, these data can be compared and combined into larger scale data sets.

The IIOE-2 should identify the variables that will be measured basin-wide and inter-calibration activities for these measurements should be conducted, manuals of standard methods should be compiled, and training thereof should be carried out.

Action 4.2.8.1: The Science and Research Working Group should establish a Task Team on Inter-calibration to insure:

- Consultation of manuals and experts on best practices, inter-calibration and the use of standards and reference materials to underpin the development of inter-calibration guidelines (or best practices) for the IIOE-2 (perhaps a manual); and
- That the guidelines that are developed include recommendations for carrying out training to insure that the guidelines are understood and followed

Objective 4.2.9: Facilitate collegial collaboration and cooperation among IIOE-2 scientists and with other relevant programs.

Collegial collaboration and cooperation among IIOE-2 scientists and communication with other relevant programmes will be vital to the success of IIOE-2.

Action 4.2.9.1: The Science and Research Working Group should:

- Facilitate collegial collaboration and communication among IIOE-2 Scientists;
- Work with the JPO on the development of scientific agenda for annual IIOE-2 Symposia to maximize opportunities for information exchange and for the embracing of an ever-broadening scientific constituency into IIOE-2; and
- Facilitate communication between the IIOE-2 and other complementary programmes by promoting placement of scientists on IIOE-2 Working Groups that are also involved in these other programs

Objective 4.2.10: Help scientists understand how they can participate in IIOE-2.

In addition to defining research priorities and motivating research and collaboration on topics that have been identified in the IIOE-2 Science Plan, guidelines need to be developed and disseminated to help scientists understand how they can participate in IIOE-2.

Action 4.2.10.1: The Science and Research Working Group should:

- Develop guidelines that explain how scientists can participate in IIOE-2;
- Insure that the IIOE-2 website that is established enables the effective dissemination of these guidelines;
- Insure that the JPO nodes are enabled as reference points for this information; and
- Insure that Working Group chairs are enabled as reference points for this information

Objective 4.2.11: Increase public awareness of IIOE-2 and ensure that managers and policy makers are informed about the scientific activities and outcomes in a timely manner.

Communication of IIOE-2 scientific objectives, outcomes and benefits to the public, to resource managers, to policy makers and to the IIOE-2's institutional and governmental stakeholders is an important goal of the Expedition, both as a public responsibility per se and also as a vehicle to building as broad a constituency as possible for IIOE-2.

Action 4.2.11.1: The Science and Research Working Group should identify opportunities for scientists to participate in IIOE-2 outreach and communication activities targeting both the public and management communities.

Action 4.2.11.2: The Science and Research Working Group should encourage IIOE-2 scientists to participate in these outreach and science communication activities.

5. Data and Information Management

5.1 Introduction

The IIOE-2 research effort will involve the full range of marine data acquisition modes, including: remote sensing; mooring deployments; research vessels; modelling; and laboratory experiments. Basic scientific research requires sound data management practices. Even greater attention must be paid to data management efforts when diverse and distributed teams of researchers expect to undertake data integration and synthesis efforts. The guidelines described in this section are intended to support individual science plans as well as the overall IIOE-2 program goals, by encouraging early sharing of data using internationally agreed rules of data exchange.

It is highly recommended that all IIOE-2 PIs and other research/technical staff plan and implement data and information management tasks in close consultation with their respective IODE National Oceanographic Data Centre (NODC)

or IODE Associate Data Unit (ADU), if existing, and with their marine librarian, if existing. Some of the tasks could also be implemented directly by the NODCs/ADUs.

In respect to data and information management, IPC has identified a number of explicit foci, as specific objectives with action items, as listed in Section 5.2 below.

However, as one over-arching objective, IPC notes that the IIOE-2 science plan will require data beyond purely 'oceanographic' (eg climatic).

Objective 5.1.1: In respect to data other than oceanographic (eg climatic) in IIOE-2, engage other relevant organizations in the Data and Information Management framework of IIOE-2.

Action 5.1.1.1: It is recommended that other relevant organizations be invited to engage in IIOE-2, including consideration of the relevancy of them being formally linked to IIOE-2, as may be pursued say in liaison with the SC and/or through association with IIOE-2 Working Groups. Such organizations would include (but not be limited to) the World Meteorological Organization (WMO), International Hydrographic Organization and the International Council for Science (ICSU) World Data System.

5.2 Data and Information Management – Objectives and Actions

Objective 5.2.1: To agree on an IIOE-2 common data exchange policy for data collected under IIOE-2.

Many, but not all, funding agencies, nations and international organizations have adopted policies that describe how data and information resulting from scientific research can or should be made available. It is imperative that project leaders, Principal Investigators (PI), and their research teams understand the data policies associated with their funding. Ideally, national policies will be compatible with the IOC, WMO and ICSU data exchange policy encouraging open exchange of ocean data and information (<http://www.iode.org/policy>). The policy encourages Member States to provide timely, free and unrestricted access to all data, associated metadata and products generated under the auspices of IOC programs.

Action 5.2.1.1: Consider the IOC data policy as a suitable data exchange policy for IIOE-2, encouraging IIOE-2 scientists/partners to provide timely, free and unrestricted access to all data, associated metadata and products generated under their auspices.

Action 5.2.1.2: Publish the IIOE-2 data policy and make it available through the IIOE-2 web site.

Objective 5.2.2: Agree on a list of core measurements (and associated data types and units) for IIOE-2 scientific activities.

Action 5.2.2.1: A list of core measurements (and associated data types) is to be developed based on the IIOE-2 research themes and arrived at by consensus among community members, and updated at least annually at workshops. This list will be made available to the IIOE-2 community.

Action 5.2.2.2: Investigators are to be encouraged to use internationally agreed core measurement names and units of measurement when sharing data. Such names and units should be documented in published guidelines.

Objective 5.2.3: Agree on sampling and analytical protocols and metadata structure.

Documentation describing sampling and analytical protocols is essential to enable accurate interpretation by colleagues wishing to collaborate with the original providers of the data.

Action 5.2.3.1: Develop and publish documentation on sampling and analytical protocols.

Action 5.2.3.2: Develop and publish metadata structures that capture the basic documentation required to interpret the resultant data. For a cruise, this includes generation of a cruise report (e.g. ROSCOP form) and a sampling event log recording all instrument activities and deployments. Mooring deployments should be documented by detailed configuration reports including sensor and instrument components. Similar documentation should be provided for other research modes (models and experimental research). Established protocols should be followed when possible, and the appropriate references cited.

Objective 5.2.4: Agree on quality control/quality assurance procedures for all data types.

An important task in the data management chain is processing of data. This includes verifying the quality of the sampled data. Depending on the data type (and instrument), methodologies exist for this purpose. To some extent, the quality control can be carried out automatically (by computerized methods) but in a number of cases this needs to be done manually.

