Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS)

Fourth Session

Mombasa, Kenya
28 February–2 March 2007

UNESCO

Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS)

Fourth Session

Mombasa, Kenya
28 February–2 March 2007

UNESCO 2007

ICG/IOTWS-IV/3
Perth, 27 April 2007
English Only

(SC-2007/WS/25)

TABLE OF CONTENTS

ANNEXES

1. WELCOME AND OPENING OF FOURTH SESSION

1 The session was opened on Wednesday 28 February at 9:00 am under the Chairmanship of Dr Jan Sopaheluwakan, ICG/IOTWS Vice Chairman. Dr Sopaheluwakan welcomed the participants and special guests to the opening ceremony of the Fourth Session of the ICG/IOTWS.

2 On behalf of the ICG/IOTWS, he thanked the Kenyan Government for hosting the meeting. He noted that significant progress towards implementing the Indian Ocean Tsunami Warning System has been made since the last ICG/IOTWS session in Bali in August 2006. Member countries have shown their commitment to continue to deploy equipment and improve the system. Countries are also increasing their capacity for institutional cooperation and working hard on community preparedness. The ICG/IOTWS now has six working groups. The groups have worked hard towards implementing the system.

3 He further noted that the IOTWS is a complex operation, owned and operated by Member States through the implementing agencies. He encouraged Member States to continue funding the effort towards a sustainable, durable and effective IOTWS.

4 The Executive Secretary of the Intergovernmental Oceanographic Commission (IOC), Dr Patricio Bernal, welcomed the participants to the session. He expressed his sincere thanks to the Government of Kenya for hosting the ICG/IOTWS-IV in Mombasa, Kenya.

5 He recalled that the intersessional period has been an important time for the IOC as it is responsible within the UN system for the only functioning tsunami warning system, which is in the Pacific Ocean. The IOC was then invited to coordinate the effort to develop a system in the Indian Ocean. The first phase of the system is now complete, but the second phase is more important —the network of national systems responsible for delivering the message. Significant effort and support will be needed and the effort will take years, as it is a very complex process. It requires coordination across ministerial boundaries and requires actions to bring up to speed the level of awareness of the population and the knowledge of what to do in the case of an emergency.

6 He stressed the need to set up a very clear set of national plans and national goals to be assessed at each ICG, to avoid losing the momentum which resulted from the catastrophic event in the Indian Ocean. He recognised that an important technical community has been built to work together to address these issues, and committed the IOC to make every effort to assist the ICG/IOTWS in achieving its plans.

7 Dr Moody Awori, Vice-President and Minister for Home Affairs and National Heritage, Kenya welcomed the delegates and distinguished guests on behalf of the Kenyan Government and officially opened the ICG/IOTWS-IV meeting. Recalling the December 2004 tsunami, and particularly its effects in Kenya, he highlighted Kenya's support for the IOTWS. The Kenyan Government is in the process of regulating protection of the coastal environment through coastal management and regulation of development.

8 He noted that the Kenyan Government also supported the efforts of former US President Bill Clinton in his efforts as Special Envoy for Tsunami Recovery, to strengthen national capacities in early warning and mitigation systems. Kenya's own national plan will operate within a multi-hazard framework.

9 He commended IOC/UNESCO for its role as enabler, bringing in expertise wherever it is available and in assisting Member States with implementation, and urged the IOC Member States to build upon existing efforts, to build an effective system for tsunami early warning.

2. ORGANIZATION OF THE SESSION

2.1 ADOPTION OF AGENDA

10 The ICG Chairman invited the Group to review and adopt the agenda.

11 Some changes were proposed in the agenda. **The ICG decided** that Agenda item 9 should be moved for presentation during the first day after Agenda Item 3. Requests for presentations were made by Indonesia, Kenya, Maldives, Malaysia and WMO. The Chair agreed to the request for presentation times, and **the ICG approved** the modified agenda. The modified agenda is available in Annex I.

2.2 DESIGNATION OF THE RAPPORTEUR

12 **The ICG designated** Ms Stella Aura of Kenya as Rapporteur.

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

13 The Chairman introduced the Session Timetable and Documentation. He mentioned that all working documents are made available through the IOTWS web site at http://ioc3.unesco.org/icg/.

3. REPORT ON INTERSESSIONAL ACTIVITIES

3.1 IOC EXECUTIVE SECRETARY'S REPORT

14 Dr Patricio Bernal, Executive Secretary of the IOC, gave a brief summary of the accomplishments of the IOTWS since its inception. Following the December 2004 tsunami, one of the IOC's first activities was to conduct assessment missions in countries around the Indian Ocean to assess requirements for an effective and durable tsunami warning system. The reports of the national assessments provide a blueprint for identifying needs on a national level. Countries in the region asserted their rights to have the authority to inform their own populations of risk of tsunami, which implies great responsibility.

15 The Executive Secretary outlined the current status of the IOTWS, highlighting the implementation of new sea level and seismographic networks which will enhance the system. The challenge now is to improve the coordination of national efforts in coordinating tsunami warning into the centre stage of national planning and national development. Coordination at national level is crucial to the successful working of the system. If this is not done then it will be difficult to implement an end-to-end system.

16 He then highlighted a parallel initiative, the Indian Ocean Consortium. This initiative was started by President Clinton in his role as UN Special Envoy for tsunami recovery. There was a good response from many heads of state in the region, and many made requests for assistance in putting in place their national plans. One problem identified was a lack of knowledge at government levels about what is required to build a national tsunami warning system. The consortium has a two-step approach: first to assist with national plans and then implementation.

17 Many agencies are part of this effort, and they are ready to help. However, the needs must be identified before they can help, and to do this the national plans must be drafted. The IOTWS Implementation Plan will be incomplete unless it incorporates the national plans. We need an engagement from all member states in the region, to regularly submit a progress report on national achievements towards implementing a tsunami warning and mitigation system. It is important for national institutions on the front line to sustain the effort, with the support of their governments.

18 A perfect warning will be useless if people do not know what to do in case of an emergency. Awareness of national plans is essential. We need to know what we have committed to do and how much progress we have achieved.

19 Iran asked if there was a programme for the Makran source region. The Executive Secretary answered that this was an important question which needs to be addressed in the national plans for countries in the region.

3.2 CHAIRMAN'S REPORT

20 The ICG/IOTWS Vice Chairman, Dr Jan Sopaheluwakan, reported on the activities of the ICG/IOTWS since the last session in Bali in August 2006. The ICG has been moving forward to facilitate the implementation process as well as following the terms of reference of the ICG.

21 He reported on a number of activities following the Bali session. Working Group 6 has had two meetings; the first in Bangkok in November, where the Chair and Vice-Chair of the group met with the ICG Secretariat and interested agencies. At this meeting they drafted a work plan. The group met again in January 2007 in Kuala Lumpur.

22 There have also been some training courses. In January, a tsunami numerical modelling course was held in Melbourne, Australia, focusing on inundation modelling and using the ComMIT software. The course was sponsored by AusAID and attended by eleven IOTWS countries.

23 A meeting of the Steering Group was held in Perth, Australia, in January 2007, and was attended by the Chairs and Vice-Chairs of the ICG/IOTWS Working Groups and also the ICG Secretariat.

24 The Vice-Chairman noted that there are some encouraging developments around the region, including the deployment of the US/Thai DART buoy in December 2006. In Indonesia, several tsunameter buoys were launched as part of the German/Indonesia cooperation. Malaysia has also deployed some buoys. In 2007 there will be further deployments.

25 Thailand informed the ICG that the buoy they installed on 1st December 2006 was in operation six hours after deployment.

26 Yemen requested that least developed countries be considered for future training programmes.

27 USA informed that they have formalised a joint US/Indonesia contribution to the IOTWS.

28 India informed that they have deployed four tsunameter systems which are currently undergoing a sea trial.

29 The Vice Chairman thanked the countries for their comments and noted that the IOC Executive Secretary has identified the integration of the national networks as one of the key roles facing the ICG/IOTWS. Another issue is the timeline, as it is important that the IOTWS moves forward from the interim system provided by the PTWC and JMA and moves forward to take more responsibility in the region. He expressed a hope that the meeting will facilitate a more active role from the IOTWS member states.

3.3 ICG/IOTWS SECRETARIAT REPORT

30 Mr Tony Elliott, Head of the ICG/IOTWS Secretariat, reported on the Secretariat's activities in the intersessional period. The Secretariat is hosted by the Australian Bureau of

Meteorology and funded by the Government of Australia. The role of the Secretariat is to support the ICG in the coordination and implementation of the IOTWS, and to be the regional focus for the IOC for the IOTWS. It is staffed by Tony Elliott, Jane Cunneen and Rezah Badal, who has been seconded by Mauritius for one year.

31 He gave a brief overview of the activities of the Secretariat during the intersessional period. One of the key achievements of the period has been the establishment of the Working Group 6 on Mitigation, Preparedness and Response. Another was the formation of the ICG/IOTWS Steering Group which met in Perth on 30–31 January 2007.

32 He also outlined the operation of the ICG, election of officers and the role of the Chair and Vice-Chair. A full copy of the report is available in Annex IV.

33 Seychelles asked for clarification on the election of Working Group Chairs. The terms are two years for Chair and Vice-Chair, but WG6 has only been in existence for six months. Is the WG6 Chair to be re-elected during this session?

34 Mr Elliott replied that WG6 would not have to elect a new Chair, and that the current Chair would see out his two-year term.

35 Mauritius requested that Working Groups be given some guidelines on the role of the Chair and Vice Chair.

3.4 REPORT FROM IOC TSUNAMI UNIT

36 Dr Peter Koltermann, Head of the IOC Tsunami Unit, presented a report on the activities of the unit and also of other ICGs during the intersessional period. The IOC Tsunami Unit was formed in 2006 and oversees the activities of the four ICGs involved in setting up Tsunami Warning and Mitigation Systems. The unit provides a wide variety of expertise, and is funded entirely by extra-budgetary resources. The expertise is made available to all ICGs and their working groups.

37 The IOC Tsunami Unit is charged to provide guidance to and assist in the consistent and coherent development of the tsunami warning systems to make best use of the existing oceanographic or meteorological sensors, communication or documentation systems. A full report is in Annex V.

3.5 JTIC REPORT

38 Mr Michael Rottmann, IOTWS Special Coordinator, IOC Jakarta office, presented a report on the opening of the Jakarta Tsunami Information Centre (JTIC) and its initial activities as well as long-term plans.

39 Mr Rottmann stressed the large donor contributions from all over the world which are being used to help build Indonesia's Tsunami Warning System. Canada has provided funding of C$ 10 M for the reconstruction in Aceh, and C$ 500,000 of that is for the JTIC in Jakarta. The JTIC is part of a global network of centres including the ITIC in Hawaii, the ICG/IOTWS Secretariat in Perth, the ASEAN Earthquake Information Centre in BMG Indonesia, the Disaster Information Centre in RISTEK Indonesia, and the French Red Cross Disaster Management Centre. The JTIC will coordinate and cooperate with these centres and also work with the Indonesian Government.

40 Tasks for the JTIC include monitoring and assisting the development of the Indonesian Tsunami Early Warning System through information services. They also provide information and assistance for awareness, preparedness and emergency response (Capacity Building).

The JTIC plans to develop a long-term strategy for the Centre and secure its financial basis, while working for transparency in the Indonesian system.

41 The centre will provide detailed information about the build up of the upstream part of the Indonesian Tsunami Early Warning System to the stakeholders, international donors and other agencies. Information about the downstream activities will also be compiled and provided to stakeholders.

3.6 ITIC REPORT

42 Dr Laura Kong, Director of the IOC International Tsunami Information Centre (ITIC), presented a report on ITIC activities relevant to the ICG/IOTWS. She reminded the participants that the mission of the ITIC is to build up technical expertise and assist with warning systems and warning centres, starting in the Pacific, and also in other areas since December 2004. The ITIC is also an information resource and distributes preparedness and educational materials. This aspect of the ITIC has increased greatly in the past two years.

43 The ITIC feels that there are two critical entities in the implementation of a tsunami warning system: the Warning Centre to provide the warning, and the National Disaster Management Organisation to receive the warning. To act fast without confusion after an event, the operating procedures of warning centres and emergency response agencies must be well defined. The process needs to be sustained at a government level and also with the advocacy groups for the 'last mile'.

44 The ITIC has been working with Indonesia for the past six months to help develop Standard Operating Procedures, working with the local agencies and stakeholders. An update to the IOTWS User's Guide (formerly known as the Communications Plan) has been distributed to all delegations attending the ICG-IV session. Best practices developed from the experience in Indonesia will also be used in other areas such as the Pacific and Caribbean.

45 Dr Kong also provided an update of all the educational materials available from the ITIC. She announced that the ITIC has purchased Tsunami Travel Time Software for distribution to IOTWS countries, and it will be available at the session. It contains calculations and map displays with estimated arrival times. Dr Kong also reviewed other materials available to countries, such as the Tide Tool software.

46 Yemen asked whether the ITIC had any programme for translation of the education materials. Dr Kong replied that the ITIC can work with countries to translate material, but that the individual countries will need to do most of the actual translations.

47 Myanmar asked why the magnitude 8.7 earthquake of March 2005 did not cause a tsunami. Dr Chip McCreery, Director of the PTWC replied that usually an 8.7 earthquake will cause a significant tsunami, but in this particular case it was fortunate that most of the movement was under an island and the water was quite shallow, preventing generation of a large tsunami.

48 Bangladesh asked if there are any plans for publications to be sent to the Ministry of Foreign affairs to get approval for translation, before translation can go ahead. The Director of the ITIC replied that it was a good suggestion.

49 Indonesia asked whether there is a problem with public access to sea level data. The Director of the ITIC replied that currently the data comes through the GTS so it is not readily available to the public.

50 Australia informed that it has put effort into putting sea level data in the CREX code onto the GTS, and offered to help countries with the use of Tide Tool.

4. REPORT AND DISCUSSION ON IOTWS STEERING GROUP

51 Professor Chari Pattiaratchi, Chair of ICG/IOTWS Working Group 4, presented a report on the first meeting of the IOTWS Steering Group, which was held in Perth on 30–31 January 2007.

52 The meeting objectives were: for the Secretariat to provide guidance on Working Group governance and funding, for the Working Groups to provide updates, to explore the gaps and overlaps between the working groups, and to identify key issues facing the IOTWS.

53 The Steering Group identified a need for a regional Tsunami Information Centre (TIC) dedicated to Indian Ocean issues, and recommended that it be discussed at ICG-IV. One possibility is to expand the ITIC in Hawaii, which currently services the Pacific Ocean, but this was felt to be less than ideal due to its geographic location and already large workload. An alternative would be to expand the recently-established Jakarta TIC to cover the whole Indian Ocean. At the moment it is dedicated to Indonesian issues.

54 The Steering Group also noted that with more system detection hardware comprising seismometers, coastal sea level gauges and deep ocean tsunameters being installed, maintenance and sustainability issues need to be addressed, and this should be given high priority at ICG-IV.

55 Several gaps and obstacles were identified for the attention of the ICG:

- Lack of paleotsunami studies and a need for better understanding of past tsunami events for informing risk assessment.
- Identification of non-earthquake tsunami sources (<10% of tsunamis), as the current system relies on an earthquake trigger,
- Systems integration issues —the ADPC has moved into a gap left by the original planning of the IOTWS and are now promising to provide a warning centre to service several countries in the region. Whatever system is put in place by ADPC, the ICG/IOTWS needs to ensure that it integrates with the other aspects of the system
- Lack of high resolution near shore bathymetric and topographic data will prove to be a limiting factor for inundation models. Detailed data (<50m grid) will be required for high risk areas.
- Lack of easily accessible repository of IOTWS information. The Secretariat informed the Steering Group that a new, unified tsunami website was currently being prepared and would be launched shortly. This website will be a source of IOTWS information and also contain links to related web sites.

56 The Group agreed that the membership of the Steering Group should consist of the office holders of the ICG/IOTWS (ICG Chair and Vice-Chairs, and all the WG Chairs and Vice-Chairs). They agreed that the Chair of the Steering Group should be held by the Chair of the ICG.

57 The Group agreed on the following Terms of Reference:

- To ensure cooperation and effective working arrangements between the six WGs;
- To work with the Secretariat to ensure the Implementation Plan of the IOTWS is up to date and meets the ICG's performance indicators (PIs) for establishment of a robust end to end warning system. The reporting of these PIs should be nominally six-monthly;
- To develop a strategic plan to ensure the sustainability of the IOTWS;

- To identify funding priorities for the IOTWS.

58 It was noted that the Group may need to engage the services of a consultant to assist with the development of a strategic plan.

59 Indonesia asked about plans for maintenance and sustainability of the system, and wanted to know if this can be expanded into cooperation with countries to develop their own equipment for disaster protection, and make the information available to other Member States.

5. WORKING GROUP SESSIONAL MEETINGS

60 The six Working Groups formed breakout groups to discuss current issues and make plans for the next intersessional period.

6. NATIONAL REPORTS

61 National Report presentations and written reports are available on the ICG/IOTWS-IV website at http://ioc3.unesco.org/icg.

62 **Australia**: Mr Rick Bailey provided a progress report on the interim Australian Tsunami Warning System (ATWS). He reported that four new seismic stations have been installed while several new tide gauges will be online by April 2007. Australia is also active in risk assessment and capacity building activities which will be built into a multi-hazard framework. Mr Bailey stressed that the Australian Tsunami Warning Centre will be operational by June 2007.

63 **India**: Mr Srinivasa Kumar Tummala summarized the recent update on the components of the Indian Tsunami Warning System. India is planning to significantly upgrade the instrumentation network of seismic stations, with up to 50 tide gauges and a dozen open ocean tsunameter buoys. He stressed that all instruments would be linked through satellite communication links with the interim tsunami warning centre in INCOIS. India also stressed that they would be prepared to act as a Regional Tsunami Watch Provider.

64 **Indonesia**: Dr Prih Harjadi reported on the planned Indonesian Tsunami Warning System which will comprise 10 local (distributed over the different districts) and one Regional Watch Centre. Out of the planned 160 seismic stations, 67 are currently online. Up to 25 tsunameters and 80 tide gauges will complete the instrumentation network. He also reported on several outreach activities supported by numerous partners, and the Bali Drill in December 2006.

65 **Iran I.R.**: Dr Vahid Chegini reported that numerous national institutions are involved in the planning of the Iranian National Tsunami Warning System (INTWS). Iran is focussing their activities on tsunami and inundation modelling, improved bathymetric maps and evacuation procedures for the endangered coastal areas.

66 **Kenya**: Dr Joseph Mukabana outlined the geographic and land-use situation on the Kenyan coastline. He reported that under the coordination of the Kenyan Meteorological Department, several additional tide gauges are installed along the coast. The whole instrumentation system will also comprise two seismic sensors and several buoys off the Kenyan coast while several sirens and warning procedures are planned to protect the population and the tourists on the Kenyan coastline.

67 Malaysia: Dr Mohd Rosaidi Bin Che Abas presented key features of the planned Malaysian Tsunami Warning System. The instrumentation network comprises up to 40 seismometers with VSAT communication links, up to 30 tide gauges and 4 deep ocean buoys

from which two are already online. Additionally, Malaysia plans to install 14 sea observing cameras. Sirens are planned to warn people in densely populated coastal areas.

68 **Mauritius**: Mr S.N. Sok Appadu outlined the responsibilities among the Mauritian ministries and agencies related to Tsunami Mitigation and Disaster Management. Mauritius upgraded its seismic network and GTS as the communication backbone for the IOTWS. Dr Appadu stressed that Mauritius urgently needs international support in training and capacity building.

69 **Myanmar**: Dr Tun Lwin recalled the impact of the 26 December 2004 tsunami in Myanmar and reported on the establishment and upgrade of the National Multi-Hazard Warning System. He stressed the different international missions on tsunami and disaster preparedness to Myanmar and outlined the various activities and projects especially on awareness and preparedness. With the assistance of IOC, GLOSS, NGOs and other international bodies, the sea-level and seismic instrumentation network will be upgraded and bathymetric maps will be provided to produce inundation maps.

70 **South Africa**: Mr Johan Steyn reported on the significant recent upgrade of the national seismic network and the associated real-time satellite communication links. The installations and upgrades have partly has undertaken in cooperation with Germany. All earthquake and tsunami related data are provided to the National Disaster Agency.