Action 5.2.4.1: For all agreed upon data types, the associated quality control protocols to check errors need to be designated and made available. A recommended source and repository for this information would be the OceanDataPractices document repository website (<http://www.oceandatapactices.net>), relating to information available from the IOC's International Oceanographic Data and Information Exchange (IODE).

Action 5.2.4.2: The results of quality control procedures should be reported with the data set in the metadata, and also as quality flags within the data set. IOC Manuals and Guides No. 54 - Volume 3 Ocean Data Standards: Recommendation for a Quality Flag Scheme for the Exchange of Oceanographic and Marine Meteorological Data (http://www.iode.org/mg54_3) is a flexible scheme that would be appropriate for this purpose.

Objective 5.2.5: Agree on modalities for, and enable the dissemination of data.

Once data have been collected, metadata will need to be created and entered into the data management system. At this stage, information on the project (with related PI contact information) will be forwarded to the JPO. The next step will be the quality control of the data. Once data have been checked for errors (in respect to quality control) they should be added to a database and made available, preferably online. It is at this stage that the agreed upon data exchange policy is particularly important: some data may become available to all users immediately, others may require a temporary embargo (to allow further scientific work), while some may be restricted. However, even embargoed or restricted data should be identifiable and theoretically discoverable through metadata. It is important that data (be it metadata or actual data) are disseminated in a timely fashion.

While the importance of an initial period of exclusive data use is recognized, the goal of IIOE-2 researchers should be to provide timely, free, and unrestricted access to data and associated metadata as soon as possible and in accordance with relevant national and funding agency data sharing policies. For the benefit of colleagues, metadata describing field programmes (e.g. cruises, moorings, instrument deployments) should be made publicly available prior to commencement of activities, and basic physical oceanography data (e.g. temperature, salinity) made available as soon as possible following completion of the field work. The early sharing of data fosters collaboration that results in improved data quality and additional opportunities for scientific publication and increased opportunities for future cooperative research proposals.

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Action 5.2.5.1: An expected data inventory should be created for each deployment (e.g. data collection activities on cruises) and the data inventories submitted to the JPO. This Action also relates to the directory of projects covered in Section 7.

Action 5.2.5.2: Agree on the timelines for the dissemination of data depending on data type, and considering factors such as the time needed for data analysis (e.g. identification of species, chemical analysis), quality control etc.

Action 5.2.5.3: Establish databases containing quality controlled data and their associated metadata, with them being able to be discovered and retrieved through online data discovery and retrieval facilities. A suggested technology framework for this purpose is the IODE Ocean Data Portal (ODP: <http://www.oceandata.portal.org>), which provides a data and information-sharing framework that links data systems and allows searching across the network, providing a unified catalog of resources available from a distributed system.

- INCOIS, Ministry of Earth Sciences, India, has offered to host the unified metadata catalogue

Action 5.2.5.4: Consider the establishment of a centralized data office to manage core measurements and IIOE-2 essential variables.

- Programs such as CLIVAR, and more recently GEOTRACES, have shown that data management efforts coordinated early in the implementation phase result in the ability to generate integrated data products much more efficiently

Objective 5.2.6: Agree on modalities and establish a mechanism for the long-term preservation of IIOE-2 data.

The data and information generated as result of scientific explorations form a valuable legacy of such programs. Each project PI is to be responsible for ensuring that data resulting from their IIOE-2 research are managed and disseminated as described above and also submitted for final archival.

Action 5.2.6.1:

- (i) Where an IODE National Oceanographic Data Centre (NODC) exists, copy or transfer IIOE-2 related datasets to the NODC for long-term archival and preservation (and data dissemination, if required). This should be done on a regular basis (annually), and when the project or institution that managed the data closes.
- (ii) Where no IODE NODC exists, make arrangements with an NODC in the region willing to archive and preserve (and disseminate if required) the data sets. This should be done on a regular basis (annually), and when the project or institution that managed the data closes.

Action 5.2.6.2: Consider the need and feasibility of a regional distributed (or centralized) data system allowing for the discovery and retrieval of all IIOE-2 data.

- INCOIS, Ministry of Earth Sciences, India, has offered to host such a regional system for data discovery and, if so agreed, also for data retrieval.

Objective 5.2.7: Publication of research results.

This objective describes actions related to making available scientific publications as IIOE-2 outputs as well as the related data sets used to prepare such publications. Formal publication of final data sets is strongly recommended to facilitate proper citation by authors of scientific publications that make use of those data sets. Data sets can be published separately from the paper and assigned a persistent identifier (e.g. a Digital Object Identifier or DOI). As such, these data sets can be referred to in a unique and persistent manner. This is also important to support reproducibility of results when data sets are used from large data bases that may change over the course of the research program (e.g. yearly updates as additional field expeditions are completed). This is also relevant to 5.2.6 above. DOI identifier systems are recommended because the major publishers will accept a data set with a DOI as a citable reference.

Action 5.2.7.1: Develop and publish a metadata structure and methodology for data publishing/data citation for use by the IIOE-2 research community.

Action 5.2.7.2: Make data sets available together with scientific publications using the methodology for data citation/data publishing.

Action 5.2.7.3: Make available all publications (including grey literature) related to IIOE-2 research (and support) activities.

Action 5.2.7.4: For its “grey literature”, the IIOE-2 may consider the use of the OceanDocs (<http://www.oceandocs.org>) as a suitable repository.

While publication in journals will be done under the individual responsibility and authority of the scientists and their employer institutions, the IIOE-2 may wish to consider an agreement with selected journals to allow making available the “collected reprints” (full text) of publications published on IIOE-2 activities.

Action 5.2.7.5: IIOE-2 should consider developing an agreement with selected journals to make “collected reprints” of publications published on IIOE-2 activities available.

Objective 5.2.8: Develop ancillary information systems associated with IIOE-2 research.

The IIOE-2 will create a constituency of many (likely hundreds) marine researchers deriving from countries bordering the Indian Ocean and beyond and involved in undertaking research cruises, other observations and associated research. It is important that this community be identifiable as both specific research initiative alliances and also as individuals. Hence, relevant contact information should be documented and available so that researchers may be easily identified and contacted by not only the IIOE-2 community but also by other researchers at any time.

Action 5.2.8.1: Develop and maintain an updated regional directorate of research professionals (and ancillary staff) relating to IIOE-2. This could be achieved using the IOC’s OceanExpert directory (<http://www.oceanexpert.net>).

In respect to Action 5.2.8.1, see also Section 7.

Objective 5.2.9: Develop and update data and information management capacity.

Data/information management requires specialized expertise that is generally not always available across the whole of the research community. In many countries, specialized facilities have been established for the management

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of oceanographic data and information. Within the IOC community, these include National Oceanographic Data Centres (NODCs), IODE Associate Data Units (ADUs) and OBIS Nodes. In addition, a number of marine libraries already exist in the region.

It is important that IIOE-2 leverage these existing facilities in support of the IIOE-2 program.

If such facilities do not exist in any particular country/institution participating in the IIOE-2, then the following actions are recommended:

Action 5.2.9.1: Establish ADUs/NODCs where they are not yet established as feasible and as required.

Action 5.2.9.2: Provide specialized training and education on data and information management as required and through the framework of the IIOE-2 Capacity Development Working Group

Objective 5.2.10: Establish a Regional Coordination Unit for IIOE-2 Data and Information Management at INCOIS, Hyderabad, India.

Given the offer of India (as announced on 20 October 2015 by Dr Satheesh Shenoi, Director, INCOIS, at IPC Meeting No 7 at INCOIS, Hyderabad, India) to assist as required with the coordination of data and information management within the framework of IIOE-2, as well as to host IIOE-2 data and information as required, a Regional Coordination Unit for IIOE-2 Data and Information Management will be established at INCOIS.

Action 5.2.10.1: Prepare and publish Terms of Reference for the Regional Coordination Unit for IIOE-2 Data and Information Management, to be undertaken by SC and JPO liaison with INCOIS and with the specific engagement of the Data and Information Management Working Group.

Action 5.2.10.2: Establish the Regional Coordination Unit for IIOE-2 Data and Information Management at INCOIS.

6 Capacity Development

6.1 Introduction

Many from the overall constituency of countries participating in IIOE-2 have relatively well advanced skills, infrastructure and general capacities for scientific research, related technologies in ocean and associated climate observations, processing techniques (including numerical) for processing data thereof, and knowledge and methods to apply the benefits for societal well-being. However, many countries from the Indian Ocean rim per se still lack adequate competencies and capacities in this realm.

The IIOE-2 offers an opportunity to help redress this divergence by enhancing capacity and thereby contributing to the creation of more knowledgeable societies in this context of science.

Capacity development (CD) actions within the IIOE-2 will focus on the IIOE-2 Science Plan and will build on the existing relevant CD strategies and frameworks of its core sponsors (IOGOOS, SCOR and UNESCO IOC). In this context, capacity development that connects the science to its downstream societal applicability is also a major priority for many IIOE-2 stakeholders, and is a major cross-cutting objective of IIOE-2. In order to enhance its proposed CD efforts, for example in support of imperatives relating to the linking of the science with policy, IIOE-2 will seek partnerships beyond the core sponsors.

6.2 Capacity Development - Objectives and Actions

The implementation plan for the CD component of IIOE-2 is designed to stimulate research and create associated expertise in the international community, especially among developing Indian Ocean Rim nations. The objective is to contribute to their ongoing capacity development efforts by enabling them to effectively participate and benefit from IIOE-2.

Objective 6.2.1: Review current capacity development initiatives in the region and how they can contribute to IIOE-2.

Action 6.2.1.1: Convene a meeting of the major international and regional organizations that conduct capacity development, including IOC, SCOR, Partnership for Observation of the Global Oceans (POGO), Western Indian Ocean Marine Science Association (WIOMSA), Indian Ocean Rim Association (IORA) etc; determine what each organization could/would contribute; and develop a detailed capacity development plan for their potential engagement in IIOE-2, including how related resourcing/funding could be prospectively developed to support the plan.

Objective 6.2.2: Understand current capacity development needs of Indian Ocean countries and align these needs with the IIOE 2 Science Plan.

Over the past decade, numerous CD needs assessments have been carried out by projects and programmes to guide CD activities for the Indian Ocean region and beyond. For IIOE-2, it will be important to access and use the latest relevant assessments for the IIOE-2 region. In this context, the priorities of developing countries for CD within IIOE-2, as articulated by representatives of developing countries in the Indian Ocean region at various recent IIOE-2 planning meetings, are to be also considered. Hence, there is the essential need, early in the IIOE-2 process, for a survey of Indian Ocean constituents' key needs in capacity development. These are to be aligned with the IIOE-2 Science Plan including specifically where achieving CD objectives will benefit from or require participation on expeditions at sea.

Action 6.2.2.1: Continue a review of existing capacity development needs assessments; ascertain their relevance to CD actions within IIOE-2.

Action 6.2.2.2: Design and implement a questionnaire based survey to identify specific CD needs of Indian Ocean countries in order to close gaps in related knowledge and infrastructure and to align the needs with the IIOE-2 Science Plan.

Action 6.2.2.3: Develop an inventory of ongoing national CD efforts related to IIOE-2 CD objectives.

Action 6.2.2.4: Align CD activities under IIOE-2 with other national, inter-governmental and not-for-profit organisations operating in the Indian Ocean region.

Objective 6.2.3: Develop human resources in the context of IIOE-2 Capacity Development.

Human resources (eg academic staff, researchers, technicians, managers, students) are the foundation required for any research and management activities. This foundation must be built and also maintained. In this regard, and in the context of CD objectives for IIOE-2:

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Action 6.2.3.1: Organize short-term training courses in response to requests formulated by Indian Ocean rim countries.

Action 6.2.3.2: Support requests from young developing country scientists to participate in CD actions, eg for conference attendance and mentoring.

Action 6.2.3.3: Empower constituents to not only participate through collaborations in research and observations, but also in the analysis of data and related publication of results (e.g as can be achieved via IODE Training Programs).

Action 6.2.3.4: Promote collaboration among universities (and associated research institutions) in the IO region; align cooperation between UNESCO Chairs and IOC programs, and SCOR to this end.

Action 6.2.3.5: Promote ocean-related faculty development by assisting with the organization of training courses, workshops and “summer schools” based on the IIOE-2 needs.

Action 6.2.3.6: Encourage and promote the engagement of early career researchers in the IIOE-2 through the creation, implementation and resourcing of the IIOE-2 Early Career Scientists Network.

Action 6.2.3.7: Create and distribute promotional products targeted to early career researchers (such as an Early Career Scientists Network brochure).

Objective 6.2.4: Increase access to existing online training courses, resources and learning materials.

Several programmes have made their training materials available online. Partnering with these facilities and adding content to existing online infrastructure increases access to verified training materials and resources for classroom based as well as distance learning.

Action 6.2.4.1: Review online learning materials relevant to the priority training areas of IIOE-2 (see above) and explore the creation of new ones, making resources available online, where possible.

Action 6.2.4.2: Use the experience of the OceanTeacher Global Academy (OTGA) in enabling the sharing the course material, in promoting student and teacher mobility and in promoting regional and interregional collaboration through community building.

- The OceanTeacher Learning Management System (LMS), which is a tool of the OceanTeacher Global Academy, is offered for use by all regional training centres for the storage, management and sharing of training contents.

Objective 6.2.5: Increase access to research infrastructure including on-board opportunities.

On-site and on-board experience is essential for the career of an ocean researcher. Many Indian Ocean countries do not have ocean-going research vessels, and the IIOE-2 provides a unique opportunity to facilitate on-board training. Strategies for expanding capacity and opportunities for CD beyond scheduled science cruises include broader access to ships of opportunity and the use of science-mobilized commercial vessels. Scientists from the region must be given opportunities to participate in research cruises financially supported through bilateral and/or international arrangements. To this end, the following recommendations are made.