71 **Sri Lanka**: Mr Amarasinghe summarized the Sri Lankan progress achieved in building a national Tsunami Warning System which is strongly linked to the National Disaster Management Plan and built into an end-to-end multi-hazards warning system. The downstream component of the tsunami warning system will rely on tsunami warning towers, of which three are already in place. Mr Amarasinghe stressed that for further progress there is an urgent need for training and capacity building.

72 **Thailand**: Dr Smith Dharmsaroja reported on the establishment and responsibilities of the National Disaster Warning Centre (NDWC). He emphasized that in a case of national disaster warnings the NDWC —through its in-built studio— will interrupt the programmes of 14 TV stations and several radio stations to broadcast the warnings. In reporting on the instrumentation upgrade he urged the plenary to re-visit the challenging plans on open ocean buoys and carefully evaluate the installation and maintenance costs against the added value of backup information.

73 **Maldives**: Dr Abdullah Algeen focussed his report on the recent activities to establish a national multi-hazard early warning system for natural hazards; namely storm surges, hurricanes, tsunamis, earthquakes and sea-level rise. He outlined the stages of emergency developed for the national warning system, and summarised plans for awareness programmes, seminars and workshops, with a timeline for full implementation of the system.

74 **Germany**: Dr Joern Lauterjung reported on the progress of the German Indonesian Tsunami Warning System and also on the cooperation with other Indian Ocean countries to install seismic and sea level instrumentation. He provided an overview on the instrumentation installation time-frame which will ensure the end-to-end system for Indonesia to be in place by end of 2008. Additionally Germany reported on seismic training courses in cooperation with BMG and USGS as well as on Ph.D. and Post-Doc. scholarship programmes for applicants from Indian Ocean countries.

75 **USA**: Mr Anastasia Orestes reported on recent progress in the USAID IOTWS programme. Although some funds are channelled through NOAA for sea level instrumentation, the programme mainly focuses on downstream activities like training courses, community resilience and capacity building for disaster managers and other stakeholders. He ended by stressing that USAID is planning to fund a training institute in Thailand.

76 Bangladesh asked Australia if there is a possibility they could help with inundation mapping and structural mitigation. Mr Bailey replied that Australia is happy to provide any advice and already has plans for training courses in cooperation with other international organisations. Bangladesh also addressed India and asked how they plan to link their system to the IOTWS. India replied that they plan to harmonize warning bulletins with other watch providers like Australia.

7. UN AGENCIES AND ADPC REPORT

7.1 ISDR REPORT

77 Dr Stefanie Dannenmann reported on ICG/IOTWS related activities which have been undertaken in close coordination with IOC, WMO, OCHA and other NGO's, including those through the flash appeal initiative "Strengthening the Early Warning and Preparedness". She emphasised ISDR's capacity and experience in preparedness and disaster reduction and their co-ordinating role between the different UN agencies in that role.

7.2 WMO REPORT

78 Mr Stephen Njoroge presented a report on behalf of WMO. He outlined the GTS technical arrangements to distribute Tsunami Warning System messages to and reported on upgrades and improvements to the GTS system. He emphasised that the WMO is happy to provide the GTS as the backbone communications system for the IOTWS.

7.3 ADPC REPORT

79 Mr Arjunapermal Subbiah presented an update of the activities of the ADPC. He reported on milestones towards the establishment of an operational regional tsunami warning facility, with the start of operations planned for December 2009. His presentation included a discussion of regional programme elements and future planned activities.

8. REPORT BY THE INTERIM TSUNAMI ADVISORY SERVICE

80 Dr Charles McCreery, Pacific Tsunami Warning Center (PTWC) Director, gave a report on the status and activities of the Interim Tsunami Advisory Information Service being provided by PTWC and the Japan Meteorological Agency (JMA). He explained that there continue to be enhancements to the near real time sea level network in the Indian Ocean with data from 41 coastal stations now available to PTWC and JMA as well as to Member States on the WMO Global Telecommunications System (GTS). He also noted that data from Thailand's newly installed deep ocean sensor in the Bay of Bengal is also available on the GTS. These stations enable quicker detection and evaluation of any tsunami generated in the Indian Ocean.

81 He then explained that since ICG/IOTWS-III in August of 2006, PTWC has responded to 72 earthquakes in the Indian Ocean region but that only one, a magnitude 6.5 event in the Gulf of Aden, was large enough to warrant a bulletin. He observed that based on historical data, it is typical that only one or two events per year will be large enough to require a bulletin. He noted that the IOC is preparing to post a summary of recent tsunamis on its web site and that eight have occurred since the beginning of 2006, although none was in the Indian Ocean.

82 Dr McCreery gave an overview of the communications test conducted by PTWC on 20 February 2007. Such tests are regularly conducted by PTWC and by JMA to ensure Member State Focal Points are receiving bulletins in a timely manner. He showed that the incomplete responses received from Focal Points can only partially measure the performance of the three communication methods: GTS, fax, and email. However, the GTS appeared to be the quickest

method of dissemination with reported delays of only 1 to 5 minutes. Fax delays were typically 10-15 minutes, and email was delayed from 1 to 59 minutes. Dr McCreery noted that JMA results are qualitatively similar. He re-emphasized the importance of this testing and urged the Group to be diligent in responding.

83 Lastly, Dr McCreery commented on a few additional issues related to the interim service. He said that PTWC and JMA would work together to create a single form for responding to communications tests. He noted that the reporting of new sea level stations and their metadata to PTWC and JMA was being done effectively but on an ad hoc basis and that a more formal method is needed to ensure the information is available to Member States in a timely manner. He indicated that the PTWC website is being upgraded and will soon include a full listing of expected tsunami arrival times for future tsunami events, as well as more graphical products. He referenced the TTT travel time software distributed by ITIC as an alternative for computing expected arrival times. Finally, he explained that PTWC will disseminate its preliminary parameters for earthquakes as either a heads-up for a bulletin or to indicate that no tsunami threat exists for smaller felt earthquakes near the coast.

9. WORKING GROUP PROGRESS REPORTS

9.1 WORKING GROUP 1 PROGRESS REPORT: SEISMIC MEASUREMENTS, DATA COLLECTION, AND EXCHANGE

84 The Chair of Working Group 1, Dr P.J. Prih Harjadi, reported on the updated seismic network in the IO region which now has up to 30 broad band sensors online as part of the network. He stressed the sharing of real-time waveform date among member states and pointed out that seismic training courses and capacity building are essential for the entire region. The Group made the following recommendations:

- The group endorsed the high importance of sharing waveform data in real time for tsunami warning purposes.
- Where the countries can not provide waveform data in real time, it is recommended to share the parametric data including phase arrival time in real time.
- The SeedLink protocol and miniseed format are the recommended method for real time waveform data exchange.
- The Group recommended that the seismology training should be extended to all Indian Ocean sub-Regions.

85 The full report is available in Annex VII.

86 Bangladesh thanked the WG for the work and asked for the timeline to install or upgrade the planned stations. The WG chair replied that this is dependent on national plans and ongoing bi-lateral projects.

9.2 WORKING GROUP 2 PROGRESS REPORT: SEA LEVEL DATA COLLECTION AND EXCHANGE, INCLUDING DEEP-OCEAN TSUNAMI DETECTION INSTRUMENTS

87 The Working Group 2 Chair, Mr K. Premkumar, summarized the progress and findings of the intersessional period. He provided a brief overview on the tsunameter systems and presented an updated list of actions and recommendations. The group held an intersessional meeting on 26 February in Mombasa, Kenya.

88 The Group made the following recommendations:

- The finalised Implementation plan of WG2 should be hosted in the IOTWS website for reference and adoption.
- ICG to endorse India's Tsunameter test facility at NIOT as reference test house available for Member States.
- Member states to approach their respective National Hydrographic office to promulgate the Mariners notification for the Tsunameter location when each deployment is accomplished with a clear instructions to the ships that they should keep off the Tsunameter site preferably by 3 miles to avoid ship noise interference and inadvertent damage by running over on the tsunameter system. Further, IOC secretariat are requested to take up with the International Hydrographic Office for immediate updating in the Charts and Regular bi-annually NAVAREA message about this to create awareness to the Mariners.
- Member States to depute their national Focal points for WGs meetings including WG2. Letter to be issued to all concerned.

89 The full report is available in Annex VIII.

90 The Vice Chair of WG2, Mr Ken Jarrott, reported on the first meeting of the International Tsunameter Partnership (ITP), which was held in Chennai, India on 20–21 February 2007. The ITP is comprised of global key players from IOC Member States and supply companies. The full report is available in Annex IX.

91 Germany noted that the map of deep ocean buoys (tsunameters) needs to revised for publication in the IOTWS Implementation Plan.

9.3 WORKING GROUP 3 PROGRESS REPORT: RISK ASSESSMENT

92 Ms Beatrice Akunka presented a report on behalf of the Chair of Working Group 3, Professor Sam Hettiarachchi. She reported on progress achieved and outlined the activities planned for the next intersessional period. The WG has two workshops planned; one to assess tsunami hazards in the Indian Ocean, and the other to bring together Risk Assessment experts.

93 The Group made the following recommendations:

- Professor Sam Hettiarachchi nominated to remain as Chair of the WG and Dr John Schneider as Vice-Chair.
- IOTWS Member States are requested to identify possible new members for WG3 who have expertise in Risk Assessment.

94 The full report is available in Annex X.

9.4 WORKING GROUP 4 PROGRESS REPORT: MODELLING, FORECASTING AND SCENARIO DEVELOPMENT

95 The Working Group Chair, Professor Chari Pattiaratchi, reported on the activities and developments in the intersessional period. In particular, he outlined the results of the training course on inundation modelling which was held in Melbourne, Australia, 10-19 January 2007. The course was hosted by the Australian Bureau of Meteorology and funded by AusAID, and was attended by 13 participants from 11 Indian Ocean countries. A meeting of the Working Group was held in Mombasa, Kenya, on 26 February 2007. Two further training courses are planned for 2007.

96 The Group made the following recommendations to the ICG:

- Continue training on inundation modelling (two more courses planned for 2007).

- Encourage participation of countries in the working group —more commitment from the countries is required.
- Provide guidelines for other working groups (e.g. risk assessment) on model limitations.

97 A full report is available in Annex XI.

9.5 WORKING GROUP 5 PROGRESS REPORT: THE ESTABLISHMENT OF A SYSTEM OF INTEROPERABLE ADVISORY AND WARNING CENTRES

98 The Working Group Chair, Mr Geoff Crane, reported on progress during the intersessional period and presented a timeline for implementation. In presenting the recommendations, he stressed some points were modifications of recommendations from the ICG-III session, e.g. engagement of international media, report positive achievements without overstating progress and for tsunami travel times a restricted access web site should be provided. A meeting of the Working Group was held in Mombasa, Kenya on 26–27 February 2007.

99 The Group recommended the establishment of a Task Team to develop an implementation plan for an interoperable system for the provision of tsunami watches in the Indian Ocean. The team should have the following Terms of Reference:

- Develop capability guidelines for a Regional Tsunami Watch Provider (RTWP).
- Identify RTWPs.
- Consult with National Tsunami Warning Focal Points to determine appropriate requirements for services/products from Watch Providers.
- Exchange information on methodologies.
- Complete implementation plan for consideration by Member States at ICG/IOTWS-V, including transition strategy for interim service for integration into Ch 3.5 of the IOTWS Implementation Plan.

100 A full report is available in Annex XII.

9.6 WORKING GROUP 6 PROGRESS REPORT: MITIGATION, PREPAREDNESS AND RESPONSE

101 The Vice Chair of Working Group 6, Mr Che Moin Umar, reported on progress achieved during the intersessional period. A meeting was held in Kuala Lumpur on 24–25 January 2007, and also in Mombasa, Kenya on 27 February 2007.

102 The Group made the following recommendations:

- Chair of Working Group 6 to request all Member States to indicate interest in coordinate and/or participate in the Working Group's activities.
- The outcome of this request, together with estimated costs for each activity, will be consolidated by Chair and Vice Chair to be submitted to the ICG Secretariat.
- Working Group 6 to develop project proposals, seek technical and financial support and start implementation phase.

103 A full report is available in Annex XIII.

10. UPDATE ON THE SUPPORT PACKAGE OF THE CONSORTIUM OF ISDR SYSTEM PARTNERS

104 Dr Stefanie Dannenmann reported on the progress towards implementation of the support package of the consortium of ISDR system partners.

105 There are seven partner agencies in the consortium, and it is coordinated by the ISDR. Each partner is responsible for one element of the plan. The aim is to assist countries in developing national plans and identifying further efforts to accelerate the process.

106 By ICG-III in Bali in July 2006, eleven countries had responded to the invitation by advising their interest and two more countries responded shortly after. The plans were presented at the ICG-III session in Bali and technical reviews were completed soon after. The total amount requested by the countries was $ 90 million.

107 The donor outcome did not meet the requests, and there were only three donor offers. There is still a long way to go before requested funds have been mobilised. Some consortium partners have indicated they have funds available within their existing resources.

108 The next step is to mobilize the funds, organise coordination among different government agencies and consortium partners, and ensure coordination among consortium partners that do not have country offices.

109 ISDR would like to start by conducting a single country program, where actions of the agreed outlines are supported by existing funds or by resources from the Indian Ocean Consortium. During the intersessional period, the IO Consortium also plans to refine the country plans and mobilize more resources.

11. REPORT AND DISCUSSION OF IOTWS IMPLEMENTATION PLAN

110 Mr Tony Elliott reported on updates to the IOTWS Implementation Plan.

111 He outlined the objectives of the plan and reminded the ICG that it reflects the work and decisions of the ICG and its Working Groups. The Implementation Plan is a living document and will evolve as the implementation progresses. It needs constant review, verification and augmentation. It should clearly identify the differences between the optimal system design and implementation status.

112 Most sections of the Implementation Plan had been updated for the ICG session; in particular the Working Group plans were now up to date. However the document does not contain details of individual National Plans, and Mr Elliott requested Member States to forward copies of their plans to the Secretariat. These are important to document the progress of IOTWS implementation and indicate gaps and needs for donor agencies consideration.

113 Mr Elliott made several suggestions for improving the format of the Implementation Plan to make it more user-friendly and accessible. He committed the Secretariat to work on restructuring and reformatting the Plan in the interesessional period for circulation as a working document prior to the next ICG session.

114 The Executive Secretary noted that this was a unique opportunity to discuss which way the national plans will be included in the implementation plan. The IOC does not have a large centralised budget which can allocate resources to each of the IOTWS Member States, so it relies on the Member States to provide those resources. The document needs to be as clear as possible. Previously, the downstream part of the warning system was not properly captured by the document. It is vitally important to know what the countries are doing and have some benchmarks to measure progress.

115 The USA commended the ICG Secretariat on the presentation and informed that they were pleased that the Implementation Plan is in dynamic form on the web. They requested that it be updated more frequently than for every ICG.

116 Yemen requested that the IOC consider those countries which do not have the infrastructure for developing national plans or providing information for the Implementation Plan.

117 WMO noted that the omission of national plans in the Implementation Plan is a major problem, as it is the national plans which will bring out the different levels of capacity in each country. It is important that the national governments participate in this process.

12. ELECTION OF ICG/IOTWS OFFICERS

118 **The ICG agreed** to elect the ICG/IOTWS Officers (one Chairperson and two Vice-chairs), Working Group Chairpersons and Vice-Chairs to serve for the successive term.

119 **The ICG elected** Dr Jan Sopaheluwakan of Indonesia for the next term (proposed and seconded by Australia and South Africa), with Mr Rick Bailey of Australia (proposed and seconded by Indonesia and Thailand) and Dr Shailesh Nayak of India (proposed and seconded by Bangladesh and Iran) to serve as Vice-Chairs.

120 **The ICG approved** the nominations of the following Working Group Chairpersons and Vice-Chairs:

Working Group 1 Chair: Dr Fauzi of Indonesia
Working Group 1 Vice-Chair: Dr Spiro Spiliopoulos of Australia

Working Group 2 Chair: Mr K. Premkumar of India (second term)
Working Group 2 Vice-Chair: Mr Ken Jarrott of Australia (second term)
Working Group 2 Vice-Chair: Dr Parluhutan Manurung of Indonesia

Working Group 3 Chair: Prof Sam Hettiarachchi of Sri Lanka (second term)
Working Group 3 Vice Chair: Dr John Schneider of Australia (second term)

Working Group 4 Chair: Prof Chari Pattiaratchi of Sri Lanka (second term)
Working Group 4 Vice Chair: Dr Diana Greenslade of Australia

Working Group 5 Chair: Mr Geoff Crane of Australia (second term)
Working Group 5 Vice Chair: Mr Charles Ngunjiri of Kenya

121 The Chair and Vice Chair of Working Group 6 will remain for the next intersessional period as they have only served a six-month term.

13. PROGRAMME AND BUDGET FOR 2006–2007

122 Mr Tony Elliott presented the programme and budget for 2007–2008.

123 The IOC Tsunami unit has funds until the end of 2008 and the ICG/IOTWS Secretariat has funds until June 2009. The budget for the ICG/IOTWS Secretariat is 400,000 Australian Dollars per year, of which about two thirds goes to salaries and operating costs.

124 The remainder is used for operations of the ICG/IOTWS. Training courses are organised for the next year, including two training courses for WG4 funded by USAID and two for WG3 (one funded by AusAID and one by WAPMERR).

125 **The Executive Secretary** noted that much of the IOC's work on tsunami since 2004 has been funded by generous donations. The coordination has been supported by extra-budgetary resources, which will continue until 2008/2009. The regular budget of IOC and UNESCO cannot defray these extra expenses, so it is important that we are fully transparent and accountable to the donor community. We do not foresee difficulty in continuing our work but we do need support from Member States.

14. NEXT SESSION

126 **The ICG thanked** Malaysia for its generous offer to host the next meeting, scheduled for February 2008.

127 **The ICG recommended** that working group meetings be held two to six months before the next ICG so that the results can be available before the meeting.

15. OTHER BUSINESS

16. ADOPTION OF THE SUMMARY REPORT AND RECOMMENDATIONS

128 **The ICG reviewed** the recommendations from the session and a proposed resolution. After some debate and changes to the wording of the resolution, the **ICG adopted** the resolution given in full in Annex II.

17. CLOSE OF MEETING

129 The Chairman thanked the delegates and representatives for coming to Kenya and thanked the Kenyan Government for generously hosting the session.

130 The session was closed at 1:45 pm on Friday 2 March 2007.

ANNEX I

AGENDA

1. WELCOME AND OPENING OF FOURTH SESSION

- Dr Patricio Bernal, Assistant Director-General of UNESCO and Executive Secretary of the Intergovernmental Oceanographic Commission
- Dr Jan Sopaheluwakan, Deputy Chairman of Earth Sciences, Indonesian Institute of Sciences, ICG/IOTWS Vice Chair
- His Excellency, Dr Moody Awori, MP., EGH, Vice-President and Minister for Home Affairs and National Heritage, Kenya
- Group Photo

2. ORGANIZATION OF THE SESSION

2.1 ADOPTION OF AGENDA

2.2 DESIGNATION OF THE RAPPORTEUR

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

3. REPORT ON INTERSESSIONAL ACTIVITIES

3.1 IOC EXECUTIVE SECRETARY'S REPORT

3.2 CHAIRMAN'S REPORT

3.3 IOTWS SECRETARIAT REPORT

3.4 REPORT FROM IOC TSUNAMI UNIT

3.5 JTIC REPORT

3.6 ITIC REPORT

4. REPORT AND DISCUSSION ON IOTWS STEERING GROUP

5. WORKING GROUP SESSIONAL MEETINGS

6. NATIONAL REPORTS

7. UN AGENCIES AND OTHER ORGANISATIONS

7.1 ISDR REPORT

7.2 WMO REPORT

7.3 ADPC REPORT

8. REPORT BY THE INTERIM TSUNAMI ADVISORY SERVICE

9. WORKING GROUP PROGRESS REPORTS

9.1 WORKING GROUP 1 PROGRESS REPORT: SEISMIC MEASUREMENTS, DATA COLLECTION, AND EXCHANGE

9.2 WORKING GROUP 2 PROGRESS REPORT: SEA LEVEL DATA COLLECTION AND EXCHANGE, INCLUDING DEEP-OCEAN TSUNAMI DETECTION INSTRUMENTS

9.3 WORKING GROUP 3 PROGRESS REPORT: RISK ASSESSMENT

9.4 WORKING GROUP 4 PROGRESS REPORT: MODELLING, FORECASTING AND SCENARIO DEVELOPMENT

9.5 WORKING GROUP 5 PROGRESS REPORT: THE ESTABLISHMENT OF A SYSTEM OF INTEROPERABLE ADVISORY AND WARNING CENTRES

9.6 WORKING GROUP 6 PROGRESS REPORT: MITIGATION, PREPAREDNESS AND RESPONSE

10. REPORT AND DISCUSSION OF IOTWS IMPLEMENTATION PLAN

11. UPDATE ON THE SUPPORT PACKAGE OF THE CONSORTIUM OF ISDR SYSTEM PARTNERS

12. ELECTION OF ICG/IOTWS OFFICERS

13. PROGRAMME AND BUDGET FOR 2006–2007

14. NEXT SESSION

15. OTHER BUSINESS

16. ADOPTION OF THE SUMMARY REPORT AND RECOMMENDATIONS

17. CLOSE OF SESSION

ANNEX II

RECOMMENDATIONS

ICG/IOTWS-IV.1

The Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System,

Having met for its 4th Session in Mombasa, Kenya,

Recalling the Resolution XXIII-12 that established the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System,

Noting the coordinating role of the Intergovernmental Oceanographic Commission,

Recognizing the progress towards establishing tsunami warning centres in all countries around the Indian Ocean since the Sumatra Tsunami in 2004,

Reaffirming that the Indian Ocean Tsunami Warning and Mitigation System (IOTWS) will be a coordinated network of national systems and capacities, and will be part of a global network of early-warning systems for all ocean-related hazards,

Reaffirming further that each Member State has the responsibility to issue warnings within its respective territories,

Recalling its commitment to an open, free and unrestricted sharing of tsunami-relevant real-time observational data in accordance with the UNESCO/IOC Oceanographic Data Exchange Policy and without prejudice to the sovereignty of Member States,

Inviting partners of the Indian Ocean Consortium to consider extending their assistance to all countries of the Indian Ocean,

Acknowledging

i) the interim coverage for tsunami advisory information provided to the Indian Ocean region by the Pacific Tsunami Warning Centre (PTWC) and the Japan Meteorological Agency (JMA),

ii) the continuing support of the IOC/ITIC (International Tsunami Information Centre) to assist the ICG/IOTWS and its Secretariat in development of communications and capacity-building activities,

iii) that the IOC successfully developed a comprehensive programme of capacity-building on tsunami protection for the Indian Ocean, in order to assist all countries of the region, including the coastal African countries and Middle-Eastern countries, to have the capacity to protect their populations.

iv) The continuing support of the WMO/GTS programme and its NHS to assist the ICG/IOTWS and its Member States in dissemination of tsunami warnings and exchange of data,

Having reviewed the progress made in the implementation of the IOTWS,

Concludes that:

i) the countries of the Indian Ocean rim have taken positive steps towards establishing and developing national tsunami warning centres;

ii) countries of the Indian Ocean are engaged in further and close cooperation in the establishment of the IOTWS;

iii) countries of the Indian Ocean rim are progressing towards defining the requirements and capabilities for National Tsunami Warning Centres to take over the function as a regional tsunami watch providers;

iv) national implementation of effective and sustainable end-to-end early warning and mitigation systems is of critical importance;

v) Member States not having sufficient capacity to develop tsunami early warning and mitigation systems should be given special support to accelerate this process;

Welcomes and notes with interest the work in progress by a number of countries towards developing Regional Tsunami Watch Provider capability including Australia, India, Indonesia, Malaysia, Thailand/ADPC, and Iran;

Invites other countries around the Indian Ocean to review their potential to also be Regional Tsunami Watch Providers; and

Recommends to:

- Develop by the end of 2007 an implementation plan for an interoperable system of Regional Tsunami Watch Providers, including a transition from the interim service providers for presentation to the next session of the ICG/IOTWS;
- Work towards providing full regional coverage for the Indian Ocean countries by the end of 2008.

ANNEX III

SUMMARY OF WORKING GROUP RECOMMENDATIONS TO THE ICG

Working Group 1: Seismic Detection, Measurement and Data Exchange

Recommendations

- The group endorsed the high importance of sharing waveform data in real time for tsunami warning purposes.
- Where the countries can not provide waveform data in real time, it is recommended to share the parametric data including phase arrival time in real time.
- The SeedLink protocol and miniseed format are the recommended method for real time waveform data exchange
- The Group recommended that the seismology training should be extended to all Indian Ocean sub-Regions
- The Group should have a guide book on how to establish seismic station, equipment specification, operations and maintenance
- The Group agreed to nominate Dr Fauzi (Indonesia) as Chair and Dr Spiliopoulos (Australia) as Vice Chair, to be approved by the ICG plenary.

Action Items

No	Action	Person Responsible	Due Date
1	Develop two new stations in Kenya	KMD	2008
2	Up to 40 seismic stations will be developed by Germany in Indian Ocean region	GFZ of Germany	March 2010
3	New chairman and vice election	Current chairman	End of March, 2007

Working Group 2: Sea Level Measurement, Data Collection and Exchange, including Deep Ocean Tsunami Detection Instruments

Recommendations:

- Mr K. Premkumar, India was nominated to continue as the Chair and Mr Ken Jarrott as the Vice Chair for Deep Ocean Stations.
- Dr Parluhutan Manurung, Indonesia was nominated to serve as the Vice-Chair for Coastal sea level station in place of Mr Bernie Kilonsky who will step down.
- Mr Ken Jarrott, Australia was nominated to serve as Chair of the ITP (International Tsunameter Partnership), with Ridwan Djamaluddin, Indonesia, to serve as Vice Chair.
- The finalised implementation plan of WG2 should be hosted in the IOTWS web site for reference and adoption.
- ICG to endorse India's Tsunameter test facility at NIOT as reference test house available for Member States.

- *Data Repositories and Archiving for Sea Level Data*. Working Group 2 has identified the need for systematic quality assurance, data management, and long term archiving of IOTWS core station observational data. Working Group 2 recommends that the Paris Secretariat coordinate with IOC/GLOSS/IODE to identify (1) best practices appropriate to the Indian Ocean regional for core station data quality assurance, and (2) best practices appropriate to the Indian Ocean region for data management at national warning centres and regional watch providers
- *Global Telecommunications System Resources Information and Update*: Working Group 2 recommends that the Perth Secretariat, in close consultation with appropriate WMO regional bodies, develop and maintain an operational database of core IOTWS instruments, all relevant metadata, their operational status, and other information of use to national warning centres or regional watch providers. The database should be made available on the Internet. This database should be updated regularly; the Secretariat should also proactively notify IOTWS national points of contact, national warning centres, and regional watch providers of significant changes to IOTWS core station system status.
- *Access to IOTWS Core Station Data*: It is understood that many Member States are not receiving IOTWS core sea level station data. Working Group 2 recommends that the Perth Secretariat, in close consultation with appropriate WMO regional bodies, prepare a short technical memorandum that informs IOTWS Member States how to access core station data. Such information should include a description of the process to request relays from regional hubs, entries into national warning centre tables, and other steps required to receive core station data. The purpose of this technical memorandum is to help facilitate interactions between national warning centres, national operators of observational networks and national meteorological agencies.
- Member States to approach their respective National Hydrographic office to promulgate the Mariners notification for the Tsunameter location when each deployment is accomplished with clear instructions to ships that they should keep off the Tsunameter site preferably by 3 miles to avoid ship noise interference and inadvertent damage by running over on the tsunameter system. Further, IOC secretariat are requested to take up with the International Hydrographic Office for immediate updating in the Charts and Regular bi-annually NAVAREA message about this to create awareness to the Mariners.
- Member States to depute their national Focal points for WGs meetings including WG2. Letter to be issued to all concerned.

Action Items

No	Action	Person Responsible	Due Date
1	To evolve common standards and best practices and allied issues reference under ITP by a group of Experts drawn from USA, India, Sonardyne UK	Vice Chair-Deep Oceans	Mar 07-First document. June 07-Final
2	*Global Telecommunications System Issues: Data Latency Test* – Conduct a data latency test for deep ocean and in situ observations and publish the results in an informational memorandum to be distributed to Indian Ocean Member States and observers by the Perth Secretariat	Vice Chair-Deep Oceans	Shall begin from April 07 and WG5 Chair will coordinate.
3	Member states to depute their national Focal points for WG2 meeting. Letter to be issued to all concerned	Chair, ICG/IOTWS Secretariat	Mar 07
4	Database for Tracking Progress and Plans for Sea Level Stations to Full Operational through IOTWS website	Vice Chairs	Limited operation by

No	Action	Person Responsible	Due Date
			June 07 before wider access.
5	Sea Level Observation Network Design: WG2 to undertake a review of the composite deep ocean and coastal sea level observing network, based on a consideration of warning times, and of other objectives or pragmatic constraints	Vice Chair-Deep Ocean Station	By June 07 in consultation with WG4
6	National Reports received in power-point from India, Indonesia including USA input, Germany, Kenya, Malaysia, Sri Lanka would be hosted in the IOTWS web site. The soft copy would be given to ICG/IOTWS Secretariat.	Chair to ICG/IOTWS Secretariat	April 07

Working Group 3: Risk Assessment

Recommendations

- Prof. Sam Hettiarachchi nominated to remain as Chair of the WG and Dr John Schneider as Vice-Chair.
- IOTWS Member States are requested to identify possible new members for WG3 who have expertise in Risk Assessment.

Action Items

ACTION	PERSON RESPONSIBLE	DEADLINE
1) Mitigation options and decision support methodology A common and best practice methodology and guidelines will be developed for use by member nations. The working group will liaise with similar working groups in other IOC Tsunami Working Groups to streamline and standardize methods and guides, and share knowledge and information. The working group recognizes that methods and guides will reflect regional diversity. It is expected that documentation of methodologies and guidelines would be available via the internet.	John Schneider Slava Gusyakov Torsten Schlurmann and Mawardi Nur	June 2007
2) Mitigation Options and Decision Support Case Studies Case studies developed by June 2006 will be enhanced through the application of mitigation options to demonstrate decision mechanisms for stakeholders including emergency response managers, land use planners, and national and local governments. These options include: • Environmental Barriers (e.g., mangroves, sand dunes), • Artificial Countermeasures (e.g., tsunami breakwaters, sea walls), • Land Cover and Land Use (e.g., building set-backs, tsunami-specific zonation), • Tsunami Resistant Infrastructure (e.g.: building codes and certification), • Evacuation Plans (e.g., vertical evacuation, tsunami-safe zones, time is a factor). • Harness indigenous knowledge for reducing vulnerability (eg: animal behaviour, folklore/songs)	Sam Hettiarachchi	October 2007

ACTION	PERSON RESPONSIBLE	DEADLINE
3) Workshop and training exercises To facilitate knowledge transfer and information sharing a series of workshops and materials to supplement the case studies will be developed.	Sam Hettiarachchi	July 06-June 08
4) Development of an Integrated Regional Tsunami Hazard/Risk Model • Together with WG 4 develop credible tsunami scenarios for the Indian Ocean region, with initial focus on major earthquakes • Generate an Indian Ocean tsunami hazard map for earthquake sources and deep-ocean propagation, followed by consideration of volcanoes and landslides (June 2008).	John Schneider, with Chair of WG4	June 2007 June 2008
5) Training Workshops Training Workshop on Risk Assessment to be supported and hosted by WAPMERR in Dubai January or April 2007 for 3-4 days. Tsunami sources, Tsunami inundation scenarios (from WG3), Vulnerability/impact, Probability, Uncertainty will be covered in the workshop. Subsequent Workshop on mitigation in later 2007 or the following year.	Adel Karas Sam Hettiarachchi John Schneider Slava Gusyakov Velly Asvaliantina Beatrice Akunga	2007
4) Future Activities It is expected that other activities will be identified through the life of the working group, including information management, data collection standards, and GIS and database development to facilitate access to information for modelling and risk assessment purposes.	Sam Hettiarachchi	TBD

Working Group 4: Modelling, Forecasting and Scenario Development

Recommendations:

- To highlight to the countries of the Indian Ocean that absence of high resolution nearshore bathymetric and topographic data will limit the successful application of inundation models. Detailed and accurate data (<50m grid) is required for high risk areas.
- Continue training in the use of the inundation model ComMIT. Two training programs will be undertaken in 2007 in Jakarta and Bangkok through funding provided by USAID.
- Encourage participation of countries in the working groups – more commitment from the countries is required.
- To nominate Prof. C Pattiaratchi (Sri Lanka) and Dr Diana Greenslade (Australia) as the Chair and vice-Chair of the working group for the next term.

Action Items

NO	ACTION	PERSON RESPONSIBLE	DUE DATE
1	Develop inundation maps for the coastal communities of the Indian Ocean region including translation of the inundation projections to evacuation maps.	C. Pattiaratchi	End 2015
2	Model benchmarks to be accepted and available on the IOC website	Behrens/ Asvaliantina	December 2007
3	Links to tsunami scenario databases to be available on the IOC website.	C. Pattiaratchi	August 2007
4	Continue short term training with at least two courses to be completed by end 2007	C. Pattiaratchi / D. Greenslade/ V. Titov / ICG Secretariat	Next ICG
5	Support long-term training requirements for model maintenance, ongoing consultation and support at selected institutions.	C. Pattiaratchi	2015
6	Compilation of a list of historical events and post on the IOC website.	C. Pattiaratchi	Dec 2007
7	A standard glossary including all terms that are used to measure tsunami inundation be available on the IOC website.	C. Pattiaratchi	Dec 2007
8	Develop a meta-database of tsunami scenarios, including a link from the IOC website	Behrens/ Asvaliantina	Next ICG
9	Develop a document to provide guidelines on model limitations.	All	Next ICG

Working Group 5: A System of Interoperable Advisory and Warning Centres

Recommendations

Some recommendations from WG 5 to ICG III are still valid. In summary, these are:

- Engage the international media
- Report positive achievements without overstating progress
- Provide more travel times, but on a restricted access web site
- Distribute the “Observatory” message to give the earliest possible alert

Some recommendations to ICG-IV are developments of recommendations to ICG-III.
In summary, these are:

- Provide graphical tsunami bulletins
- Provide more detail in tsunami bulletins, stratifying the level of threat
- Develop a programme of exercises for both the interim and developing IOTWS (incorporated into the work programme for the Task Team)

And there were some new recommendations. In summary, these are:

- Establish a Task Team to coordinate the development of the IOTWS

- Establish a central registry of information metadata in the ICG Secretariat
- Maintain strong liaison with WMO on communications networks and data management issues

Action Items

No	Action	Person Responsible	Due Date
1	Establish a Task Team to develop an Implementation Plan for an interoperable system for the provision of Tsunami Watches for the Indian Ocean, for integration into Chapter 3.5 of the UNESCO IOC IOTWS Implementation Plan	Chair of task team (Geoff Crane, Australia)	December 2007
2	Task Team to define a set of performance indicators for RTWP Services and Products as a component of the Implementation Plan.	Chair of task team (Geoff Crane, Australia)	
3	Encourage the interim tsunami watch providers to develop their products to enhance their value to users. This should include a method of stratifying the level of threat within tsunami watch bulletins which would incorporate appropriate emphasis on the dangers associated with even very small tsunami.	WG5 Chair, Vice Chair	
4	Continue to encourage the interim tsunami watch providers to develop graphical versions of their international tsunami watch bulletins.	WG5 Chair, ICG/IOTWS Secretariat	
5	Conduct regular tests of the interim IOTWS, including simple exercises	WG5 Chair/ICG/IOTWS Secretariat, Interim tsunami watch providers	
6	Establish a centralised source of information on availability of data (details of national contacts, national tsunami focal points, seismic data, sea level data, etc)	ICG/IOTWS Secretariat	
7	Maintain strong links and close liaison between IOC and WMO on communications and data management issues.	ICG/IOTWS Secretariat	

Working Group 6: Mitigation, Preparedness and Response

Recommendations

- Chair of Working Group 6 to request all member states to indicate interest in coordinating and/or participating in the Working Group's activities.
- The outcome of this request, together with estimated costs for each activity, will be consolidated by Chair and Vice Chair to be submitted to the ICG Secretariat.
- Working Group 6 to develop project proposals, seek technical and financial support and start implementation phase.

Action Items

No	Action	Person responsible	Due Date
1	**GOVERNANCE**		
1.1	Revisit existing national steering committees to ensure appropriate representation. MS task to report back	Member States	2007
1.2	Support national policy adjustment through workshops.	Member States	2008
1.3	Stimulate government commitment by cooperating with other working groups to adapt their scientific findings to government language.	Chair/Member States	2008
1.4	Support the integration of disaster risk reduction into political policy trough national platforms.	Member States	2007
2	**COMMUNITY RESILIENCE**		
2.1	Ongoing regional training program on coastal community resilience assessment tools and action planning process by e.g.: • Encouraging MS to utilise work already carried out under the CCR initiative, including USAID project.	ICG Secretariat/Chair/ Member States	2007
2.2	Sharing experience and lessons learned in using the assessment tools and implementing action plans by e.g.: • Regional CCR workshop with USAID and other partners	USAID/Chair/ Member States	2007
2.3	Sharing best practices and lessons learned on promoting sustainable and diverse livelihoods and supporting social and cultural networks that enhance community resilience, through: • Workshop to share best practices and lessons learned. Invite partners such as APEC. • Sharing products from ongoing projects, e.g. USAID. • Enhancing traditional coping mechanisms • Incorporating scientific research findings with indigenous knowledge	USAID/Chair/ Member States/ICG Secretariat	2007
2.4	Encourage MS to gather examples, develop new and implement existing guidelines on engaging the private sector in micro-credit and insurance schemes.	ICG/Chair/Member States	2007
3	**MITIGATION**		
3.1	Adapt and promote existing guidelines on land-use and evacuation planning (considering both flat and hilly countries).	Member States	2008
3.2	Regional training program on assessment, identification and implementation of appropriate coastal land-use, evacuation zones and mapping (including GIS).	ICG/Chair	2008
3.3	Share best practices and lessons learned in national assessment, identification and implementation of land-use and evacuation planning.	Member States	2008
3.4	Training programme and sharing of best practices and lessons learned on management of sensitive coastal resources and natural protective features.	ICG/Member States	2008
4	**PREPAREDNESS & RESPONSE**		
4.1	Engage with country and regional media corporations to encourage them to become partners/stakeholders with governments at all levels to disseminate factual and timely tsunami warnings and information to communities. Through a regional workshop.	ICG/Chair/Member States	2007

No	Action	Person responsible	Due Date
4.2	Assist countries to establish 'national disaster safety day' to sustain awareness and strengthen preparedness through drills and education. A written Policy Brief signed by the Chair of WG6, to be disseminated to all MS.	ICG	2007
4.3	Document traditional knowledge and symbols on the incidents of hazards, including tsunamis, for possible use in education, public awareness and media campaigns, as well as an international lessons learned report.	Member States	2007
4.4	Form partnerships with IFRC and social/religious bodies to utilise established networks for the dissemination of community specific tsunami information materials.	IFRC/Member States	2007
4.5	Engage an expert to assess the gaps that are preventing governments to establish SOPs (including division of responsibility) at all levels. • Mid term —addressing the outcomes of such assessment. • Long term —follow-up on that action to bridge the gaps have been taken.	ICG Secretariat	2007
5	**ANALYSIS & EVALUATION**		
	Identify international organisations engaged in vulnerability and capacity assessment (VCA) and develop a coordinated approach to VCA, based on the results of the risk mapping conducted by Working Group 3.	ICG Secretariat	2007

ANNEX IV

REPORT FROM THE ICG/IOTWS SECRETARIAT

The ICG/IOTWS Secretariat operates from the IOC Regional Programme office at the Bureau of Meteorology in Perth, Western Australia, and is supported by the Government of Australia with funds committed up to mid-2009. The main role of the Secretariat is to coordinate the work of the ICG and to be the regional focus for the IOC for the IOTWS.