Action 6.2.5.1: Establish a register of infrastructure and centres of expertise for marine science studies in all the Indian Ocean countries.

Action 6.2.5.2: Enable a link and access to the register of IIOE-2 cruises and associated activities to identify training opportunities.

Action 6.2.5.3: Develop an inventory of CD opportunities, activities and plans related to IIOE-2 and make this inventory a dynamic (continuously updated) document that is widely available to the community for planning purposes.

Action 6.2.5.4: Periodically assess alignment between available resources and CD objectives to identify and share with the community specific resource gaps where additional capacity will have a significant impact on achieving CD goals.

Objective 6.2.6: Increase awareness of capacity development opportunities.

The proposed CD actions need to be brought to the awareness of the IIOE-2 constituency and advertised widely in order to effectively to meet the CD objectives. To this end, the following recommendations are made.

Action 6.2.6.1: Use currently available portals and capacities within the IIOE-2 constituency for capacity development, for example as could be used to promote and implement actions such as summer schools, participation in research cruises, analyses, observational and related processing techniques, modelling, publication etc.

Action 6.2.6.2: Regularly disseminate information on CD opportunities.

Action 6.2.6.3: Develop eligibility criteria for CD opportunities.

7 Operational Coordination

7.1 Introduction

The objective of the Operational Coordination component of IIOE-2 is to develop and integrate web-based tools, databases and partnerships to enable a sufficient level of cooperation, resource-sharing, scientific collaboration and capacity alignment. The Operational Coordination Working Group will work collaboratively with other IIOE-2 Working Groups, committees and other stakeholders to achieve this goal.

7.2 Operational Coordination – Objectives and Actions

Objective 7.2.1: Establish a central web-based expedition planning utility for operational coordination and cruise archiving, linked to the IIOE-2 website.

Action 7.2.1.1:

- Maintain an updated IIOE-2 research activity spreadsheet and link to the IIOE-2 website
- Link the JCOMMOPS cruise database and portal with the IIOE-2 website
- Develop or adapt available web-based platforms that can aggregate planned IIOE-2 research activities, facilitate communication and collaboration among IIOE-2 participants, and archive completed cruises and other activities

- Establish processes and support through the JPO for assessing emerging infrastructure gaps, aligning available capacity and resources with research needs, and assisting with mobilizing and coordinating additional capacity where needed

Objective 7.2.2: Establish an opportunity/volunteer vessel database of commercial-sector ships and fixed platforms available for research and observations.

Action 7.2.2.1:

- Work with JCOMMOPS, the World Ocean Council (WOC) and others to aggregate transit data from commercial shipping firms who agree to provide routine access to their commercial vessels as ships of opportunity platforms
- Develop an opportunity/volunteer vessel database that aggregates and presents cruise routes, schedules and contact information
- Integrate the database with expedition planning tools to enable integration with IIOE-2 project planning.
- Provide coordination assistance for project liaison between PIs and commercial operators as needed through the JPO.

Objective 7.2.3: Establish a database of “in-kind” resource support from institutions, national fleets, and funding agencies, including from both planned deployments and resources available through an application process.

Action 7.2.3.1:

- Aggregate committed resources and opportunities to apply for assistance through a proactive, community wide assessment and request process.
- Develop a database of resources and links to applications, presented on the IIOE-2 website.
- Ensure sufficient detail within a template format and continuous updating to facilitate effective research planning and access to resource/funding opportunities.

Objective 7.2.4: Establish a review process to ensure complete and usable data inputs from the research community into integrated IIOE-2 expedition planning tools.

Action 7.2.4.1:

- Establish an appropriate level of detail for planning data required for effective research support, operational coordination and collaboration
- JPO to review, evaluate and facilitate improvement in user effectiveness in populating and using the planning tools for resource-sharing, collaboration and communication

Objective 7.2.5: Utilize existing JCOMMOPS operations that support maintenance of observation systems in the Indian Ocean for shared use by IIOE-2 PIs.

This objective is motivated by the opportunities to leverage existing observation systems operations to support IIOE-2 research.

Action 7.2.5.1:

- JCOMMOPS will share cruise track files and scheduling data from planned JCOMMOPS cruises for upload to the GOCEPT expedition planning tool
- Solicit proposals from PIs on the IIOE-2 website to join planned JCOMMOPS cruises
- JCOMMOPS will respond to proposals to modify and extend planned JCOMMOPS cruise tracks and days-at sea in order to facilitate IIOE-2 research

Objective 7.2.6: Evaluate current consensus on use of certified reference materials and standard analytical methods where consistent use of such methods will likely impact the quality of inter-study data comparison and integration across IIOE-2 research.

This objective is in respect to supporting inter-calibrated sampling & standard methods as appropriate across IIOE-2 studies.

Action 7.2.6.1:

- The IIOE-2 Steering Committee to assess the current general use and availability of certified reference materials (chemical, physical and biological) and standardized methods of analysis
- Undertake a review of methods manuals from programmes such as GO-SHIP and GEOTRACES, and availability of commercial preparations (e.g. IAPSO Standard Seawater, etc.)
- Identify parameters for which reference materials and/or standard analytical methods should be recommended for use across IIOE-2 studies

In this context, also refer also to Chapter 4.

Objective 7.2.7: Provide access to references on recommended methods and sources for acquiring calibration materials.

Action 7.2.7.1:

- Develop and host technical documents, or link to existing documents hosted elsewhere, that describe recommended reference materials and methods, accessible from the IIOE-2 website
- Identify sources for recommended certified reference materials, linked from the IIOE-2 website, which can be ordered from commercial suppliers

Objective 7.2.8: Establish a process for reviewing planned and developing research projects toward discovering, communicating and enabling opportunities for collaboration among PIs.

This objective is in respect to advocating and facilitating opportunities for collaborative, multidisciplinary and trans-disciplinary IIOE-2 research.

Action 7.2.8.1:

- Solicit input from relevant members of the IIOE-2 Steering Committee (e.g. members at Regional Coordination and Science Delivery Levels) to help identify opportunities for collaboration and cooperation within their regions and disciplines

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- Publicize opportunities on the IIOE-2 website where collaborative research would be facilitated by available instrumentation for shared-use, available ship time, etc.
- Encourage new proposals from the science community that complement active IIOE-2 studies and would contribute to more fully addressing multidisciplinary questions identified by the Science Plan

Objective 7.2.9: Provide operational support to capacity development efforts identified and prioritized by the IIOE-2 Capacity Development Working Group and Steering Committee.

This objective is in respect to organizing and managing operational resources needed to support the capacity development goals of IIOE-2.