The Secretariat currently has two full time staff: Jane Cunneen and the Head of Secretariat, Tony Elliott. The team will be joined in the near future by Rezah Badal, who will be seconded for 1 year from the Mauritius Oceanographic Institute under a secondment programme funded by AusAID. Under this scheme it is envisaged that up to 3 individuals from different IOTWS Member States will be seconded to the Secretariat to provide additional support to the team and further opportunities for capacity building.

The intersessional period since ICG-III in Bali has been extremely busy and the Secretariat has been heavily involved in organising the following meetings and workshops:

- Organised and attended the WG6 coordination meeting in Bangkok, 1–2 November.
- Helped to organise and attended the WG4 training course on Inundation Modelling in Melbourne, 10–19 January
- Organised and attended the WG6 intersessional meeting in Kuala Lumpur, 24–25 January.
- Organised and attended the Steering Group Working Group Chairs' meeting, 30–31 January.
- Helped to organize and attended the Inaugural Meeting of the International Tsunameter Partnership (ITP) in Chennai, 20–21 February.

The establishment of Working Group 6 on Mitigation, Preparedness and Response was an important achievement of the intersessional period. Through a series of meetings the group is making good progress towards development of their workplan. Another significant achievement was the establishment of a Steering Group to ensure cooperation and effective working arrangements between the six Working Groups. The aims of the Steering Group are to improve the cohesion and integration of the Working Groups and to develop a strategic plan to ensure sustainability of the IOTWS.

The Secretariat also attended the following meetings, workshops and training courses: meetings with NDWC, USAID, UNESCAP, UNDP and ADPC in Bangkok; AEMC workshop in Melbourne; ITSU Training Program at ITIC, Hawaii; meetings with BMG and BPPT in Jakarta; US-Thai DART buoy launching ceremony in Phuket; meetings with Meteorological Services Department and National University of Singapore in Singapore; the ITU-ESCAP Disaster Communications Workshop in Bangkok; and meetings with Malaysian Meteorological Service in Kuala Lumpur.

The Secretariat implemented IOC's satellite phone initiative in September 2006. The purpose of this initiative is to ensure that the National Warning Centre in each Member State has a fallback communication channel in the event that other channels are disrupted during an emergency. The satellite phones are not intended to be a primary communication channel but can be used to complement the standard channels. Communications tests carried out by the Secretariat have had disappointing results and we will be working with the Member States to identify problems and enhance the utility of this service.

As the first term of the ICG comes to an end it is timely to review its structure and identify areas for improvement. The ICG is a Primary Subsidiary Body of the IOC and has a membership of 28 Indian Ocean Member States. Non-Indian Ocean IOC Member States, UN Agencies and other invited inter- and non-governmental organisations have observer status in the ICG. The Working Groups are Secondary Subsidiary Bodies created by the ICG and have the same membership rules as the ICG. However, additional criteria for membership of the Working Groups are technical capability and continuity of membership. The Working Groups are not "training grounds" and members are expected to be able to contribute their scientific and technical expertise for the benefit of the IOTWS.

At the national level, the Secretariat relies heavily on the National Focal Points as point of contacts for two way exchange of information. There has been some confusion over the roles of the focal points and the system is not working effectively. To reiterate, there are two types of focal point in each country – the Tsunami Warning Focal Point (TWFP) and the Tsunami National Contact (TNC) – and the Secretariat would greatly appreciate if each Member State could update details of both. The TWFP is the contact point for 24/7 warnings and will typically be working in an operational National Warning Centre. The TNC is the person who should be contacted on administrative and policy matters, typically someone who will attend ICG meetings as a representative of his/her government. For both TWFPs and TNCs, the contact persons must be nominated by the Ministry of Foreign Affairs of the Member State. It is not possible for us to accept nominations that are not endorsed by this level of government.

Looking forward to the next intersessional period, the Secretariat will continue to work closely with the Working Groups and the Steering Group and will continue to liaise with Member State TWFPs and TNCs. We anticipate that there will be closer coordination between the Working Groups with more emphasis on cross cutting issues affecting 2 or more groups as the IOTWS continues to develop into an integrated end-to-end system.

ANNEX V

REPORT FROM THE IOC TSUNAMI UNIT

The IOC Secretariat supports all Tsunami Warning Systems through its Tsunami Co-ordination Unit. This includes providing the Secretariats for each of the present four systems, namely:

- Pacific Tsunami Warning System PTWS with its Secretariat at ITIC, Hawaii,
- Indian Ocean Tsunami Warning and Mitigation System IOTWS with its Secretariat in Perth, Australia,
- Northeast Atlantic, Mediterranean and Connected Sea Tsunami Warning and Mitigation System NEAMTWS with the secretariat function taken care of by the Unit in Paris, France,
- Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions CARIBE-EWS with its Secretariat in Cartagena, Colombia.

At present the Unit assists in the development of terms-of-reference and governance structures for the Global Tsunami and other Ocean-related Hazards Early Warning System (GOHWMS) to be discussed and adopted at the 24th IOC Assembly in June 2007.

Together the Unit provides and has access to a wide variety of expertise in seismology, oceanography, communication and telecommunication, warning centre operations, computing and programming, legal affairs and general management. With its offices close to the oceans potentially affected it also draws on local and regional knowledge. All this expertise is made available to all Intergovernmental Co-ordination Groups and their Working Groups. The Unit is charged to raise synergy effects in the development and maintenance of the existing four TWSs, provide guidance to and assist in the consistent and coherent development of the systems to make best use of existing oceanographic or meteorological sensor, communication or documentation systems. This also includes the promotion of experiences and lessons learnt from other systems or from natural disasters.

To ensure a consistent development, the unit on the advice of the ICGs is pursuing the documentation of the state of a TWS, and the needs for its future development through a living **Implementation Plan**, the documentation of a particular system's mandate, operations, responsibilities and performance through its **Operations Plan,** and the definitions of its communications and product development and delivery structure through its **Communications Plan.** In all, these plans will provide for the stakeholders of the systems a general outline to adapt these instruments to their needs and requirements.

Through the International Tsunami Information Centre ITIC in Hawaii, USA the Unit has been organizing and assisting in capacity building programmes and activities to numerous member states, drawing on its long-standing expertise and valuable resources. These are now being implemented in the other, newer systems and promote the necessary awareness and preparedness measures to ensure the effectiveness of the TWSs. Other TICs are being developed in conjunction with the respective TWSs, or have been focussed on nationally identified requirements as the J-TIC in Jakarta, Indonesia.

The dominant data streams essential to the real-time operations of all such Early Warning Systems, seismic and sea level data, are being constantly monitored in order to improve performance and coverage, and potentially identify new technologies or scientific achievements. Alternative streams, methods or processes are reviewed so that a high level of redundancy is available in case of natural disasters and their effects, also, on the TWS infrastructure.

IOC interacts directly and continuously with the Permanent Delegations of Member States to UNESCO to ensure a viable and targeted communication; the Unit briefs the Permanent Delegations on developments and the status of the TWSs.

Through these efforts and the strong co-operations with the ICGs the Unit strives to minimize efforts and resources needed for member states to develop and operate national tsunami warning systems at national, regional and global scales and maximize all efforts to reduce the risks of ocean-related hazards and safe lives and livelihoods.

ANNEX VI

ICG/IOTWS WORKING GROUP 1
Seismic Measurements, Data Collection and Exchange
REPORT OF SESSIONAL MEETING ICG-IV (28 FEBRUARY 2007)

Chair: Dr. P.J Prih Harjadi
Vice Chair: Dr. Fauzi

1. WG TERMS OF REFERENCE

- Identify the core seismic stations in Indian Ocean region
- Establish the core seismic network in Indian Ocean region
- Make seismic data of core seismic station available to member state countries in real time for tsunami warning purposes.
- Establish the communication link to the members to update the status of development of seismic stations and new available technology

2. MEETING OBJECTIVES

- Evaluate the previous recommendation
- Identify the difficulties to establish the seismic network in each country especially to those core seismic stations.
- Propose the possibility to overcome the difficulties

3. DISCUSSION OF ISSUES

- Overview of the previous recommendation from ICG1, 2 and 3, to evaluate the current status of core stations. (*The group requests member states to update the core station status table provided*)
- Identify the current problems in establishing new station of the core stations
- Data sharing; waveform, parametric data, status of seismic waveform database
- Provide technical guidelines on the establishment of seismic stations namely, equipment specification, operations and maintenance.
- Automatic data processing; seiscomp 2.5
- Training for seismologists in the region
- Seismic Data transmission, problem of regulatory issues
- Election of WG-1 chairman

4. REVIEW OF OUTSTANDING ACTIONS

- Kenya identified 3 more stations to be installed and shared; 1 station is Geofon, 2 stations are Kenya (KMD)
- Indonesia identified 2 more existing seismic stations to be shared
- Germany installed and will install seismic stations in; Indonesia (23), Sri Lanka (2), Maldives (2), Yemen (2), Kenya (2), Tanzania (2), S-Africa (5), Madagascar (2)

5. AGREED ACTIONS AND DEADLINES

No	Action	Person Responsible	Due Date
1	Develop 2 new stations in Kenya	KMD	2008
2	Up to 40 seismic stations will be developed by Germany in Indian Ocean region	GFZ of Germany	March 2010
3	New chairman and vice election	Current chairman	End of March, 2007

6. WORKING GROUP RECOMMENDATIONS TO THE ICG

- The group endorsed the high importance of sharing waveform data in real time for tsunami warning purposes.
- Where the countries can not provide waveform data in real time, it is recommended to share the parametric data including phase arrival time in real time.
- The SeedLink protocol and miniseed format are the recommended method for real time waveform data exchange
- The Group recommended that the seismology training should be extended to all Indian Ocean sub-Regions
- The Group should have a guide book on how to establish seismic station, equipment specification, operations and maintenance
- The Group agreed to nominate Dr Fauzi (Indonesia) as Chair and Dr Spiropoulos (Australia) as Vice-Chair, to be approved by the ICG plenary.

7. WORKING GROUP PARTICIPANT LIST

Name	Country/Organisation	email
Kuria Zacharia	Kenya	zkuria@uonbi.ac.ke
Eluid M Mathu	Kenya	emathu@uonbi.ac.ke
Gladys Kianji	Kenya	kianji@uonbi.ac.ke
Lesley Choo	Singapore	Lesley_choo@nea.gov.sg
Toni Kraft	Germany	toni@gfz-potsdam.de
Stephen Njorge	WMO	snjoroge@wmo.int
P.J. Prih Haryadi	Indonesia	prih@bmg.go.id
FAUZI	Indonesia	fauzi@bmg.go.id
Johan Steyn	South Africa	jsteyn@geoscience.org.za
Jotham G Otido	Kenya	cmg@bidii.com
Laura Kong	UNESCO/IOC	l.kong@unesco.org
Stella Aura	Kenya	stella@meteo.go.ke

8. NEXT MEETING

Not identified for the next meeting.

ANNEX VII

ICG/IOTWS WORKING GROUP 2
Sea Level Data Collection and Exchange, including Deep Ocean Tsunami Detection Instruments
REPORT OF SESSIONAL MEETING ICG-IV (28 FEBRUARY 2007)

Chair: **Mr. K.Premkumar, India**
Vice Chairs **Mr. Ken Jarrott – Deep Ocean Stations**
Mr. Bernie Kilonsky, Outgoing Vice-Chair, Coastal Sea Level Stations
Mr. Parluhutan Manurung-In Coming –VC,-Coastal Sea Level Stations

A working group intersessional meeting was held on 26 February 2007 in Mombasa, Kenya.

1. WG TERMS OF REFERENCE:

- Examine various user requirements (i.e. a multi-hazard approach) for the IOTWS sea level gauge network;
- Examine the current and future requirements for the IOTWS, taking account of information obtained from the IOC National Assessment on the Sea Level Network;
- Investigate the technical issues of bandwidth and satellite coverage;
- Investigate the issues with interoperability between existing (and future)sea level stations, such as the lack of meta data;
- Address the issue of the sustainability of the system; and
- Form a DART operators group to investigate various issues relating to the IOTWS deep-ocean tsunami detection instruments network.

2. MEETING OBJECTIVES :

- Review the progress made so far in respect of the ToR;
- Review the Implementation Plan;
- Review the ICG III/WG2 meeting action items;
- Report on the ITP inaugural meet;
- International Data Exchange Protocols, Communication Channels and message formats;
- Explore the deployment operation /collaboration;
- Capacity building and Training.

3. DISCUSSION OF ISSUES:

1. Review the Implementation Plan;
2. Vice Chair for Coastal Sea level station;
3. ITP Status;
4. Presentation of National Reports by India, Indonesia, Australia, Germany, Kenya, Malaysia,Sri Lanka, and USA.
5. India’s Tsunameter test facility at NIOT available for Member States;
6. Common standards and best practices and allied issues for reference under ITP;
7. WG4 model evaluation for optimum sitting of Sea level gauges;

4. REVIEW OF OUTSTANDING ACTIONS:

Ref.	Action	Person Responsible	Status
1.	**Update of Coastal Station Action Plans** Updates required on coastal station plans and achievements from India and Indonesia and Australia to Bernie Kilonsky to complete the picture for the Indian Ocean	Australia, India and Indonesia reps	Countries have provided the information and update completed.
2.	**Performance Standards for Deep Ocean Stations** – minimum set of instrument characteristics to be developed in consultation with members and suppliers, for review by members	Vice Chair Deep Ocean Stations	Draft finalised
3.	**Formalisation of Documentation Pertaining to Interoperability**: WG2 to issue all relevant interoperability guidance documents in a consistent form, with version stamping and change control records if appropriate. IOTWS Web site host preferred	Vice Chairs	Document nearing completion and expected to be available by 7 April
4.	**Sea Level Observation Network Design.** WG2 to undertake a review of the composite deep ocean and coastal sea level observing network, based on a consideration of warning times, and of other objectives or pragmatic constraints.	Vice Chairs	Deep ocean network design completed. Warning systems performance of core coastal stations to be analysed for a limited ocean region, as a pilot exercise for wider application. Work to be performed in conjunction with WG4 Plan Completion Date: subject to negotiation with WG4 – within 6 months?
5.	**Database for Tracking Progress and Plans for Sea Level Stations to Full Operational** Status – concept proposed by Australia for Deep Ocean Stations to be developed into web accessed communal data base for both Deep Ocean and Coastal Stations. Map-referenced database to capture relevant information on equipment types, and specifically, the state of plans or progress towards a fully operational state (i.e stations reporting continuous data to agreed protocols via the GTS, with demonstrated end-to end capacity to receive data by other IOTWS nations). That the coastal and deep ocean data viewers use consistent symbols/colours etc. where possible. A) Deep Ocean Stations Tracking Database B) Coastal Stations Database	Vice Chairs	Data structures developed for prototype system. Web access tools to be developed and accessed through IOTWS web site. Limited trial by 7 June before wider access.
6.	**Data Repositories and Archiving for Sea Level Data .** Working Group 2 has identified the need for systematic quality assurance, data management, and long term archiving of IOTWS core station observational data. Working Group 2 recommends that the Paris Secretariat coordinate with	IOC Paris Secretariat	Decision on the approach be conveyed by 7 April

Ref.	Action	Person Responsible	Status
	IOC/GLOSS/IODE to identify - best practices appropriate to the Indian Ocean regional for core station data quality assurance - best practices appropriate to the Indian Ocean region for data management at national warning centers and regional watch providers		
7.	**<u>First Meeting of International DART Partnership.</u>** To convene the first meeting of the International DART Partnership. Agenda: 1) Technical Exchange – state of technology survey – all products at R&D, test and operational status Instrument Standards Network Design – Deep Ocean Stations Capability Development – Needs and Objectives 2) Sustainability Issues 3) ITP Governance and Reporting Arrangements	Vice Chair, Deep Ocean Stations	Held at NIOT, India on 20 and 21 Feb. 2007. A separate report will be presented by Ken Jarrott—Vice Chair—Deep ocean stations.

5. AGREED ACTIONS AND DEADLINES

No	Action	Person Responsible	Due Date
1	To evolve common standards and best practices and allied issues reference under ITP by a group of Experts drawn from USA, India, Sonardyne UK	Vice Chair-Deep Oceans	7 March–First document. 7 June–Final
2	*Global Telecommunications System Issues:* *Data Latency Test* Conduct a data latency test for deep ocean and in situ observations and publish the results in an informational memorandum to be distributed to Indian Ocean Member States and observers by the Perth Secretariat	Vice Chair-Deep Oceans	Shall begin from 7 April and WG5 Chair will coordinate.
3	Member states to depute their national Focal points for WG2 meeting. Letter to be issued to all concerned	Chair, ICG/IOTWS Secretariat	7 March
4	Database for Tracking Progress and Plans for Sea Level Stations to Full Operational through IOTWS website	Vice Chairs	Limited operation by 7 June before wider access.
5	Sea Level Observation Network Design: WG2 to undertake a review of the composite deep ocean and coastal sea level observing network, based on a consideration of warning times, and of other objectives or pragmatic constraints	Vice Chair-Deep Ocean Station	By 7 June in consultation with WG4
6	National Reports received in power-point from India, Indonesia including USA input, Germany, Kenya, Malaysia, Sri Lanka would be hosted in the IOTWS web site. The soft copy would be given to ICG/IOTWS Secretariat.	Chair to ICG/IOTWS Secretariat	7 April

6. WORKING GROUP RECOMMENDATIONS TO THE ICG:

- Mr K. Premkumar, India was nominated to continue as the Chair and Mr Ken Jarrott as the Vice Chair for Deep Ocean Stations.
- Dr Parluhutan Manurung, Indonesia was nominated to serve as the Vice-Chair for Coastal sea level station in place of Mr Bernie Kilonsky who will step down.

- Mr Ken Jarrott, Australia was nominated to serve as Chair of the ITP (International Tsunameter Partnership), with Ridwan Djamaluddin, Indonesia, to serve as Vice Chair.
- The finalised implementation plan of WG2 should be hosted in the IOTWS web site for reference and adoption.
- ICG to endorse India's Tsunameter test facility at NIOT as reference test house available for Member States.
- Data Repositories and Archiving for Sea Level Data. Working Group 2 has identified the need for systematic quality assurance, data management, and long term archiving of IOTWS core station observational data. Working Group 2 recommends that the Paris Secretariat coordinate with IOC/GLOSS/IODE to identify (1) best practices appropriate to the Indian Ocean regional for core station data quality assurance, and (2) best practices appropriate to the Indian Ocean region for data management at national warning centres and regional watch providers
- Global Telecommunications System Resources Information and Update: Working Group 2 recommends that the Perth Secretariat, in close consultation with appropriate WMO regional bodies, develop and maintain an operational database of core IOTWS instruments, all relevant metadata, their operational status, and other information of use to national warning centres or regional watch providers. The database should be made available on the Internet. This database should be updated regularly; the Secretariat should also proactively notify IOTWS national points of contact, national warning centres, and regional watch providers of significant changes to IOTWS core station system status.
- Access to IOTWS Core Station Data: It is understood that many Member States are not receiving IOTWS core sea level station data. Working Group 2 recommends that the Perth Secretariat, in close consultation with appropriate WMO regional bodies, prepare a short technical memorandum that informs IOTWS Member States how to access core station data. Such information should include a description of the process to request relays from regional hubs, entries into national warning centre tables, and other steps required to receive core station data. The purpose of this technical memorandum is to help facilitate interactions between national warning centres, national operators of observational networks and national meteorological agencies.
- Member states to approach their respective National Hydrographic office to promulgate the Mariners notification for the Tsunameter location when each deployment is accomplished with clear instructions to ships that they should keep off the Tsunameter site preferably by 3 miles to avoid ship noise interference and inadvertent damage by running over on the tsunameter system. Further, IOC secretariat are requested to take up with the International Hydrographic Office for immediate updating in the Charts and Regular bi-annually NAVAREA message about this to create awareness to the Mariners.
- Member states to depute their national Focal points for WGs meetings including WG2. Letter to be issued to all concerned.

7. WORKING GROUP PARTICIPANT LIST

Name	Country/address	email
K. Premkumar	**India**,National Institute of Ocean Technology, Ministry of Earth sciences, Chennai, India	prem@niot.res.in
Ken Jarrott	**Australia,** Bureau of meteorology, Melbourne	k.jarrott@bom.gov.au
Parluhutan Manurung	**Indonesia,** National coordinating Agency, For Survey &Mapping (Bakosurtanal),Jakarta	parluhutan@bakosurtanal.go.id

Name	Country/address	email
David McKinnie	**USA**,NOAA US/IOTWS 7680 Sandpoint Way NE Seattle WA 98122	david.mckinnie@.noaa.gov
Mohd Rasaidi Bin Che Abas	**Malaysia,**Seismological Division, Malaysian Meteorological Department,Jalan Sultan, Patalian Jaya, Selangor, Malaysia	rosaidi@kjc.gov.my
Mika Odido	**IOCWIO/ODINAFRICA** Project office,**Kenya**	m.odido@unesco.org
Edward M.Muriuki	**Kenya,** Met Dept, P.B 30259, Nairobi	edmuriuki@yahoo.com
Gladys.K.Kianji	**Kenya,**University of Nairobi,Dept. of Geology P.B 30259,Nairobi	kianji@uonbi.ac.ke
Charles Magor	**Kenya**, Kenya Marine & Fisheries Institute P.B 81651,Mombasa.	cmagori@kmfri.co.ke
Bernie Kilonsky	**University of Hawaii**	kilonsky@hawaii.edu
Cathryn Primrose	**FugroOceanor,** Trondheim, Norway	c.primrose@oceanor.com
EMS Wijeratne	**Sri Lanka,** Oceanography Division, NARA	emsw@nara.ac.lk
Ulrich Wolf	**UNESCO**,Programme specialist,Tsunami Unit, IOC, Paris	u.wolf@unesco.org
Joen Lauterung	**Germany**	

8. NEXT MEETING:

The WG proposed to convene the next WG2 meeting along with the ITP meeting scheduled for 7 August in Jakarta.

ANNEX VIII

ICG/IOTWS WORKING GROUP 3
REPORT OF SESSIONAL MEETING ICG-IV (28 FEBRUARY 2007)

Chair: Ms Beatrice Akunga (on behalf of the Chair, Prof. Sam Hettiarachchi)

1. WG TERMS OF REFERENCE

The development of a tsunami early warning system for the Indian Ocean needs to be put into a risk management framework that can be applied at global, regional, national and local levels. The goal is to reduce vulnerability and strengthen coping capacities of communities with regard to tsunami risk as outlined below:

- Develop guidelines for tsunami risk assessment as part of a multi-hazard risk management framework.
- Provide guidance to emergency response managers on the preparation of risk assessment products.
- Facilitate the application and use of model outputs for tsunami hazard and risk assessment.
- Facilitate data sharing, including access to and development of databases, incorporating exposure, tsunami hazard and vulnerability.
- Facilitate capacity building, including knowledge transfer, in the form of workshops, training programs and case studies for risk assessment in all Indian Ocean countries.
- Facilitate and promote the process of developing cost-effective and practical mitigation options and measures.
- Liaise with other modelling committees (including other ICG/IOTWS working groups) and organisations or professional groups that are developing models and data for their implementation.

2. MEETING OBJECTIVES

1) Review outstanding Action Items (see below)
2) Discuss timing of planned workshops for 2007.

3. DISCUSSION OF ISSUES

The Tsunami Hazard Workshop has been delayed until after June 2007, to allow for recruitment of a tsunami hazard expert at Geoscience Australia. This expert will play a key role in the workshop. It was agreed that the second workshop (Risk Assessment), to be sponsored by WAPMERR, would also be delayed in order to use the results of the Tsunami Hazard workshop. The second workshop will be held in Dubai and a date was tentatively set for the second half of October 2007.

4. REVIEW OF OUTSTANDING ACTIONS

4.1 Preparation of Risk Assessment Methodology and Guidelines
This activity was scheduled for December 2006. The draft will now be ready by June 2007. This document would be discussed at the Workshop and Training Exercises in Risk Assessment (sponsored by WAPMERR) to be held in the 3rd or 4th quarter of 2007 and if necessary modified.

4.2 Mitigation Options and Decision Support Case Studies
This activity was scheduled for December 2006. It is now scheduled for October 2007 and the Case studies will be discussed Workshop and Training exercise described in Section 4.1

5. ACTION ITEMS

ACTION	PERSON RESPONSIBLE	DEADLINE
1) Mitigation options and decision support methodology A common and best practice methodology and guidelines will be developed for use by member nations. The working group will liaise with similar working groups in other IOC Tsunami Working Groups to streamline and standardize methods and guides, and share knowledge and information. The working group recognizes that methods and guides will reflect regional diversity. It is expected that documentation of methodologies and guidelines would be available via the internet.	John Schneider Slava Gusyakov Torsten Schlurmann and Mawardi Nur	June 2007
2) Mitigation Options and Decision Support Case Studies Case studies developed by June 2006 will be enhanced through the application of mitigation options to demonstrate decision mechanisms for stakeholders including emergency response managers, land use planners, and national and local governments. These options include: – Environmental Barriers (e.g., mangroves, sand dunes), – Artificial Countermeasures (e.g., tsunami breakwaters, sea walls), – Land Cover and Land Use (e.g., building set-backs, tsunami-specific zonation), – Tsunami Resistant Infrastructure (eg: building codes and certification), – Evacuation Plans (e.g., vertical evacuation, tsunami-safe zones, time is a factor). – Harness indigenous knowledge for reducing vulnerability (e.g.: animal behaviour, folklore/songs)	Sam Hettiarachchi	October 2007
3) Workshop and training exercises To facilitate knowledge transfer and information sharing a series of workshops and materials to supplement the case studies will be developed.	Sam Hettiarachchi	6 July–8 June
4) Development of an Integrated Regional Tsunami Hazard/Risk Model • Together with WG4 develop credible tsunami scenarios for the Indian Ocean region, with initial focus on major earthquakes • Generate an Indian Ocean tsunami hazard map for earthquake sources and deep-ocean propagation, followed by consideration of volcanoes and landslides (June 2008).	John Schneider, with Chair of WG4	June 2007 June 2008
5) Training Workshops Training Workshop on Risk Assessment to be supported and hosted by WAPMERR in Dubai January or April 2007 for 3-4 days. Tsunami sources, Tsunami inundation scenarios (from WG3), Vulnerability/impact, Probability, Uncertainty will be covered in the workshop. Subsequent Workshop on mitigation in later 2007 or the following year.	Adel Karas Sam Hettiarachchi John Schneider Slava Gusyakov Velly Asvaliantina Beatrice Akunga	2007
4) Future Activities It is expected that other activities will be identified through the life of the working group, including information management, data collection standards, and GIS and database development to facilitate access to information for modelling and risk assessment purposes.	Sam Hettiarachchi	TBD

6. WORKING GROUP RECOMMENDATIONS TO THE ICG

1) Prof. Sam Hettiarachchi nominated to remain as Chair of the WG and Dr John Schneider as Vice Chair.
2) IOTWS Member States are requested to identify possible new members for WG3 who have expertise in Risk Assessment.

7. WORKING GROUP PARTICIPANT LIST

Name	Country/Organisation	email
Beatrice Akunga	Kenya	nyabokeakunga@yahoo.com
Adel Karas	WAPMERR	a_karas@wapmerr.org
«First_Name» Gusiakov	WAPMERR	gvu@sscc.ru
Jane Cunneen	IOC	j.cunneen@unesco.org

8. NEXT MEETING

The date and venue for the next meeting will be decided amongst the WG members through email. It is likely that a WG meeting will be held during the planned workshop in October 2007

ANNEX IX

ICG/IOTWS WORKING GROUP 4
Modelling, Forecasting and Scenario Development
REPORT OF SESSIONAL MEETING ICG-IV (28 FEBRUARY 2007)

Chair: Prof C Pattiaratchi

1. WG TERMS OF REFERENCE

- Develop standards for operation and application of models
- Facilitate the development: source, deep water propagation, inundation and forecast models
- Develop bench mark tests for model verification and validation
- Facilitate the development of a web-based community model
- Development of credible case scenarios for model application for the entire Indian Ocean including all possible sources (Sundra Arc, Makran region etc).
- Facilitate capacity building and knowledge transfer in the form of web-based tools and training programs
- Liaise with other working groups, especially WG3 - Tsunami hazard detection, characterisation and risk assessment for model requirements and effective model usage and application

2. MEETING OBJECTIVES

To discuss the following:

- Adoption of the model standards document
- Update on the collation of test cases, including field data
- Report on Training programme in Melbourne
- Future training programmes
- Provision/facilitation of bathymetry data for inundation modelling

3. DISCUSSION OF ISSUES

Introduction

The chair gave an overview of the “vision” for the group – to develop inundation maps for the Coastal communities of the Indian Ocean within 10 years, and steps needed to obtain this goal. Terms of reference were reviewed.

3.1 Adoption of the model standards document

There was some discussion on the model standards document. In particular:

- The requirement for mass conversation
- The recommendation for code to be open source
- The requirement for peer-reviewed reviewed publications.
- On the basis of this discussion, some minor modifications were made to the model standards document and the edited version was duly adopted.

3.2 Update on the collation of test cases, including field data

Little progress has been made in the inter-sessional period towards collating data from field cases. It was agreed to move the deadline for this to December 2007.

3.3 Report on training programme in Melbourne

The Chair gave a report on the inundation modelling training course held in January 2007 at the Bureau of Meteorology in Melbourne, Australia. It was noted that only India, Indonesia and Australia were able to provide their own high-resolution bathymetry data for the course. Some of the results obtained by the participants during the course were presented.

3.4 Future training programmes

USAID have indicated that they will provide funding for 2 further inundation modelling training courses in 2007. They will be held in Jakarta and Bangkok and the dates are yet to be confirmed.

3.5 Provision/facilitation of bathymetry data for inundation modelling

Availability of high-resolution bathymetry and topography data continues to be an outstanding issue. The group noted that Sri Lanka have plans to map a significant portion of their coastline using LIDAR. This is an activity of the Sri Lankan government and data would be freely available for researchers. It was noted that navigation charts are usually available for shipping lanes and ports, and can be digitised, if not done already. Typically some of these are commercially available. It may be possible to transform the data to other grids (e.g. finite element grids) and then distribute redistribute it freely.

The group agreed that it was important to share their data where possible.

3.6 Reports of countries

National reports on modelling activities were given by:

- The Chair (impact of offshore bathymetry features on WA, impact of reflections off Maldives on Sri Lanka)
- Germany (summary of GITEWS, including potential use of GPS to obtain real-time crust deformation)
- Australia (T1 – scenario database and applications)

3.7 Other business

Mr Joern Behrens presented a document regarding a proposal for a meta-database of tsunami scenarios. It was agreed that this would be a useful tool and further development was encouraged.

Mr Behrens proposed that the working group develop a document to provide guidelines for other working groups (e.g. risk assessment) on model limitations.

4. REVIEW OF OUTSTANDING ACTIONS

The action plan was reviewed and modified as follows:

No	Action	Person Responsible	Deadline/Progress
1	Develop inundation maps for the coastal communities of the Indian Ocean region including translation of the inundation projections to evacuation maps.	C. Pattiaratchi	End 2015

No	Action	Person Responsible	Deadline/Progress
2	Develop web based (internet enabled) community model for tsunami propagation and inundation.	C. Pattiaratchi/ V. Titov	Funds allocated by USAID. ComMIT model developed. Action complete.
3	Model standards be accepted and implemented	D. Greenslade / C. Pattiaratchi	Model standards document completed and adopted by the working group. Action complete.
4	Model benchmarks to be accepted and available on the IOC website	Behrens/ Asvaliantina	Model benchmarks identified and to be available from IOC website by December 2007
5	Model scenarios to be developed and available on the IOC website.	C. Pattiaratchi	Model scenarios to be developed by August 2007.
6	Work together with IOC to summarise the results and maintenance of the website.	C. Pattiaratchi	by December 2007
7	Training for member states including both short-term and long-term strategies: • Short term training could include a short course with a form of an IOC sanctioned certification or award of a diploma (similar to that implemented by the WMO). • For long term training we recommend the award of 50 IOC fellowships over 5 years for postgraduate training (~40k per annum).	C. Pattiaratchi / D. Greenslade/ V. Titov / ICG Secretariat	At least 3 training courses to be organised within the next 12 months. AusAid funded one workshop in Melbourne in January 2007. USAID to fund 2 training programmes in Jakarta and Bangkok in 2007.
8	Support long-term training requirements for model maintenance, ongoing consultation and support at selected institutions.	C. Pattiaratchi	2015
9	Compilation of a list of historical events and post on the IOC website.	C. Pattiaratchi	Dec 2007
10	A standard glossary including all terms that are used to measure tsunami inundation be available on the IOC website.	C. Pattiaratchi	Dec 2007

5. AGREED ACTIONS AND DEADLINES

No	Action	Person Responsible	Due Date
1	Develop inundation maps for the coastal communities of the Indian Ocean region including translation of the inundation projections to evacuation maps.	C. Pattiaratchi	End 2015
2	Model benchmarks to be accepted and available on the IOC website	Behrens/ Asvaliantina	December 2007
3	Links to tsunami scenario databases to be available on the IOC website.	C. Pattiaratchi	August 2007
4	Continue short term training with at least two courses to be completed by end 2007	C. Pattiaratchi / D. Greenslade/ V. Titov / ICG Secretariat	Next ICG
5	Support long-term training requirements for model maintenance, ongoing consultation and support at selected institutions.	C. Pattiaratchi	2015

No	Action	Person Responsible	Due Date
6	Compilation of a list of historical events and post on the IOC website.	C. Pattiaratchi	Dec 2007
7	A standard glossary including all terms that are used to measure tsunami inundation be available on the IOC website.	C. Pattiaratchi	Dec 2007
8	Develop a meta-database of tsunami scenarios, including a link from the IOC website	Behrens/ Asvaliantina	Next ICG
9	Develop a document to provide guidelines on model limitations.	All	Next ICG

6. WORKING GROUP RECOMMENDATIONS TO THE ICG

- To highlight to the countries of the Indian Ocean that absence of high resolution nearshore bathymetric and topographic data will limit the successful application of inundation models. Detailed and accurate data (<50m grid) is required for high risk areas.
- Continue training in the use of the inundation model ComMIT. Two training programs will be undertaken in 2007 in Jakarta and Bangkok through funding provided by USAID.
- Encourage participation of countries in the working groups – more commitment from the countries is required.
- To nominate Prof C Pattiaratchi (Sri Lanka) and Dr Diana Greenslade (Australia) as the Chair and vice-Chair of the working group for the next term.

7. WORKING GROUP PARTICIPANT LIST

Name	Country	email
C Pattiaratchi	Sri Lanka	Chari.pattiaratchi@uwa.edu.au
D. Greenslade	Australia	d.greenslade@bom.gov.au
J Behrens	Germany	Joern.behrens@awi.de
N Surip	Malaysia	norainis@macres.gov.my
P.D. Amerasinghe	Sri Lanka	amasklk@yahoo.com
R.M. Badal	Mauritius	rezahmb@moi.intnet.mu
Pariatmono	Indonesia	pariatmono@ristek.go.id
P. Ambenje	Kenya	ambjenje@meteo.go.ke
S. Marigi	Kenya	
A. Shaka	Kenya	ayubshaka@yahoo.co.uk
T. Tatong	Thailand	ttatong@hotmail.com
J. Tychsen	Denmark	gt@geus.dk

8. NEXT MEETING

To de advised.

ANNEX X

ICG/IOTWS WORKING GROUP 5
A System for Interoperable Advisory and Warning Centres
REPORT OF SESSIONAL MEETING ICG-IV (28 FEBRUARY 2007)

Chair: Mr Geoff Crane

An intersessional meeting of Working Group 5 was held at the Whitesands Hotel, Mombasa, Kenya on 26-27 February 2007. The meeting continued the same location at a sessional break-out period on 1 March 2007 during IOTWS ICG IV. A total of 21 members participated in the meeting.

1. WG TERMS OF REFERENCE

- To progress the establishment of a coordinated regional warning system for the entire Indian Ocean basin, through the establishment of a network of National inter-operable Warning Centres.
- Advise on the modalities of operation, methods and standards for development and issuance of warnings, and requirements in terms of coordination and operating within a multi-hazard approach.
- In consultation with the IOC Secretariat, examine the IOC/WMO Assessment process results still underway, and develop guidelines for the distribution of tsunami warnings by National Tsunami Warning Centres (NTWCs) to emergency centres in their country, the media and the public. These Guidelines will be included in the IOTWS master plan being developed by the IOC tsunami technical unit.
- Provide further detailed elaboration of the roles of RTWPs (including responsibility for advisories) and NTWCs.

2. MEETING OBJECTIVES

The Chair welcomed delegates to the meeting. In his introductory remarks Mr Crane summarised progress to date and noted the excellent rapport and spirit of cooperation that has characterised previous meetings of the group.

- The Chair noted that progress in the areas covered by the other working groups was more tangible and easier to monitor. Sea level and seismic monitoring networks, and progress in developing models, could be itemised and recorded.
- Progress in developing capabilities in warning centres was much more ephemeral with each country working to a different time line and capacities, capabilities and responsibilities being progressed independently.
- The several early meetings of WG 5 have discussed how and where countries are going, and have recognized that it was going to take time for there to be much visible evidence of progress.
- It is now time for there to be an increased focus on the requirements of Regional Tsunami Watch Providers and the status of progress towards an interoperable system for the IOTWS.
- The IO region was still dependent on the interim services from PTWC and JMA while capabilities were developing. Nations would still not be ready to take over the roles of PTWC and JMA for some time but there was a need to more clearly identify the transition path.

- The very open and frank discussions within the group recognized the issues still needing to be resolved for implementation of an IOTWS.
- The Chair advised that Australia will table a proposed plan for consideration by WG 5, which would recommend the establishment of a Task Team to provide better coordination of the development of RTWPs and the interoperable watch system for the IOTWS, and advised that a background paper would be circulated for subsequent discussion by members during the meeting.
- The Chair reiterated that tsunami warnings within individual countries were the sovereign responsibilities of those countries, and that the proposed plan was specifically to coordinate the development of RTWPs.

The Head of the IOC ICG/IOTWS Secretariat in Perth Mr Tony Elliott added his welcome to delegates. He reiterated the need for WG 5 to move forward and identify progress. He noted that already there has been lots of talk in previous ICG meetings – now an outcome is needed to resolve issues surrounding the establishment of RTWPs.

3. DISCUSSION OF ISSUES

3.1 AUSTRALIAN PROPOSAL FOR TASK TEAM TO DEFINE RESPONSIBILITIES OF RTWPS UNDER THE IOTWS INTEROPERABLE WARNING SYSTEM

As intimated in his introductory remarks, the Chair took up the issue of the need for better monitoring and closer coordination of the progressive development of an interoperable system of watch providers and warning centres for the countries of the Indian Ocean.

- Referring to the first item on the agenda for the second day the Chair advised the meeting that Australia would be putting forward a recommendation regarding how the development of the IOTWS could be better monitored and coordinated.
- The need comes from there still being a vacuum in terms of what the end result would look like in terms of interoperable system, RTWPs, etc.
- Circulated a discussion paper on the recommendation which included comprehensive background notes and an outline of the way forward.
- Gave an overview of the recommendation to establish a Task Team and the background discussion.
- Proposal is to set-up a task team to enable better liaison between countries developing RTWPs, report status in participating countries, develop guidelines and commitments.
- Noted the ongoing issues of accreditation. Need some way of having confidence that warnings are coming from agencies working at appropriate level. Close interaction between RTWPs, comparison of techniques, and benchmarking could be a preferred alternative to accreditation.
- Participants were invited to read the paper in detail prior to consideration of the Task Team proposal the next morning.

The “Task Team” discussion paper is included as Annex I.

3.2 REPORT FROM 1ST ICG/IOTWS STEERING GROUP MEETING

The Head of the ICG/IOTWS Secretariat, Mr Tony Elliott, reported on the first meeting of the IOTWS Steering Group, which was held in Perth, Australia, on January 30 and 31 2007. The full report is available at http://ioc3.unesco.org/icg/ under the Working Documents link.

3.3 REPORT ON OPERATIONAL IMPLEMENTATION ISSUES FOR THE INTERIM INDIAN OCEAN TSUNAMI WARNING SERVICE

The Director of the Pacific Tsunami Warning Centre (PTWC), Dr Chip McCreery, reported:

- Interim service now based on adequate seismic data but still minimal sea level data sources.
- Difficulties with information on the Tsunami Warning Focal Points (TWFP), the real time 24/7 operational liaison points, and the Tsunami National Contacts (TNCs).
- Communications tests from both JMA and PTWC get very little feedback.