Action 7.2.9.1:

- Examine planned expedition activities for opportunities to coordinate resources, ship time and project scientists identified and prioritized for support by the Capacity Development objectives of IIOE-2
- Develop specialized expeditions: to support planned capacity development-focused programs; to support scientists from developing nations working in collaborative science teams with colleagues in developed nations; and to focus on supporting early career scientists, women scientists, students and other priorities.

8 Outreach and Communication

8.1 Introduction

A well-organized, professional and efficient outreach and communication programme and promotional campaign as part of IIOE-2 will have the benefit of providing the IIOE-2 with visibility. It will also create and help to maintain an understanding and appreciation amongst its constituency of the fundamental and applied importance and value of IIOE-2 to society. It will emphasize the paramount role that the Indian Ocean plays in the everyday life of the coastal communities of the Indian Ocean.

It will help to bring scientists in closer association with concerned stakeholders and the public. It will assist in bridging the gap between scientifically derived knowledge and everyday life.

It will help build a constituency for the IIOE-2, across the spheres of communities, institutions, scientists, government (through their leaders, policy makers and advisors) and organisations including representative global and regional bodies and NGOs etc.

It is desirable from the very beginning of the IIOE-2 to capture the world's attention and garner its interest in the IIOE-2. It will encourage world-wide action and engagement at a multitude of levels in support of IIOE-2 and empower people to concrete actions.

It is important to make IIOE-2 highly visible and its aims, objectives and activities clearly understood amongst both the scientific community and decision-makers in countries both within the Indian Ocean domain and also beyond, as well as in related inter-governmental organisations and entities.

Outreach and communication in IIOE-2 will also help underpin the search and acquisition of support and resources for IIOE-2.

8.2 Outreach and Communication - Objectives and Actions

Objective 8.2.1: Develop an IIOE-2 Communication Strategy and related Implementation Plan to ensure that the 'IIOE-2' is effectively communicated and that its brand is consistently applied and highly visible to all potential stakeholders.

Action 8.2.1.1: Notwithstanding the early actions recommended herewith (below), the JPO should also engage an expert science communicator to undertake a comprehensive strategic review of the initial IIOE-2 communication framework, with recommendations thereof to be delivered via a report.

Action 8.2.1.2: The expert communications review called for above, would form the basis of a revised outreach and communications strategy and implementation program.

Objective 8.2.2: Develop, implement and maintain an IIOE-2 website.

Action 8.2.2.1: Given the offer of India made on 20 October 2015 by Dr Satheesh Shenoi, Director, INCOIS, at IPC Meeting No 7 at INCOIS, Hyderabad, India, the IIOE-2 website will be established, hosted, managed operationally across all required facets and maintained by INCOIS.

Action 8.2.2.2: In collaboration particularly with the JPO and SC's Executive and Working Groups, the Indian JPO Office and its host INCOIS will be responsible for the design, implementation and maintenance of an IIOE-2 website, and will also coordinate and manage inputs/outputs of materials for it. This will cater for the website needs of all facets of the IIOE-2, including external constituents such as the general public, and technically connected spheres (eg governmental, institutional, scientists (established and early career), funding agencies and organisations (including philanthropic).

Objective 8.2.3: Capture and build interest in IIOE-2 amongst the general public through a public event and promotional materials campaign.

Action 8.2.3.1: The JPO to coordinate the development and implementation of a public event campaign for IIOE.2, including aspects such as public outreach events and promotional materials (eg products as IIOE-2 badged items).

Action 8.2.3.2: Indian JPO Office to coordinate and fund the design, selection process and dissemination of an IIOE-2 logo, and the placement of the logo on an initial set of materials to initiate the awareness campaign for the logo.

Action 8.2.3.3: The JPO, in conjunction with the SC, to ensure the logo is used as widely as possible on appropriate IIOE-2 related products (electronic and hard form, such as publications, notices, presentations, posters, conference/workshop banners, cruise flags etc).

Objective 8.2.4: Showcase and promote the relevancies of the IIOE-2 research being undertaken and its impacts and benefits across the scientific, cultural, social and economic spheres and directly link IIOE-2 research activities to related communication initiatives.

Action 8.2.4.1: JPO to directly draw on the IIOE-2 research activities to identify and link appropriate information to general communication initiatives of the Outreach and Communications Working Group.

Action 8.2.4.2: The JPO will provide facilitation and assistance to the Science and Research Working Group in its public awareness objective (4.2.11).

Objective 8.2.5: Maintain a regular and current dissemination mode of cross-cutting information and general news and specific announcements for IIOE-2.

Actions 8.2.5.1: Indian IIOE-2 JPO node to maintain and manage the Indian Ocean Bubble 2 newsletter.

Action 8.2.5.2: JPO to facilitate, coordinate and encourage principle IIOE-2 stakeholders (from the SC, WGs, National Committees Chairs, Pls, JPO personnel etc) to deliver regular briefings (notes, PPTs, papers etc) to their own institutional focal points and others as required, and to this end the JPO should also develop:

- A generic IIOE-2 presentation (regularly updated) for general use in this context; and
- In harmony with the website's function, also produce brochures, posters, electronic notices etc for general dissemination on both over-arching aspects and also specific aspects of IIOE-2 as these evolve (eg major scientific breakthroughs, events etc).

Objective 8.2.6: Promotion of IIOE-2 via presentations and contributions at local, national scientific and institutional forums.

Action 8.2.6.1: JPO to facilitate the presentation of IIOE-2 information at relevant forums (eg conferences, workshops, meetings) and via relevant publication modes, such as through UNESCO IOC, SCOR and IOGOOS related media, international journals, etc.

Objective 8.2.7: Provide the full IIOE-2 constituency with an avenue for information, general communication and queries on all aspects of IIOE-2.

Action 8.2.7.1: The JPO nodal network will be, for the full IIOE-2 constituency, an efficient avenue for general communication on IIOE-2, thereby providing readily accessible and direct personal and e-communication modes of contact for the general IIOE-2 community (across all spheres) to be able to seek information, make queries and obtain outputs and advice on all aspects of IIOE-2.

Action 8.2.7.2: The IOC IIOE-2 Coordinator will be the principal point of contact for general communications (public included) on IIOE-2: but will do so by effectively linking, keeping informed and working collegially and closely with the Indian JPO Node Leader and other focal points of the administrative network of IIOE-2 (eg SC elements (particularly the sponsors and Executive elements), IOC HQ and regional offices etc).

9 Translating Science for Society

9.1 Introduction

Approach and Benefits

The IIOE-2 Science Plan contains a detailed discussion of capacity development activities proposed as part of IIOE-2 referring to all of the IIOE-2's six science themes. Capacity development represents a critical component for the delivery of societal benefit in the context of IIOE-2 and is discussed in Chapter 4. Increasing understanding of the Indian Ocean and its coastal systems among the people and communities living in this region will empower better-informed public stewardship of ocean resources for emerging Blue Economy imperatives. Insight gained from

scientific research, advances in observations, and innovative technologies will further enable evaluation of trade-offs between alternative management scenarios, enhance the ability to balance competing demands on ecosystems, and strengthen economic and scientific competitiveness of Indian Ocean rim countries.