Other comments:

- Ed Young (NOAA USA) noted a lack of feedback on information provided by interim tsunami warning service from PTWC. US IOTWS Program now proactively seeking inventory information from users to help improve effectiveness.
- Advised that the US IOTWS has now appointed an interim Tsunami Notification Coordinator to collate a range of information – feedback on all events to assess what happened within the interim tsunami alerting system, and would be available to help in collating other information on the progress of development of the components of the IOTWS. The Coordinator will be working out of Bangalore, India initially, but will relocate to Honolulu.
- Recommended such feedback needs to be a fundamental element of any interoperable system and formalised.
- Passed out copies of the draft US Concept of Operations (CONOPS) for Tsunami Warning Centers and requested WG members review the CONOPS document and provide feedback on how it can be utilized by IOC and member countries.
- Curt Barrett (NOAA USA) suggested US CONOPS (Concept of Operations) document on how US undertakes tsunami warnings could be used as a guideline to feed into the task team activities.
- NOAA USA advised of the establishment of a Tsunami Training Institute and tsunami courses to be taught at the University of Washington in Seattle.
- The Chair thanked the US for its continuing contribution to the WG, and for producing the Tsunami CONOPS draft document.
- The Chair emphasized the importance of post-mortem of what happened in each event (did everything work, what were the problems, and how to immediately correct), as a requirement for continuous improvement – captures the gaps. Constant monitoring or feedback mechanism is critical to ensure that the system continues to operate at maximum efficiency.
- Value of exercises was expressed and that it would be good to start as soon as possible, even if all parts not in operation, because it may accelerate the progress and especially more actively engage those countries that are not as active as others yet.
- The Chair noted that some of the issues raised in relation to the interim tsunami warning service for the IO were covered by recommendations from WG 5 to ICG III, and would be captured again in the review of those recommendations.

3.4 COUNTRY REPORTS

Reports on progress towards the development of tsunami watch and warning procedures in their countries were presented by country representatives of Australia, India, Kenya, Malaysia, Sri Lanka and ADPC. Full country reports, including reports from several other countries that were not represented at the intersessional meeting of WG 5, are available on http://ioc3.unesco.org/icg under the Speaker/Presentations link.

4. REVIEW OF OUTSTANDING ACTIONS

Recommendations from WG 5 to ICG III were discussed to assess which of them had lapsed, which were still current but didn't need restating, which were still relevant but needed updating and reiterating, and whether there were additional recommendations flowing from developments since ICG III.

- *Recommendation #1*: Adverse publicity on the state of development of the IOTWS was still an issue, and since ICG III there had been further negative press. More detailed reporting on IOTWS implementation progress may assist the Secretariat to better represent the IOTWS in any publicity.
- *Recommendation #2*: Curt Barrett stated NOAA was pleased to provide an interim service, but won't be able to do so forever into the future. Need better guidance on when interoperable system can replace the interim system. Task Team proposal may help address the information vacuum and provide timelines and an implementation plan for RTWPs achieving operational status and interoperability of system. Sri Lanka stated very happy with PTWC and JMA interim service, and requests that the new interoperable system run in parallel with interim service as part of the evaluation.

  Recognising the need to replace the interim system, WG5 agreed with the need to implement wherever possible the developing interoperable system within 3-5 year timeframe as discussed at ICG III in July 2006. The principle function of the proposed Task Team will be to facilitate this.
- *Recommendation #3a*: Issue - to evacuate or not evacuate in the case of small tsunami. How to stratify the level of threat? On 15 November 2006, Kuril Island event, PTWC provided a warning of an intermediate level of threat. Hawaii evacuated just the beaches on advice of small tsunami affecting the coastal region (rather than mass potential false alarm evacuation and its consequences). Very positive response from EM community. Huge benefits in cost savings and minimising community disruption. Chip McCreery strongly recommends the two step approach. If the lower level threat is issued and proves to be an overkill there is not too much unnecessary consequence.

  Is there a need for guidance on capabilities and warning output for WG6 consideration? Stratification of prediction and proposal for graphical tsunami warnings need explanation and clarification to recipients.
- *Recommendation #3b*: Difficult to stratify threat for moment, but vision for delivering optimised warning output.
- *Recommendation #4*: Will help to better identify specific threats to different countries (as opposed to generalised threat information in present travel time maps without amplitude information, which can be misleading). US still looking to get graphical representation project funded. Need to consult with WG6 on output, plus other ICGs. Use of graphical scenarios to illustrate beaming has confused emergency managers. Need more detailed explanation of those scenarios and why a different graphical product is required.
- *Recommendation #5*: Discussions on the issues of using travel time maps, as mentioned above. Need to combine scenario/energy beaming focus maps with travel times to enable full and appropriate application. NOAA/ITIC have acquired and revised travel time software to be available soon.
- *Recommendation #6*: ISDR (public affairs in Geneva) and ABU organising another media workshop this year (first one in June 2005, Bangkok?). ACTION: Need to convey outcomes from WG5 and WG6 into next media workshop being organised by ISDR. Information on recent related activities by ISDR is included in this report as Annex II.

- *Recommendation #7*: Need to have at least simple exercise of interim system to check communications systems working, responses happening, receipting of messages, using test scenarios. PTWC noted there are costs involved (phone calls, etc). However, in principle agreement by PTWC to undertake an exercise. JMA not in attendance to consulted. Noted there is already monthly testing of RANET SMS and satellite phones.

  ACTION: Need to begin constrained exercises of interim system as a matter of urgency. Who? When? Talk about assigning to task team, but that's not the primary focus of that group.

- *Recommendation #8*: Work still in progress to forward earliest observatory (seismic) message. Some concern over MOU with USGS to not issue anything for events with Mw below 6.5. Have WMO product ID available. Still need to issue service change notice and send out. If use WMO header then information available to the world, which may not be beneficial and misused (information has greater uncertainties). Maybe be better to use SMS/RANET or internet to specified users. Methods of utilising RSS feeds being investigated by PTWC. Tsunami Warning Markup Language being investigated by Australia.

  These discussions on the recommendations from WG5 to ICG III formed the basis of formulating WG 5 recommendations to ICG IV. Those recommendations were finalised at the sessional component of this meeting of WG5, held during ICG IV on 1 March 2007, and are included in Section 11 of this report.

- ACTION: Now transitioning from development to operational implementation, need ICG Secretariat to provide central source of up-to-date information on codes, data availability, sea level station metadata, etc. Will be included in recommendations.

- ACTION: As a matter of urgency, WG5 needs to establish a formal mechanism for post event review and feedback for interim service and planned interoperable system. Collection of this information is to be supported by Secretariat. Could be handled by the proposed Task Team.

5. AN INTEROPERABLE SYSTEM FOR THE INDIAN OCEAN

The Chair reviewed the deliberations at previous WG 5 meetings that had resulted in the agreed model for the provision of the IOTWS. An intersessional meeting at Singapore in November 2005 had considered a model based on the WMO operational model for Regional Specialised Meteorological Centres (RSMCs). Under that model, particular RSMCs have responsibility for issuing warnings for designated hazards over a defined area of responsibility. A draft proposal for an IOTWS based on the WMO model was taken to the WG 5 sessional meeting at IOC II in Hyderabad in December 2005.

At the WG 5 sessional meeting at ICG II it was quickly agreed that there had been only a small number of member states represented at the Singapore intersessional meeting and that the draft proposal for an IOTWS did not represent the views of the member states generally. The draft proposal was set aside, and that meeting determined a different model. It was established that the member states did not want a system with particular warning centres having designated areas of responsibility, but wished for there to be a number of sources of information. These sources would be designated as Regional Tsunami Watch Providers. Recipient countries would be able to enter into bi-partite agreement with one or more of the panel of RTWPs.

The Chair briefly reviewed the history of the list of countries that have indicated an intention to develop the capability to become an RTWP. The meeting welcomed the news that the Thai Government had designated ADPC as its official Regional Tsunami Watch Provider. The current list or potential RTWPs stands at six – Australia, India, Indonesia, Iran, Malaysia and Thailand (ADPC).

The Chair then briefly reiterated remarks he had made at the opening of the meeting regarding the difficulty in monitoring and coordinating progress towards RTWP capability, with the different countries at different stages of development and implementing a variety of different scientific techniques.

6. PROPOSAL FOR A "TASK TEAM" TO COORDINATE THE DEVELOPMENT OF THE IOTWS

The Chair invited members to consider the discussion paper (Annex I) distributed by Australia earlier in the meeting, containing a proposal to establish a "Task Team" to assist in development and implementation of the IOTWS. Because the agreed model for the IOTWS, comprising an interoperable system of International Watch Providers and National Warning Centres for the countries of the Indian Ocean, required a close working interaction between Member States it was essential that during the development of the system there was effective liaison and coordination between the developing systems.

After the introduction of the "Task Team" concept and the discussion paper early in the meeting there had been numerous positive references to the proposal over the subsequent day and a half. It had become clear that there was widespread support for the proposal. The proposed membership – representatives from member states developing RTWP capability, representatives from the interim service providers, and the option to include invited experts as required, was discussed and accepted. Representatives from member states that will be recipients of products from RTWPs expressed keen interest in the way the system developed, and were assured that they would be kept informed of Task Team activities, and that representatives from those countries could be invited to participate in meetings of the Task Team whenever it was warranted.

There was enthusiastic participation from Member States in a sub-group of WG5 convened to consider the details of the operation of the Task Team, including its Terms of Reference. The conclusions from this sub-group are detailed in Recommendation 1.

Another small sub-group, predominantly from PTWC, was convened to draw up a list of performance indicators. The conclusions from this sub-group are also included in Recommendation 1.

All the participants at the WG5 meeting then considered the work programme for the Task Team. The offer from Australia to host the first meeting in June 2007 was readily accepted. It was agreed that the team should meet twice between ICG IV and ICG V, and that there should also be a workshop in early September 2007, incorporating a desk top exercise, and planning for future exercises. The work programme for the Task Team is also included in Recommendation 1.

7. AGREED ACTIONS AND DEADLINES

No	Action	Person Responsible	Due Date
1	Establish a Task Team to develop an Implementation Plan for an interoperable system for the provision of Tsunami Watches for the Indian Ocean, for integration into Chapter 3.5 of the UNESCO IOC IOTWS Implementation Plan	Chair of task team (Australia)	June 2007
2	Task Team to define a set of performance indicators for RTWP Services and Products as a component of the Implementation Plan.	Chair of task team (Australia)	End 2007

No	Action	Person Responsible	Due Date
3	Encourage the interim tsunami watch providers to develop their products to enhance their value to users. This should include a method of stratifying the level of threat within tsunami watch bulletins which would incorporate appropriate emphasis on the dangers associated with even very small tsunami.	WG5 Chair, Vice Chair	
4	Continue to encourage the interim tsunami watch providers to develop graphical versions of their international tsunami watch bulletins.	WG5 Chair, ICG/IOTWS Secretariat	
5	Conduct regular tests of the interim IOTWS, including simple exercises	WG5 Chair/ ICG/IOTWS Secretariat, Interim tsunami watch providers	
6	Establish a centralised source of information on availability of data (details of national contacts, national tsunami focal points, seismic data, sea level data, etc)	ICG/IOTWS Secretariat	
7	Maintain strong links and close liaison between IOC and WMO on communications and data management issues.	ICG/IOTWS Secretariat	

8. WORKING GROUP RECOMMENDATIONS TO THE ICG

Some recommendations from WG 5 to ICG III are still valid so have not been repeated. In summary, these are:

- Engage the international media
- Report positive achievements without overstating progress
- Provide more travel times, but on a restricted access web site
- Distribute the “Observatory” message to give the earliest possible alert

Some recommendations to ICG-IV are developments of recommendations to ICG III. In summary, these are:

- Provide graphical tsunami bulletins
- Provide more detail in tsunami bulletins, stratifying the level of threat
- Develop a programme of exercises for both the interim and developing IOTWS (incorporated into the work programme for the Task Team)

And there were some new recommendations. In summary, these are:

- Establish a Task Team to coordinate the development of the IOTWS
- Establish a central registry of information metadata in the ICG Secretariat
- Maintain strong liaison with WMO on communications networks and data management issues

Recommendations

1. **Establish a Task Team to develop an Implementation Plan for an interoperable system for the provision of Tsunami Watches for the Indian Ocean, for integration into Chapter 3.5 of the UNESCO IOC IOTWS Implementation Plan (Technical Series No 71).**

(a) Chair of the Task Team – Australia
(b) Terms of reference for the Task Team:

- Develop capability guidelines for a RTWP
- Identify RTWPs
- Consult with National Tsunami Focal Points to determine appropriate requirements for services and products from Watch Providers.
- Exchange information on methodologies.
- Complete an implementation plan for consideration by member states at ICG V, including a transition strategy for the interim service; for integration into Ch 3.5 of the IOTWS Implementation Plan.

(c) Membership of the Task Team

- Representatives of potential RTWPs (Australia, India, Indonesia, Iran, Malaysia, Thailand/ADPC)
- Representatives of the interim watch providers (PTWC, JMA)
- Invited experts as required (eg from US IOTWS Program, German GITEWS, Japan JICA)

(d) Work Programme for the Task Team

- Meet twice before ICG V :
  - June 2007 in Australia
  - November 2007 at a location tbd
- Conduct a Regional Workshop “Issuing, receiving and Utilising Tsunami Watches in the Indian Ocean – now and in the future;”
  - in early September 2007 at a location tbd
- Concurrent with the Regional Workshop, conduct a table top exercise, and develop plans for future exercises.

2. Task Team to define a set of performance indicators for RTWP Services and Products as a component of the Implementation Plan. Performance indicators to be defined:

- Elapsed time from earthquake to Watch issuance
- Elapsed time from issuance to receipt
- Percent of countries that receive timely Watch
- Accuracy of earthquake parameters - location, depth, magnitude
- Accuracy of forecast
- Elapsed time to tsunami detection
- Elapsed time to tsunami evaluation
- Elapsed time to cancellation
- Reliability of Watch office - power, computers, communications

3. (Refinement and amalgamation of R.3(a) and R.3(b) to IOTWS ICG III)

Continue to encourage the interim tsunami watch providers to develop their products to enhance their value to users. This should include a method of stratifying the level of threat within tsunami watch bulletins which would incorporate appropriate emphasis on the dangers associated with even very small tsunami. These enhanced international tsunami watch bulletins would provide more specific guidance to national warning agencies in their formulation of warnings to the general public. Initially the stratification should aim to specify the tsunami threat into three categories – no threat; danger in the water, on beaches and to marine infrastructure; and threat of land inundation. RTWPs should develop their services to

incorporate these enhancements so that the benefits are not lost in the transition from the interim IOTWS to a permanent IOTWS. The vision for the future should be a multi-level threat scale.

4. (Refinement of R.4 to IOTWS ICG III)
Continue to encourage the interim tsunami watch providers to develop graphical versions of their international tsunami watch bulletins. However, the enthusiasm of national tsunami warning agencies for direct access to tsunami model scenarios should be tempered, and specific graphical products be developed to cover the range of uncertainties in the input data upon which international tsunami watch bulletins are based.

5. (Refinement of R.7 to IOTWC ICG III)
The interim IOTWS should be tested regularly. There is a need to have at least simple exercises of interim system using test scenarios to check that communications systems are working, receipting of messages is taking place, responses are happening.

6. Establish a centralised source of information on availability of data (details of national contacts, national tsunami focal points, seismic data, sea level data, etc) to be collated and maintained by the ICG/IOTWS Secretariat.

7. Maintain strong links and close liaison between IOC and WMO on communications and data management issues.

9. WORKING GROUP PARTICIPANT LIST

Intersessional Meeting (26–27 February 2007)

Name	Country/Organisation	email
Geoff Crane (Chair)	Australia	g.crane@bom.gov.au
Rick Bailey	Australia	r.bailey@bom.gov.au
Anita Dwyer	Australia	anita.dwyer@ausaid.gov.au
Torsten Riedlinger	Germany	torsten.riedlinger@dlr.de
Srinivasa Kumar	India	srinivas@incois.gov.in
Gordon Otieno Muga	Kenya	ghorduuh@yahoo.com
Charles M Ngunjiri	Kenya	ngunjiri@meteo.go.ke, mainangunjiri@yahoo.com
Ephantus N Ngotho	Kenya	enngotho@yahoo.com
Kennedy Shikami	Kenya	shikamik@gmail.com
Shahruddin Yusof	Malaysia	shahyu@mosti.gov.my
Noraini Surip	Malaysia	norainis@macres.gov.my
Mohd Rosaidi Bin Che Abas	Malaysia	rosaidi@kjc.gov.my
G H P Dharmaratna	Sri Lanka	gdharmaratna@yahoo.com
A R Subbiah	Thailand/ADPC	subbiah@adpc.net
Ranjith George	USA	ranjith.george@saic.com
Edward H Young Jr	USA	Edward.Young@noaa.gov
Curt Barrett	USA	Curt.Barrett@noaa.gov
Orestes Anastasia	USA	oanastasia@usaid.gov
Charles S McCreery	USA	charles.mccreery@noaa.com
Tony Elliott	IOC	t.elliott@unesco.org

Name	Country/Organisation	email
Laura Kong	IOC/ITIC	l.kong@unesco.org

Sessional Meeting, 28 February 2007

Name	Country/Organisation	email
Geoff Crane (Chair)	Australia	g.crane@bom.gov.au
Rick Bailey	Australia	r.bailey@bom.gov.au
Torsten Riedlinger	Germany	torsten.riedlinger@dlr.de
Srinivasa Kumar	India	srinivas@incois.gov.in
Gordon Otieno Muga	Kenya	ghorduuh@yahoo.com
Charles M Ngunjiri	Kenya	ngunjiri@meteo.go.ke, mainangunjiri@yahoo.com
Joseph R Mukabana	Kenya	mukabana@meteo.go.ke
James Oduor	Kenya	j.oduor@aridland.go.ke
Col Amadi Shem	Kenya	amadi@rdmcoe.org
Shahruddin Yusof	Malaysia	shahyu@mosti.gov.my
Mohd Rosaidi Bin Che Abas	Malaysia	rosaidi@kjc.gov.my
S.N.Sok Appadu	Mauritius	meteo@intnet.com
A R Subbiah	Thailand/ADPC	subbiah@adpc.net
Ranjith George	USA	ranjith.george@saic.com
Edward H Young Jr	USA	Edward.Young@noaa.gov
Curt Barrett	USA	Curt.Barrett@noaa.gov
Charles S McCreery	USA	charles.mccreery@noaa.com
Peter Koltermann	IOC	p.koltermann@unesco.org
Tony Elliott	IOC	t.elliott@unesco.org
Laura Kong	IOC/ITIC	l.kong@unesco.org
Stephen Njoroge	WMO	snjoroge@wmo.int

10. NEXT MEETING

Before end 2007; date to be decided by WG members through email.

ANNEX I to WG5 report

Proposal from Australia - Recommendation to WG5
A System of Interoperable RTWPs and NTWCs for the Indian Ocean

Recommendation

Recognising the different levels of preparedness of RTWPs and NTWCs among countries of the Indian Ocean, members request WG5 to work towards developing a mechanism among Tsunami Warning Centres to establish a plan for an interoperable system of RTWPs by the end of 2007 for presentation at the next ICG/IOTWS.

To coordinate this work members request that ICG/IOTWS establish a task team under WG 5 – an RTWP Establishment Task Team.

Background

The Indian Ocean Tsunami (IOT) which occurred on 26 December 2004 caused death and destruction on a massive scale in many countries. Most casualties occurred in countries in the NE Indian Ocean, predominantly on the Indonesian island of Sumatra and in countries around the Bay of Bengal – mainly Thailand, Sri Lanka and India. Lesser effects were experienced in many other countries, reaching west to the east coast of Africa, and southeast to Australia.

Historically there have been numerous tsunami in the Indian Ocean. These have been caused by submarine earthquakes in both the region of the Indonesian archipelago and in the Arabian Sea. Also in the Indonesian region there have been tsunami generated by volcanic activity, most notably the Krakatoa eruption in the 1880s. But prior to the IOT the overall risk of disaster from tsunami in the Indian Ocean basin had been regarded as much lower than for the Pacific Ocean. Although a tsunami warning system has been in place for the countries around the Pacific Ocean since the 1960s, none had been set up for the Indian Ocean.