Policy Requirements and Evidence

Good policy for sustainable usage of the oceans requires good information. It should be founded on solid evidence, be well implemented and receive broad support across Indian Ocean societies. But limiting progress in regards to this aspiration is the fact that large swathes of the Indian Ocean marine estate remain uncharacterised, leaving Indian Ocean rim countries with major gaps in understanding of its marine systems, and an inability to measure their resilience to change or use. There are also large gaps in our understanding of social, cultural and economic drivers, and how they affect decisions. Importantly, many of the changes needed for long-term food security require multidisciplinary research planning and implementation, to support the implementation of key strategies to prepare for critical and emerging issues.

The Science

To meet these challenges and opportunities, our science must be collaborative, integrated, and internationally engaged. We must develop better tools for managers, better decision-making systems and new supporting technologies. Our research must further quantitative modelling and address methods to better integrate coupled socioeconomic and biophysical approaches to resource assessment, including cumulative impacts.

By taking a more integrated approach to the design, implementation and delivery of experimental marine science, we will be able to test system-level hypotheses for the drivers of changes of our coasts and oceans, including direct comparisons of anthropogenic impacts versus natural variability in order to be able to discern and decouple their respective influences.

IIOE-2 research initiatives and relevancies for societal benefit.

The IIOE-2 Science Plan is structured around six scientific themes. Each of these include a set of scientific questions that need to be addressed in order to improve our understanding of the physical forcing that drives variability in marine biogeochemical cycles, ecosystems and fisheries in the Indian Ocean and develop the capacity to predict how this variability will impact human populations in the future. It is also important to emphasize that most of these questions are relevant to open ocean, coastal and marginal sea environments.

9.2 Translating Science for Society – Objectives and Actions

Objective 9.2.1: In the context of facilitating the translation of the IIOE-2 science for societal benefit, at a minimum all IIOE-2 endorsed projects should identify links with national and/or international benefits in the following categories.

Action 9.2.1.1:

In respect to the scientific relevancies:

- Enhancing basic scientific knowledge, understanding;
- Associated activities to communicate progress to peers (e.g. presentations and peer-reviewed publications) and public (e.g. media releases, public seminars); and
- Identifying the alignment of the science objectives (referring to themes 1-6) with societal benefits and then facilitating the transfer of the science for those benefits.

Action 9.2.1.2:

In respect to environmental relevancies:

- Identifying how the research activity will directly or indirectly contribute to sustainable environments and environmental management (global, basin-scale, regional, coastal); and
- Facilitating the transfer of those activities and outputs for environmental sustainability imperatives.

Action 9.2.1.3:

In respect to social relevancies:

- Identifying how the research activity will directly or indirectly increase or at least support the social well-being of humanity, e.g. through:
 - o Capacity development;
 - o Communication of research results to the public;
 - o Policy development, including relating to the issue of 'social license to operate' (SLO); and
 - o Facilitating the transfer of those activities and outputs for societal benefit imperatives.

Action 9.2.1.4

In respect to economic relevancies:

- Identifying how the research activity will directly or indirectly contribute to sustained economic growth and or poverty eradication in the Indian Ocean region while maintaining a healthy ecosystem, as articulated in emerging 'Blue Economy' frameworks, and as relates to:
 - o Improved disaster preparedness and risk management;
 - o Sustainable exploitation of living and non-living marine resources;
 - o Regional and coastal management etc; and
 - o Facilitating the transfer of those activities and outputs for economic benefit imperatives.

In order to estimate the quantitative socio-economic value and impact of new scientific knowledge generated by the IIOE-2 initiative, the following objectives and complementary actions are recommended for the Working Group to act on.

Objective 9.2.2: To estimate the societal and economic value of proposed IIOE-2 research, through conducting a socio-economic assessment study that references, and is complementary to, the IIOE-2 Science Plan.

Action 9.2.2.1:

- Solicit and review one or more proposals from relevant academic, inter-governmental and other communities to conduct an economic impact assessment of the societal application of new scientific knowledge derived from IIOE-2;
- Ensure that the assessment links to widely recognized socio-economic challenges and concerns, and to specific impacts identified in the IIOE-2 Science Plan; and
- Publish a position paper or report on study conclusions, including a non-technical summary of key results and implications.

Objective 9.2.3: Widely disseminate the results of the IIOE-2 socio-economic assessment to global public, governmental and other stakeholder communities.

Action 9.2.3.1:

- Publish and communicate the socio-economic assessment study conclusions through the public media, in scientific conferences, publications and other venues and modes (including through the JPO, Outreach and Communication WG and annual IIOE-2 symposia);
- Develop an integrated analysis comparing the estimated value of resources needed to support IIOE-2 activities with the economic and societal return from new knowledge, as estimated by the economic assessment study; and
- Integrate study conclusions into presentations for funding and other support, to member states, funding agencies and the private sector.

10 Sponsorship and Resources

10.1 Introduction

The objective of the Sponsorship and Resources component of IIOE-2 is to provide:

- The basic resourcing for the operational administrative and day-to-day practical functions of the IIOE-2 (eg of the JPO offices; SC; Working groups; public interaction; communications etc); and
- The more strategic overarching effort required to seek larger scale IIOE-2 wide resources support. This relates to establishing a strategy and the resources to proactively seek financial and other material support for IIOE-2, both through and beyond the resources that have been and will be committed from traditional funding and institutional sources for the day-to-day operations

10.2 Operational day-to-day resourcing and sponsorship role – Objectives and Actions

This relates to the basic day-to-day practicalities under the auspices of the Sponsorship and Resources Working Group, which will be overseen by the JPO.

Objective 10.2.1: Provide the day-to-day underpinning resources to administer and run the IIOE-2 through the functions of the JPO.

Action 10.2.1.1:

- The Sponsorship and Resources Working Group will begin its tenure under the leadership of the JPO and will service the immediate and sustained practicalities for the general underpinning of the IIOE-2. This will refer to functions supported by (but not limited to) the following set of actions:
 - o Maintaining JPO node resourcing;
 - o Supporting the SC;
 - o Facilitating and supporting annual symposia and complementary inter-sessional meetings (eg of the Working Groups, SC Executive etc);
 - o Resourcing the JPO focal point roles for general public engagement in IIOE-2;
 - o Providing the conduit and linkages for IOC's interests and engagement (under the auspices of the IOC nodal office in Perth and its IOC IIOE-2 Coordinator function);

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- o Through the JPO's Indian IIOE-2 nodal office, resourcing and leading and managing key functions including the IIOE-2 website and Regional Coordination Unit for IIOE-2 Data and Information Management at INCOIS, Hyderabad, India;
- o Resourcing the needs of the JPO in facilitating outreach and communication through initial leadership and facilitation of the Outreach and Communications Working Group;
- o Initial leadership and facilitation of the Translating Science for Society Working Group and its functions

10.3 Facilitation of the acquisition of larger scale over-arching strategic support to IIOE-2 – Objectives and Actions.

The Implementation Strategy herewith goes into a relatively greater degree of motivational and guiding detail, in light of the critical and ambitious need to try to create a resourcing landscape for IIOE-2 that helps it reach its optimum potential. This is in terms of science and its delivery for societal benefit, through leveraging the vast amount of general interest, and governmental, institutional and personal engagements that IIOE-2 has already harnessed for its mission.