Following the IOT the need for a tsunami warning system for countries in the Indian Ocean has been recognised and there is international activity to put a system in place, under the auspices of the UNESCO IOC. The establishment of effective tsunami warning systems in countries at risk would significantly reduce loss of life in future tsunami events.

The establishment of an independent warning system for the Indian Ocean was always going to take some years. The sheer complexity of setting up seismic and sea-level monitoring networks, the infrastructure and expertise necessary to process the data, the large numerical modelling effort to generate tsunami scenarios, the composition and dissemination of tsunami bulletins, and the extensive communications networks required to collect data and distribute bulletins, just cannot be put in place quickly. In addition there is a need for much capacity building, both technical training within agencies issuing warnings, and public education and awareness training to enable communities to respond effectively.

Recognising that the requirement was urgent, an immediate response was achieved when the existing tsunami warning centres in the Pacific Ocean operated in Hawaii by NOAA (PTWC) and in Tokyo by JMA agreed to provide an interim Indian Ocean tsunami advisory service.

In the aftermath of the IOT a review of the threat of tsunami to countries around the Indian Ocean has identified that in addition to the significant risk of a tsunami originating from the Indonesian region there is also a significant risk around the Arabian Sea and on to east Africa for a tsunami originating from the region of the Makran Trench in the Gulf of Oman.

The Makran region contains an active subduction zone and has historically been affected by tsunami, the most recent disaster having occurred in 1945. An earthquake of magnitude 8.1 created a huge tsunami in this region killing at least 4000 people and having great economical

impact in Pakistan, Oman, and Iran. The coastal areas of Iran along the Sea of Oman and Pakistan in the vicinity of the Indian Ocean have developed extensively during the last two decades and the high growth of population has greatly increased the risk of loss of life due to any future tsunami.

There is a clear need for a tsunami warning system covering the entire Indian Ocean basin, capable of providing warnings for tsunami generated anywhere within the basin, and capable of delivering warnings to all countries within the basin. However, from the outset of deliberations by the IOC, initially in Paris and Mauritius in early 2005, and subsequently at all sessions of the ICG/IOTWS, it has been acknowledged that for both political and geophysical reasons it will not be practical or achievable for there to be a single Indian Ocean Tsunami Warning Centre.

At IOC IOTWS ICG I in Perth in July 2005 it was proposed that there be an interoperable system of systems – an integrated system comprising input from a small number of countries that would develop tsunami monitoring and warning capability and would provide tsunami warnings for the region, and national tsunami warning centres within each country to deliver tsunami warnings to their citizens. WG 5 was established to coordinate the establishment of this system.

At ICG 1 seven countries indicated an intention to develop tsunami warning capability – Australia, India, Indonesia, Iran, Malaysia, Pakistan and Thailand. At that first meeting these countries were still formulating their plans and were not in a position to indicate a time to completion or whether they would ultimately provide warnings for all or part of the Indian Ocean basin.

At an intersessional meeting of WG 5 in Singapore in November 2005 France indicated that it might also develop tsunami warning capability at its Indian Ocean territory of La Reunion. At that meeting there was also discussion about a possible accreditation procedure, similar to that employed by WMO for its Regional Specialised Meteorological Centres. And there was consideration of a possible division of the Indian Ocean into regions of responsibility for the countries that were developing tsunami warning capability. These concepts were formulated into a series of draft recommendations that were to be taken to ICG II.

At ICG II in Hyderabad in December 2005 WG 5 met to further consider the draft recommendations from the intersessional meeting. There was quick rejection of some of the draft recommendations from the intersessional WG 5 meeting in Singapore. It was agreed that there had been insufficient participation at the intersessional meeting to comprise a representative group, and that the recommendations about accreditation procedures and regions of responsibility did not reflect the views of the larger representation of member states at ICG II.

After clarification of the views of the group there was considerable discussion about the terminology to be used, and some early stage consideration about how the interoperable system of systems would operate. It was agreed to recommend that those member states that would develop international warning capability would be designated as Regional Tsunami Watch Providers (RTWPs), and that they would issue Tsunami Watches (TWs). It was agreed to recommend that TWs from RTWPs would be available to other countries in the IO basin through bilateral arrangements. It was also proposed that recipient countries could have such arrangements with more than one RTWP if they wished. There was discussion about the output from all RTWPs being freely exchanged via the WMO GTS, with the resulting option of recipient countries being able to access any or all of them. Countries hosting RTWPs have not formally committed to this exchange. A revised set of recommendations, reflecting the outcome of these discussions, was presented to ICG II.

The representative of France clarified his country's position – that it did not intend to proceed directly to develop tsunami warning capability, but would assess the tsunami warning service available to the SW Indian Ocean and be ready to contribute to the interoperable system of systems only if there was inadequate coverage from other countries.

At an intersessional meeting of WG 5 in Bali immediately preceding ICG III in August 2005 two significant issues captured the attention of WG 5 members, and diverted their discussion from the state of progress of the overall IOTWS. One was the disastrous South Java Tsunami (SJT) which occurred on 17 July 2005. The SJT had left around six hundred people dead just a few weeks before. Members were keen to discuss this event from the perspective of their individual countries, and in the context of the operation of the interim IOTWS during that event.

The other significant diversion was the excessively optimistic reporting in the international media of the state of development of tsunami warning systems in the Indian Ocean region. It was noted that the IOC Secretariat itself may have somewhat unwittingly contributed to this problem with its progress report and indication that an IOTWS was nearing completion. Media reports of substantial progress and an imminent completion timeframe had created unrealistic expectations in the eyes of the general public, and more significantly, within the governments of countries in the IO region. This had caused problems for members who found it necessary to explain to their governments the actual state of progress and justify the amount of time still to elapse before effective tsunami warning systems would be operating in their countries and across the region. The concern of members of WG 5 over the status report from the IOC was expressed in Recommendation 1 to ICG III. The long development time was explicitly noted in Recommendation 2, together with the need to ensure sustainability of systems and infrastructure through the development period and more importantly into the future.

Discussion then picked up ongoing issues relating to the interim tsunami advisory service and on the requirements of a regional tsunami watch service. Of particular interest was the format of tsunami advisory bulletins. There was considerable interest in an improved service with more discrimination of the focussing or beaming of tsunami, perhaps presented in graphical format. An earlier initial alert was discussed with perhaps the “Observatory message” being distributed. There was also discussion about travel times, whether they should be included in publicly available bulletins, and whether they could be provided for more locations. These discussions were reflected in the remaining recommendations from WG 5 to ICG III.

Since ICG III there has been further adverse publicity in the international media about the state of progress towards developing the IOTWS. In fact, progress has been quite steady and satisfactory. Establishing seismic and sea level monitoring networks, and developing the infrastructure and expertise to analyse the observational data, determine the location of an earthquake, assess its tsunamigenicity, and prepare and disseminate a tsunami warning was always going to be a slow and time-consuming process due to its complexity. But there is clearly a perception that progress has been too slow. There is a need to promote and publicise the progress to date, and the plans for advancing the development of the IOTWS.

It is appropriate now to start moving forward at a more rapid rate. In order to give a lead to this process Australia will be confirming to the plenary session of ICG IV its intention to continue to develop the capability to become a RTWP for the Indian Ocean. This should provide encouragement and incentive to other member states intending to establish RTWPs to review their positions and clarify and confirm intentions to participate in an interoperable system of watch providers and warning centres in the IO region.

There is a need to assess progress of those member states working to become RTWPs. To lead this discussion Australia will indicate its development plans, and to help to maintain momentum will support a proposal that a Task Team be established under WG 5 to finalise a plan for the interoperable warning system, taking account of the intentions of all member states. The Task Team would comprise representatives from the countries working towards becoming RTWPs, together with necessary supporting experts. This Task Team might be designated the IOTWS Task Team to Coordinate the Establishment of RTWPs.

It will be proposed that the Establishment Task Team meet twice before ICG V. Australia will be offering to host a session within a few months, with the expectation that participants will have

confirmed with their governments their plans and timeframes so that a much more definite schedule of development of the IOTWS will be available following that first Task Team session.

There are documents available to provide guidance in becoming a RTWP. The NOAA/NWS "Concept of Operations for Tsunami Warning Centres" records the requirements in great detail. To provide a high level guide for member states in establishing RTWPs, and to provide a framework within which the Task Team could operate, Australia wishes to propose a model. In very general terms, the requirements of an RTWP would be:

- Quick real-time access to the output from adequate international networks of seismic and sea level stations;
- Analysis infrastructure and competent staff to assess these data;
- Output of model scenarios from a recognised deep ocean model;
- Capability to formulate RTWs;
- Communications infrastructure to disseminate RTWs;
- Initial period of satisfactory operation as a national TWP.

This model for a RTWP could be the basis of terms of reference for the proposed Task Team, as outlined below:

Draft Terms of Reference (very much open for discussion)

1. Prepare a high level list of areas of capability – possibly:

- Adequate national seismic monitoring network
- Real time access to international seismic data
- Seismic assessment capability
- Adequate national sea level monitoring network
- Real time access to international sea level data
- Sea level assessment capability
- Access to deep ocean tsunami scenarios (details of modelling if doing it themselves or source of scenarios if from some external source)
- Tsunami Watch preparation capability
- Tsunami Watch dissemination capability

2. Monitor progress of member states against the areas of capability

- Assess extent of coverage of the IO region, noting whether RTWPs have TW capability over all or part of the IO region.

3. Assess adequacy of TW coverage over the IO basin

- To determine availability of TW services to member states
- To assist the interim providers to determine when they might be able to withdraw

4. Collate progress reports

- For information of member states
- To facilitate media statements from IOC Secretariat

A process of formal accreditation of RTWPs was dismissed at ICG II. There is nevertheless a need for a common standard of service and a way to verify the standard of operation of an international tsunami watch provider so that countries considering taking a watch service from them can have confidence in their capability. Australia wishes to propose a mechanism to

achieve these objectives, which it believes will be acceptable to all member states. It is proposed that there should be a consultative process among the member states of the IOTWS. This “benchmarking” or “peer review” type process could be undertaken by the same Task Team that has been proposed above to be set up under WG 5 to coordinate the establishment of the interoperable system of systems for RTWPs and NTWCs in the Indian Ocean. Team membership would need to include experts in all relevant fields covered by the six working groups of ICG/IOTWS, together with representatives from the two interim IO TACs. The Task Team would not have authority to approve or accredit, but would act as a reference panel to liaise with countries that are developing RTWP capability, to review progress and benchmark procedures.

Details of this Task Team proposal are being raised early in the WG 5 intersessional meeting so that participants are aware of it throughout the meeting. Progress reports from member states to this intersessional meeting would provide a starting point for the Task Team. But it is anticipated that members will need to consult further with their governments after ICG IV to confirm the details of commitments they would need to bring to the first meeting of the Task Team.

ANNEX II to WG5 report

Information on recent activities by ISDR related to WG 5 Recommendation 6 to ICG-III
Extracts from UN/ISDR publication Highlights for February 2007

1. Partnership between the World Bank and UN/ISDR
The Global Facility for Disaster Reduction and Recovery (GFDRR) of the World Bank in partnership with UN/ISDR aims at supporting global, regional and national level implementation of disaster risk reduction programs for achieving sustainable development. The partnership's impact has been strongly felt in Africa, East Asia, South Asia, Central America, South Eastern Europe, Pacific and the Middle East and North Africa. Country level risk reduction initiatives have also begun in Mozambique, Malawi, Nepal, Nicaragua, and Vietnam. On February 21 the GFDRR sponsored a media workshop at World Bank headquarters in Washington DC. Leading journalists from around the world gathered to discuss disaster risk reduction issues and devise plans for awareness-raising. This came under the Media Networks initiative, aiming at promoting disaster risk reduction in news coverage and to help to build a culture of safety and resilience to disasters.

2. Broadcasting 'Natural' Disasters: ABU Secretary-General explains
The Asia-Pacific Broadcasting Union (ABU) Secretary-General David Astley, on the occasion of the Broadcasting Engineering Society Conference, encouraged ABU members to integrate disaster risk reduction into their coverage. ABU with a potential audience of about 3 billion people highlighted broadcasters' important role in disseminating information, as information itself could constitute a vital form of aid. He also explained that disaster risk reduction is becoming an important issue that can no longer be ignored by journalists. While quoting Kofi Annan, former UN Secretary-General, David Astley emphasized that "Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; there are the disasters that did not happen."
For more information www.abu.org.my

ANNEX XI

ICG/IOTWS WORKING GROUP 6
Mitigation, Preparedness and Response
REPORT OF SESSIONAL MEETING ICG-IV (28 FEBRUARY 2007)

Chair: Michel Vielle, Seychelles
Vice Chair: Che Moin Umar, Malaysia

1. WG TERMS OF REFERENCE

- Promotion and enhancement of the institutionalisation of tsunami early warning systems, their implementation and maintenance.
- Mainstreaming of tsunami warning and mitigation system into development policy, plans, practice and legislation.
- Integration of national tsunami programs and experts into the defined national platforms for disaster risk reduction and national disaster management processes.
- Development and adaptation of tsunami-related guidelines, manuals and tools for downstream activities i.e. public information, education, training, communication processes, evacuation planning and drills, standard operating procedures and emergency management.
- Coordination at regional and sub-regional levels on the above matters.

2. MEETING OBJECTIVES

- To establish an action plan for Working Group 6 (WG6).
- Assign responsibilities to Member States

3. DISCUSSION OF ISSUES

In order to develop an action plan based on identified national needs and capacities within mitigation, preparedness and response a questionnaire had earlier been sent out to all Member States. In the first intersessional meeting the findings of this questionnaire, together with the findings of the UNESCO-IOC led 16 country assessments, formed a good basis for identifying target areas for WG6 activities.

Having defined target areas and a number of objectives in earlier intersessional meetings, the task for the participants in this sessional meeting was to develop specific activities that would meet these objectives. The final agreed work plan consists of five prioritised target areas: Governance, Community Resilience, Preparedness, Mitigation and Analysis and Evaluation. The meeting identified 18 activities that need to be initiated urgently, many of them during 2007, some in 2008.

4. REVIEW OF OUTSTANDING ACTIONS

Please see attached the established action plan for agreed actions and deadlines.

The meeting concluded that Member States as well as organisations and donors will need some time to review the finalised action plan to be able to indicate interest in coordination of and/or participation in the identified activities. Therefore, it was decided that during March the Chair will write and send out a letter to each Member State requesting their feedback on the issue of responsibility. The response will be compiled by Chair and Vice chair in April, and the aim is to provide the ICG Secretariat with information on responsibilities and estimated costs by May. By

the end of this process it is expected that project proposal(s) for one or many activities can be drafted and used in order to seek external funding support.

5. AGREED ACTIONS AND DEADLINES

No	Action	Person responsible	Due Date
1	**GOVERNANCE**		
1.1	Revisit existing national steering committees to ensure appropriate representation. MS task to report back	Member States	2007
1.2	Support national policy adjustment through workshops.	Member States	2008
1.3	Stimulate government commitment by cooperating with other working groups to adapt their scientific findings to government language.	Chair/Member States	2008
1.4	Support the integration of disaster risk reduction into political policy trough national platforms.	Member States	2007
2	**COMMUNITY RESILIENCE**		
2.1	Ongoing regional training program on coastal community resilience assessment tools and action planning process by e.g.: • Encouraging MS to utilise work already carried out under the CCR initiative, including USAID project.	ICG Secretariat/Chair / Member States	2007
2.2	Sharing experience and lessons learned in using the assessment tools and implementing action plans by e.g.: • Regional CCR workshop with USAID and other partners	USAID/Chair/ Member States	2007
2.3	Sharing best practices and lessons learned on promoting sustainable and diverse livelihoods and supporting social and cultural networks that enhance community resilience, through: • Workshop to share best practices and lessons learned. Invite partners such as APEC. • Sharing products from ongoing projects, e.g. USAID. • Enhancing traditional coping mechanisms • Incorporating scientific research findings with indigenous knowledge	USAID/Chair/ Member States/ICG Secretariat	2007
2.4	Encourage MS to gather examples, develop new and implement existing guidelines on engaging the private sector in micro-credit and insurance schemes.	IGC/Chair/Member States	2007
3	**MITIGATION**		
3.1	Adapt and promote existing guidelines on land-use and evacuation planning (considering both flat and	Member States	2008

No	Action	Person responsible	Due Date
	hilly countries).		
3.2	Regional training program on assessment, identification and implementation of appropriate coastal land-use, evacuation zones and mapping (including GIS).	ICG/Chair	2008
3.3	Share best practices and lessons learned in national assessment, identification and implementation of land-use and evacuation planning.	Member States	2008
3.4	Training program and sharing of best practices and lessons learned on management of sensitive coastal resources and natural protective features.	ICG/Member States	2008
4	**PREPAREDNESS & RESPONSE**		
4.1	Engage with country and regional media corporations to encourage them to become partners/stakeholders with governments at all levels to disseminate factual and timely tsunami warnings and information to communities. Through a regional workshop.	ICG/Chair/Member States	2007
4.2	Assist countries to establish 'national disaster safety day' to sustain awareness and strengthen preparedness through drills and education. A written Policy Brief signed by the Chair of WG6, to be disseminated to all MS.	ICG	2007
4.3	Document traditional knowledge and symbols on the incidents of hazards, including tsunamis, for possible use in education, public awareness and media campaigns, as well as an international lessons learned report.	Member States	2007
4.4	Form partnerships with IFRC and social/religious bodies to utilise established networks for the dissemination of community specific tsunami information materials.	IFRC/Member States	2007
4.5	Engage an expert to assess the gaps that are preventing governments to establish SOPs (including division of responsibility) at all levels. • Mid term – Addressing the outcomes of such assessment. • Long term - follow-up on that action to bridge the gaps have been taken.	ICG Secretariat	2007
5	**ANALYSIS & EVALUATION**		
	Identify international organisations engaged in vulnerability and capacity assessment (VCA) and develop a coordinated approach to VCA, based on the results of the risk mapping conducted by working group 3.	ICG Secretariat	2007

6. WORKING GROUP RECOMMENDATIONS TO THE ICG

- Chair of Working Group 6 to request all member states to indicate interest in coordinate and/or participate in the Working Group's activities.
- The outcome of this request, together with estimated costs for each activity, will be consolidated by Chair and Vice Chair to be submitted to the ICG Secretariat.
- Working Group 6 to develop project proposals, seek technical and financial support and start implementation phase.

7. WORKING GROUP PARTICIPANT LIST

	Name	Country/Organisation	Email
1.	Michel Vielle (Chair)	Seychelles	m.vielle@statehouse.gov.sc
2.	Anita Dwyer	Australia	anita.dwyer@ausaid.gov.au
3.	Brian Flanagan	Australia	brian.flanagan@ema.gov.au
4.	Katherine Mitchell	Australia	Katherine.mitchell@ausaid.gov.au
5.	Syed Ashraf	Bangladesh	islamasyed@hotmail.com
6.	Jan Sopaheluwakan	Indonesia	jans@lipi.go.id
7.	Stephen Musau Muange	Kenya	nationaldisasterops@yahoo.com
8.	David Mwenda	Kenya	
9.	Ephantus N. Ngotho	Kenya	enngotho@yahoo.com
10.	Julie Njeri	Kenya	julie@kenyatourism.org
11.	Boniface Wekesa Wanyama	Kenya	bwwekesa@yahoo.com
12.	Che Moin Umar	Malaysia	moin@bkn.jpm.my
13.	Mohamed Shareef	Maldives	shareef@planning.gov.mv
14.	Abdulkadir Nur Arale	Somalia	arraleh05@yahoo.com
15.	Peter Dias Amarasinghe	Sri Lanka	amasklk@yahoo.com
16.	Orestes Anastasia	USA	oanastasia@usaid.gov
17.	Abdulkhaliq Al. Ghaberi	Yemen	alGhaberi1@gmail.com
18.	Akiko Nakamura	ADRC	nakamura@adrc.or.jp
19.	Youcef Ait. Chelloucche	IFRC	youcef.aitchellouche@ifrc.org
20.	Tony Elliott	IOC	t.elliott@unesco.org
21.	Patrick Kratt	ISDR	kratt@un.org
22.	Noroarisoa Rakotondrandria	UN/ISDR Africa	noroarisoa.Rakotondrandria@unep.org
23.	Juan Carlos Villagran	UNU-EHS	villagran@ehs.unu.edu

8. NEXT MEETING

Regarding the venue for the third Intersessional meeting, Malaysia, Seychelles and Australia indicated their interest in hosting the meeting. The venue will be decided through discussions among the three Member States.