This task will seek to acquire the larger scale over-arching sustained and complete support for the execution of the IIOE-2 Science Plan and complementary activities for IIOE-2 out to 2020, and perhaps beyond.

It will also seek to address resource gaps, new opportunities for significant work, and unforeseen resource needs as identified by IIOE-2 Working Groups, the Steering Committee and the IIOE-2 community in general.

It will seek to establish a strategy and the resources to proactively garner financial and other material support for IIOE-2, both through and beyond the resources that have been and will be committed from traditional funding and institutional sources (for example, as relates to Objective 10.2.1, above).

It will benefit from the actions and outputs of Chapter 9, above.

A number of fundamental factors should be considered when designing such a strategy aimed at funding and supporting the resource needs of IIOE-2, including through sponsorships. The presumption is that there is and will continue to be a baseline level of committed resources, including scheduled scientific cruises, along with related research and capacity development initiatives from traditional intergovernmental and national programs, supported by agency science funding budgets. This sponsorship and resources effort should include a strong focus toward increasing share-of-support from these 'budget-driven' programmes over the five-year programme period. It should also be substantially directed toward gaining new and additional IIOE-2-specific commitments, including from non-traditional private-sector sources (foundations, corporations, global companies with an interest in the ocean), directly from UN member states (including from those without strong science funding mechanisms), NGOs/non-profits, and others. These latter sources may have great potential to significantly increase the total value of support - and potentially with funding that is more discretionary.

There are complex interrelationships between existing programmes and funding agencies globally, and therefore there is a need for a dedicated and strategic approach to an appeal for more support, including for dealing with non-traditional funding sources.

When considering how the IIOE-2 should think about funding activities and garnering participation, financial, in-kind and other support from existing programmes and agencies, two of the key factors that should be recognized are:

- That the number of potential sources and partnerships for funding and other support is large; and
- Informational, funding and other supporting relationships among ocean-, atmosphere- and space-focused scientific organizations, agencies and programmes is complex (as per a 2006 study by the consulting firm of Douglas-Westwood on Global Markets for Ocean Observing Systems, conducted for Industry Canada and other sponsors and which refers to the “byzantine complexity” of the network of funding and organization relationships).

The large number of stakeholders with potential interest in IIOE-2 activities therefore represents both significant potential for support and a significant logistical challenge - suggesting that a formulated, strategic approach is warranted. The governance structure established for IIOE-2, embodied by the three sponsoring organizations and the larger Steering Committee, provides an ideal platform with an appropriate stature and hence should be fully engaged in this process to ensure that a productive approach to mobilizing global support for IIOE-2 is developed and executed.

One conceptual way of thinking about this in more detail is suggested as follows. Funding, infrastructure, personnel and materiel support for IIOE-2 activities in general could be divided into the following proposed components:

1. PI-driven ‘projects’ proposed and funded through traditional governmental funding agency and private-sector (e.g. foundation) sources, qualifying as IIOE-2 activities;
2. Government-, institutional-, and intergovernmental-agency funded and scheduled research and observation activities in the IO, including cruises, as contributions to IIOE-2 (which support funded PIs);
3. New, IIOE-2-focused resources contributed by all of the above in support of IIOE-2 sub-initiatives (e.g. EIOURI, WIOURI etc.), other IIOE-2 Science Plan-focused cruises, regional capacity development programs, and other activities defined by the IIOE-2 Science Plan and its implementation strategy; and
4. Undefined support, i.e. all support (direct funding, infrastructure, in-kind, etc.) that will be needed to fully enable the IIOE-2 Science Plan and related elements of both its own complementary Implementation Strategy and that of the wider IIOE-2 portfolio – which is not currently committed, or even perhaps yet defined.

Mobilizing activity within all of these components will benefit from proactive engagement and promotion by IIOE-2 governing bodies and the community at large, but points 3 and especially 4 represent areas where active, strategic engagement to develop support will be most necessary and potentially productive. The need for resources not committed initially, for IIOE-2 projects and activities not yet defined, would also ideally be met at some level with discretionary funding (i.e. from committed discretionary organizational budgets and/or a dedicated reserve fund). An IIOE-2 discretionary reserve fund would be the most effective option and could be made up of restricted and unrestricted funds (e.g. allocated for capacity development activities, etc.).

An effort to request discretionary funding for IIOE-2 from major stakeholders would not be unlike many major public and private fundraising efforts in that it needs to be strategically planned and executed.

Taking a direct appeal to member states for funding and/or other support as an example, a normal ‘development’ (i.e. fundraising) strategy, unique for each member state, would first involve an individual assessment along the lines of:

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- What is the member state's history of participating in and funding marine science projects and initiatives, and at what level of support?
- What is the overall economic outlook and strength of their scientific funding community?
- What influential scientists are located in those states who could get behind, and benefit from, IIOE-2 by helping to make the case for IIOE-2 support to their nation's decision makers?
- What are the specific and pressing issues within each nation that align with the IIOE-2 Science Plan, capacity development goals, and other objectives?
- What regional socio-economic factors, as quantified by the planned IIOE-2 economic impact study, are vital to the member state?
- What is the resulting value of IIOE-2 science to the member state?
- What is the best method for requesting support for each state (i.e., direct contribution to a discretionary IIOE2 fund, an annually budgeted contribution, facility and infrastructure mobilization, specific project or expedition funding, etc.)?
- What is an appropriate level of funding to request?
- What are the right channels and processes to use in approaching each member state for funding?

This represents a strategic, concerted effort that will itself require some resources and a management process directed by the IIOE-2 Steering Committee – but would likely be the most effective approach for a large-scale effort like IIOE-2. The IIOE-2 socio-economic impact study that is planned (Section 9.2.2/9.2.3, above) will be vital for presenting an economic value-based context and rationale for generating large-scale support from these activities.

Similar strategies could be developed for more traditional governmental and intergovernmental funding agencies (e.g. GEF), private foundations, and even corporate sponsorships. Regarding corporate sponsorships, the broad-based, international nature of IIOE-2 is likely to create an enhanced attraction for corporate participation including for example subsidized infrastructure, programme funding, technical support, etc. Likely drivers for corporate support are public visibility and public relations – e.g. to be seen as supporting an effort that will have a positive impact on issues of sustainability, understanding climate change, capacity development, education, mitigating human environmental impact, etc., and possibly also as a technology testbed opportunity.

In terms of developing a potential 'discretionary plus restricted' funding account or pool, to be allocated by the IIOE-2 Steering Committee through some consensus-based process, a question emerges as to how much should be targeted for a capital raise for IIOE-2. One approach would be to conduct a high-level estimate of the total value of resources needed to execute the entire Science Plan, then to allocate the estimated value of each major component above. The 'residual' value in the form of a gap analysis would provide an estimate for this pool. If we assume that the main purpose of a discretionary pool would be to fill resource gaps; ensure support for all portions of the Science Plan, such as capacity development programming; enable emergent and unplanned opportunities for new research that might be otherwise difficult to fund quickly, etc. – then a 'proforma budget' exercise as described above could roughly constrain the bounds of such a fund used for this purpose.

The Sponsorship and Resources Working Group, working with other WGs, could then allocate a rational level of requested support among potential funders and stakeholders, to arrive at the additive total.

The proposed Objectives and Actions below reflect these strategies and refer to developing an effective capacity for engaging with regional and global stakeholder communities to support IIOE-2 with needed financial, technical, physical and personnel resources through 2020.

Objective 10.3.1: Identify distinct public- and private-sector stakeholder communities that can be strategically engaged to support IIOE-2 with direct funding, infrastructure, personnel and technical resources.

Action 10.3.1.1:

- Consult with the IIOE-2 Steering Committee and other resources to identify a wide range of global funding and stakeholder communities that have a potential interest and stake in the outcomes of IIOE-2 objectives and goals; and
- Identify a global base of potential corporate sponsors capable of supporting IIOE-2 with funding and other resources of value to the IIOE-2 community.

Objective 10.3.2: Develop a strategic plan for uniquely engaging within each funding and stakeholder community to commit resources that are most feasible and appropriate.

Action 10.3.2.1

- Assess each community, and individual entities within each community, for unique needs, interests and potential for supporting IIOE-2;
- Develop a plan for approaching individual organizations, agencies, foundations, corporations and others with appropriate requests for support; and
- Utilize the planned IIOE-2 socio-economic impact and “return on investment” assessment to inform potential supporters of relevant societal outcomes from IIOE-2.

Objective 10.3.3: Develop within the IIOE-2 governance structure a process for managing and making decisions pertaining to fundraising and acquiring sufficient resources for IIOE-2.

Action 10.3.3.1:

- Provide a feedback mechanism from IIOE-2 Working Groups and others to help guide and prioritize funding and solicitation activities; and
- Ensure that continuing efforts to marshal resources and commitments for the IIOE-2 Science Plan are aligned with critical resource gaps and meeting strategic objectives (e.g. capacity development, etc.).

Objective 10.3.4: Provide sufficient internal (IIOE-2) resources to support the effort of soliciting and obtaining complete and sustained financial and other support for IIOE-2.

Action 10.3.4.1:

- Develop and allocate resources needed (personnel, travel funds, communication materials, etc.) to individually engage with potentially supportive stakeholders, on a priority basis.

11 Joint Project Office

As introduced and discussed in Chapter 3, the IIOE-2's secretariat support will be provided via the Joint Project Office, currently having two major nodes, which themselves link, collaborate and work with each other and through other support centres and programmes (regional and global):

- One major JPO node is the UNESCO IOC Perth Programme Office (PPO), Perth, Western Australia (linking with other IOC offices and programmes - central and regional). The IOC PPO is itself underpinned by collaborative Western Australian Government, Australian Federal Government and IOC funding and in-kind resourcing. This node will provide IOC related linkages with IOC HQ and its network of relevant global and regional offices and programs.
- The other major JPO node is hosted by ESSO-INCOIS, Hyderabad, India, itself underpinned by Ministry of Earth Sciences (Government of India) funding and in-kind resourcing and linking with other relevant Indian agency centres and programs.

The general governance related aspects and over-arching functions and lines of management specifications relating to the JPO were given in Chapter 3.

The IOC PPO node will include the full time salaried IOC IIOE-2 Coordinator along with support staff and underpinning operational budget and resources, as available. That person will provide the principal public focal point for IIOE-2, in close collegial and collaborative alignment and operability with the Head of the Indian IIOE-2 International Project Office, who will be employed under Indian Government funding as full time with necessary underpinning resources and budget provided by the Indian Government host agency.

The general roles and functions of the JPO are as would be typical and expected for such major collaborative ocean science undertakings. The two current JPO offices will share, to varying degrees, all aspects of all JPO functions, but specifically designated and principle roles for the respective nodes are as follows.

IOC PPO Node, Perth, Australia – key responsibilities:

- Liaison and linkages with IOC stakeholders, including other IOC global and regional offices and programmes;
- Oversight and facilitation of the Sponsorship and Coordination Working Group, including a priority on facilitation of sponsorship and resources to underpin the Australian JPO node;
- Oversight and facilitation of the Translating Science for Society Working Group;
- Support of specific elements of 'Operational Coordination' (Ref: Chapter 7, above);
- Facilitation of the IIOE-2 project endorsement process, with the SC;
- Principal point of reference and contact point for general IIOE-2 communications, enquiries etc;
- Strategic facilitation of annual symposia (eg brokerage of symposia hosts), including elements of symposia sponsorship acquisition, conference coordination and event facilitation in conjunction with the Indian JPO node ;
- Coordination and implementation of selected Capacity Development projects under IIOE-2;
- Strategic support role to the IIOE-2 Steering Committee and Working Groups (see Chapter 3), including selected elements of operational support;

- Provision of over-arching integrating operational support across operational elements of the SC (eg Working Groups, National Committees, PPIs etc);
- Facilitation of IOC Co-Chair reporting requirements to IOC Executive Council and Assembly meetings, with similar support to the other two co-Chairs.

ESSO-INCOIS Node, Hyderabad, India – key responsibilities:

- Establish, host and maintain the Regional Coordination Unit for IIOE-2 Data and Information Management;
- Establish, host and maintain (including editorial functions) the IIOE-2 website across all aspects;
- Manage specific communication products (eg provide promotional materials; host and maintain the Indian Ocean Bubble 2 newsletter);
- As a priority, facilitation of sponsorship and resources to underpin the Indian JPO node.
- Support specific elements of ‘Operational Coordination’ (Ref: Chapter 7, above);
- Facilitation of the IIOE-2 project endorsement process, with the SC;
- Coordination and implementation of selected Capacity Development projects under IIOE-2, including through ITC Ocean in Hyderabad;
- Operational facilitation of annual symposia, including logistical coordination, and required administration, and including element of strategic facilitation with the IOC PPO node;
- Operational support role to IIOE-2 Steering Committee and Working Groups (see Chapter 3), including selected elements of strategic support.

12 References

Hood et al (2015). The Second International Indian Ocean Expedition (IIOE-2) Science Plan. Scientific Committee on Ocean Research.

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