The date for this next meeting will be announced by the Chair in due course.

ANNEX XII

LIST OF PARTICIPANTS

I. MEMBER STATES OF ICG

AUSTRALIA

Mr Rick BAILEY (Head of Delegation)
Project Director
Australian Tsunami Warning System
Bureau of Meteorology
P.O. Box 1289 Melbourne. VIC. 3001
Tel: +61 3 96694103, Fax: +61 3 96694695
Email: r.bailey@bom.gov.au

Mr Geoff CRANE
Warning System Specialist (Chair WG5)
Bureau of Meteorology
P.O. Box 1289 Melbourne. VIC 3001
Tel: +61 3 966 94110, Fax: +61 3966 94695
Email: g.crane@bom.gov.au

Ms Anita DWYER
Manager Disaster Risk Reduction
AusAID
GPO Box 887
Canberra 2601
Tel: +61 2 6206 4128, Fax: +61 2 6206 4587
Email: anita.dwyer@ausaid.gov.au

Mr Brian FLANAGAN
Assistant Director, Tsunami Warning Implementation
Emergency Management Australia
P.O. Box 1020 Dickson ACT 2606
Tel: +61 2 6256 4692, Fax: +61 2 6256 4563
Email: brian.flanagan@ema.gov.au

Dr Diana GREENSLADE
Bureau of Meteorology
P.O. Box 1289, Melbourne VIC 3001
Tel : +61 3 9669 4124, Fax: +61 3 9669 4660
Email: dag@bom.gov.au

Mr Ken JARROTT
Head, Observations Systems Section
Observations and Engineering Branch
Bureau of Meteorology
P.O. Box 1289 Melbourne. VIC. 3001
Tel: +61 3 9669 4163, Fax: +61 3 9669 4168
Email: k.jarrott@bom.gov.au

Ms Katherine MITCHELL
Disaster Risk Reduction Officer
Humanitarian and Emergency Section, AusAID,
GPO Box 887 Canberra ACT 2601
Tel: +61 2 6206 4543, Fax: +61 2 6206 4587
Email: Katherine.mitchell@ausaid.gov.au

BANGLADESH

Mr Ashraf Al Islam SYED,
Disaster Management Bureau,
92-93 Mohakhali C/A (4th floor) Dhaka-1212.
Tel+ 880-2-8859638, 880-2-8851615
E-mail: islamasyed@hotmail.com

INDIA

Mr Krishnan PREMKUMAR
Programme Director
National Data Buoy Programme
Velachery-Tambaram Road, Pallikaranai,
Chennai, 601302, India
Tel: 91-44-22460678, Fax: 91-44-22460661
Email: prem@niot.res.in

Mr Srinivasar Kumar TUMMALA
Scientist, Indian National Centre for Ocean Information Services
Near Pragathi Nagar, Opp. JNTU, Kukatpallu
Hyderabad, 500072, India
Tel: 9140 23892022, Fax: 91 40 23895012
Email: srinivas@incois.gov.in

INDONESIA

Dr Ir. Jan SOPAHELUWAKAN
Deputy Chairman for Earth Sciences
Indonesian Institute of Sciences (LIPI)
Gd. Widya Sarwono Lt. 3 Jl.Jend. Gatot Subroto 10, Jakarta 12710
Tel: +62 21-5251850, Fax: + 62 21-5260804
Email: jans@lipi.go.id; jx_hydrogen@yahoo.com

Dr FAUZI
Badan Meteorologi dan Geofisika
Jl.Angkasa I no.2, Kemayoran
Jakarta, 10720, Indonesia
Tel: 62 21 654 6316, Fax: 62 21 654 6316
Email: fauzi@bmg.go.id

Dr Prih HARJADI
Badan Meteorologi dan Geofisika
Jl.Angkasa I no.2, Kemayoran
Jakarta, 10720, Indonesia
Tel: 62 21 654 6316, Fax: 62 21 654 6316
Email: prih@bmg.go.id

Dr Parluhutan MANURUNG
Head of Division for Gravity and Tide, National Coordinating Agency for survey & Mapping
Jl. Raya Jakarta Bogor Km46
Cibinong, Indonesia 16911
Tel: 62-21-87907730, Fax: 62-21-27907730
Email: parluhutan@bakosurtanal.go.id

Dr Haji PARIATMONO
Assistant to Deputy Minister for Analysis of
Science and Technology Needs
BPPT Building II, 6th Floor
Jl.M.H. Thamrin No. 8, Jakarta 10340
Tel: 62-21-316 9169, Fax: 62-21-314 8192
Email: pariatmono@ristek.go.id

IRAN

Dr Vahid CHEGINI
Director
Iranian National Center for Oceanography
West Fatemi Ave
Tehran 14118113389
Tel: +(009821) 66944867
Fax: +(009821) 66944866
Email: v_chegini@inco.ac.ir

KENYA

Dr Joseph R. MUKABANA (Head of Delegation)
Director, Kenya Meteorological Department
P.O. Box 30259, Nairobi 00100
Tel: +254 020 3874214; Fax: +254 020 3876955
Email: mukabana@meteo.go.ke;
director@meteo.go.ke

Ms Beatrice AKUNGA
Fisheries Officer, Ministry of Livestock and
Fisheries Development
P.O. Box 58187 Nairobi
Tel: +254 020 0733423938
Fax: +254 20 342149
Email: nyabokeakunga@yahoo.com

Mr Peter AMBENJE
Ag. Deputy Director
Kenya Meteorological Department
P.O. Box 30259, Nairobi
Tel : 3867880-5, Fax: 3876955
Email: ambjenje@meteo.go.ke

Ms Stella AURA
Ag. Deputy Director
Kenya Meteorological Department
P.O. Box 30259, Nairobi
Tel: +254-20-3876957
Email : aura@meteo.go.ke

Mr Kiguhi BEN
Engineer
Ministry of Transport
P.O. Box 52682, Nairobi
Tel: +020-2729200
Email: benkiguhi@yahoo.com

Dr Johnson KAZUNGU
Director, KMFRI
P.O. Box 81651, Mombasa
Tel: +(041)475157
Email: cmagori@kmfri.co.ke

Ms Maria KIIO
Research Scientist
KMFRI

Mr Zachariah N. KURIA
Senior Lecturer
Dept.of Geology U.O.N
P.O. Box 30197-00100, Nairobi
Tel: +4449004 Ext. 2090
Email: zkuria@uonbi.ac.ke;
kuriazack@yahoo.com

Dr Samwel O. MARIGI
Ag. Assistant Director
Kenya Meteorological Department
P.O. Box 30259, Nairobi
Tel: +254-20-3867880
Fax: +254-20-3876955

Dr Eliud MATHU
Chairman Geology Department
University of Nairobi
P.O. Box 30197-00100, Nairobi
Tel: +254-20-4445896
Email: emathu@uonbi.ac.ke

Mr Davies MUALUME
Deputy Secretary, OOP-MSSP
P.O. Box 30510, Nairobi
Tel: +254-020-251550; Fax: +254-020-213878
Email: michomwalume@aridland.go.ke

Major Stephen MUANGE
Disaster Manager, OoP-SP-NOC
P.O. Box 30510, Nairobi
Tel: +254-733-599312
Email: nationaldisasterops@yahoo.com

Mr Gordon Otieno MUGA
Assistant Secretary
OOP – Special Programmes
P.O. Box 30510 – 00100, Nairobi
Tel: +227411
Email: Ghorduuh@yahoo.com

Mr Stephen MUNGUTI
Representative Ppo Coast Province
OCPD, Kilinini, Mombasa
Tel: +041-2224143
Email: smuluku@koa.go.ke

Mr Edward MURIUKI
Principal Meteorologist
Kenya Meteorological Department
P.O. Box 98512, Mombasa 80100
Tel: +(041) 2225685, Fax: +41 3433689
Email: edmuriuki@yahoo.com

Mr Boniface Jumwa MWANDOTTO
Deputy Managimg Director
Coast Development Authority
P.O. Box 1322 - 80100

Mombasa, Kenya
Tel: +254-041-2224490 or 2224406
Fax: +254-041-2224411
E-mail: mwandotto@cdakenya.org

Mr Abdallah MWARUWA
Managing Director
Kenya Ports Authority

Mr Tom NAMASAKA
Asst. Director, OoP-SP
P.O. Box 30510, Nairobi
Email: namasakat@yahoo.com

Mr Sam NGETE
Engineer, KMFRI
P.O. Box 81651, Mombasa
Tel: +(041)475157
Email: sngete@kmfri.co.ke

Mr Charles Maina NGUNJIRI
Ag. Assistant. Directo
Kenya Meteorological Department
P.O. Box 30259, Nairobi
Tel: +254-20-3867880
Fax: +254-20-3876955
Email: mafimbo@yahoo.com

Mr Chito NJERIA
Planning and Projects Officer
Kenya Meteorological Department
P.O. Box 30259, Nairobi
Tel: +254-20-3867880
Fax: +254-20-3876955
Email: chitonjeria@yahoo.com

Mr Ephantus NYAGAH
Senior Planning And Projects Officer
Kenya Meteorological Department
P.O. Box 30259, Nairobi
Tel: +254-20-3867880
Fax: +254-20-3876955
Email: engotho@yahoo.com

Mr David OBURA
Coordinator/Director
Cordio East Africa
P.O. Box 10135, Mombasa
Tel: (041) 5486473
Email: dobura@cordiaea.org

Mr James ODUOR
Food Security Expert
Min. of Special Programmes
P.O. Box 53547, Nairobi
Tel: +227411 ext. 22228
Email: j.oduor@aridland.go.ke

Mr Jotham G. OTIDO
Principal Geologist
Mines & Geology Dept
P.O. Box 30009 00100, Nairobi
Tel: +558034
Email: cmg@bidii.com

Mr Bakari RAMTU
Provincial Meteorologist
Kenya Meteorological Department
P.O. Box 98512, Mombasa
Tel: +(041) 3433789
Fax: +254-20-3876955

Major Stephen K. SANE
Ag. Director NDOC
National Operations Centre
P.O. Box 30510, Nairobi
Tel: +254-20-211 445
Fax: +254-020-210077
Email: sksane@yahoo.com

Mr Ayub SHAKA
Ag. Assistant Director
Kenya Meteorological Department
P.O. Box 30259, Nairobi
Tel: +254-20-3867880
Fax: +254-20-3876955
Email: ayubshaka@yahoo.co.uk

Mr Boniface W. WANYAMA
Assistant secretary, Kenya National Commission for UNESCO,
P.O. BOX 72107-00200 Nairobi
Tel: 254 721 434057, Fax: 254 20213025
Email: bwwekesa@yahoo.com

MALAYSIA

Dr Mohd Rosaidi BIN CHE ABAS
Director of Seismological Division
Malaysian Meteorological Department,
Jalan Sultan, 46667 Petaling Jaya, Selangor
Tel: 603-7967-8000, Fax: 603-79550946
Email: rosaidi@kjc.gov.my

Mr Che Moin UMAR
Director, Crisis and Disaster Management
Directorate, National Security Division, Prime Minister's Department
Level G, West Wing, Perdana Putra Building,
Putrajaya, 62502, Malaysia
Tel: 602-8888-2051, Fax: 603-8888-3051
Email: moin@bkn.jpm.my

Dr Noraini SURIP
Research Officer
Malaysian Centre for Remote Sensing (MACRES), 13 Jalan Tun Ismail
Kuala Lumpur, 50480, Malaysia
Tel: 03-26966971, Fax: 03-26973350
Email: norainis@macres.gov.my

Mr Shahruddin YUSOF
Principal Assistant Director
Level 6, Block C4, Parcel C

Putrajaya, 62662, Malaysia
Tel: 60388858204, Fax: 603-88893008
Email: shahyu@mosti.gov.my

MALDIVES

Mr Abdullah ALGEEN
Director, Department of Meteorology
Orchid Building, Male, Maldives
Tel: 960-332-5766; Fax: 960-332-0021
Email: algeen@met.gov.mv

Dr Mohamed SHAREEF
Executive Director
Ministry of Planning and National Development
Ameer Ahmed Magu
Male' 20125, Maldives
Tel: +960 3348334, Fax: +960 3327351
Email: shareef@planning.gov.mv

MAURITIUS

Mr Soobaraj Nayroo Sok APPADU
Director Meteorological Services
St. Paul Road, Vacoas, Mauritius
Tel: +230 686 1031, Fax: +230 686 1033
Email: meteo@intnet.mu

Mr Mohammed Rezah BADAL
Project Officer
Maurittius Oceanography Institute
Victoria Avenue Qautre Bornes
Tel: +230 4274434, Fax: +230 4274433
Email: rezahmb@moi.intnet.mu

MYANMAR

Dr Tun LWIN
Director General
Department of Meteorology and Hydrology
Kaba-Aye Pagoda Road, Mayangon 11061
Yangon, Myanmar
Tel: 095-01-660826/665669
Fax: 095-01-665944/665704
Email: dg.dmh@mptmail.net.mm;
tun.dmh@mptmail.net.mm

SEYCHELLES

Mr Michel VIELLE
Director General
Disaster Risk Management Agency
State House P.O. Box 55 Victoria
Mahe, Seychelles
Tel: +248 322979, Fax: +248324039
Email: m.vielle@statehouse.gov.sc

SINGAPORE

Mr Lesley CHOO
Head Systems and Communications
Meteorological Services, National Environment Agency
P.O. Box 8, Changi Airport Singapore 918141
Tel: +65-65429819, Fax: +65 65 45 7192
Email: lesley_choo@nea.gov.sg

SOMALIA

Hon. Abdulkadir NUR ARALE
Chairman of NTDMB
National Tsunami Disaster Management Bureau
Isha Baidoa, Somalia 622
Tel: +2521-871170, +2521-214532
Email: arraleh05@yahoo.com

SOUTH AFRICA

Mr Johan STEYN
Technologist: Seismic Netwkorks
Council for Geoscience
280 Pretoriastreet, Silverton/Pretoria
South Africa 157
Tel: 27 12 841 1182, Fax: 27 12 841 1424
Email: jsteyn@geoscience.org.za

SRI LANKA

Mr Peter Dias AMARASINGHE (Head of Delegation)
Secretary, Ministry of Disaster Management and Human Rights
2, Wijerama Mawatha
Colombo 7 Sri Lanka
Tel: 94-11-2695012, Fax: 94-11-2681982
Email: amasklk@yahoo.com

Mr G.H.P. DHARMARATNA
Director General, Department of Meteorology,
383, Buddhaloka Mawatha, Colombo 7.
Tel: +94 11 2694 104, Fax: +94 11 2698 311
Email : gdharmaratna@yahoo.com,
Meteo1@sltnet.lk

Prof. Chari Pattiaratchi
School of Environmental Systems Engineering
(M015), The University of Western Australia,
35 Stirling Hwy, Crawley 6009
Western Australia
Tel: 61 8 6488 3179, Fax: 61 8 6488 1015
Email: Chari.Pattiaratchi@uwa.edu.au

Dr E.M.S WIJERATNE
Research Officer
NARA
Colombo-15, Sri Lanka
Tel: 0094 11 2521008, Fax: 0094 11 2521932
Email: emsw@nara.ac.lk

THAILAND

Dr Smith DHARMSAROJA (Head of Delegation)
Chairman Of The Committee For The National Disaster Warning Administration
National Disaster Warning Center
Rattanathibet Road

Muang 11000
Tel: +66 2 5892497, Fax: +66 2 5896008
Email: smith_dhar@yahoo.com

Group Captain Chitipat BEJRABURNIN
Chief of Policy and Planning
National Disaster Warning Center,
Rahanatibet Road, Bang Kra Sor,
Muang, Nonthaburi
Tel: 02-5892497, Fax: 02-5896008
Email: bejraburnin5@hotmail.com

Rear Admiral Thaworn CHAROENDEE
Vice Executive Director,
National Disaster Warning Center,
RaHanatibet Road, Bang Kra Sor, Muang,
Nonthaburi
Tel: 025892497, Fax: 025896008
Email: ndwc_thawon@hotmail.com

Mr Passkorn KUNTHASAP
Senior Geologist
National Disaster Warning Center,
RaHanatibet Road, Bang Kra Sor, Muang,
Nonthaburi
Tel: 025892497, Fax: 025896008
Email: passkornk@hotmail.com

Mr Tinnakorn TATONG
Chief Information Dissemination
National Disaster Warning Center,
RaHanatibet Road, Bang Kra Sor, Muang,
Nonthaburi
Tel: 025892497, Fax: 025896008
Email: ttatong@hotmail.com

Mr Waiyapot WORAKANOK
Assisstant Executive Director
National Disaster Warning Center,
RaHanatibet Road, Bang Kra Sor, Muang,
Nonthaburi
Tel: 025892497, Fax: 025896008
Email: waiyapot1@yahoo.com

YEMEN

Mr Abdulkhaleg Yahia AL GHABERI
Director General of Environmental Emergency
Ministry of Water & Environment,
P.O. Box 20391 Sana'a
Tel: + 967711 181 757; Fax: + 9671 418 295
E-mail: alGhaberi1@gmail.com;
eeuyememem@yemen.net.ye

MEMBER STATES OF IOC
OBSERVERS TO ICG

GERMANY

Dr Reinhold OLLIG (Head of Delegation)
Director, Ministry for Education and Research
Heinemannstrasse 2 D-53175 Bonn
Tel: +4 91888 573469, Fax: +49 1888 57 83469
Email: reinhold.ollig@bmbf.bund.de

Dr Jörn BEHRENS
Alfred-Wegener-Institute for Polar and Marine
Research Head of Tsunami Modeling Group
Am Handelshafen 12
27570 Bremerhaven
Tel: +49471-48311781, Fax: +49471-4831 1590
Email: jbehrens@awi-bremerham.de

Prof Ernst FLÜH
Gitews-Koordination Ozeanbodeninstr.
IFM-GEOMAR Kiel
Tel: +0431/600-2328, Fax: +0431/600-2922
Email: eflueh@ifm-geomar.de

Dr Toni KRAFT
Gitews/Geofon Seismologie
GeoForschungsZentrum
14473 Potsdam
Tel: +0331/288-1247, Fax: +0331/288-1277
Email: toni@gfz-potsdam.de

Dr Joern LAUTERJUNG
Head of Scientific Staff
Geoforschungszentrum Potsdam (GFZ)
Telegrafnberg D-14473 Potsdam
Tel: +49 331-2881020, Fax: +49 331 2881002
Email: lau@gfz-potsdam.de

Dr Torsten RIEDLINGER
German Aerospace Center (DLR)
Oberpfaffenhofen 82234 Wessling Germany
Tel: +49 8153283674 Fax: +49 8 153 28 1445
Email: Torsten.Riedlinger@dlr.de

Dr. Guenter STRUNZ
German Aerospace Center (DLR)
Oberpfaffenhofen, 82234 Wessling
Tel: +49 8153281314, Fax: +498153281445
Email: Guenter.strunz@dlr.de

UNITED STATES OF AMERICA

Mr Curtis BARRETT (Head of Delegation)
Manager NOAA Tsunami Project,
1325 East West Highway,
SSMCII, Room 11, 152
Silver Spring MD, Maryland 20910
Tel: 301-713-1784x136
Email: curtis.barrett@noaa.gov

Mr Orestes ANASTASIA
Program Manager US IOTWS Program USAID
Regional Development Mission/Asia,
Diethelm Towers A, 10th Floor
93/I Wireless Road Bangkok 10330 Thailand
Tel: +66 2 263 7468, Fax: +66 2 263 7497
Email: oanastasia@usaid.gov

Dr Charles MCCREERY
Director, Pacific Tsunami Warning Centre
91-270 Ft.Weaver Rd
Ewa Beach, HI 96706 USA
Tel: +1 808 6898207, Fax: +1 808 68944543
Email: charles.mccreery@noaa.gov

Dr David MCKINNIE
Coordinator, NOAA Indian Ocean Tsunami
Warning System Project
7600 Sand Point Way NE Seattle, WA 98115
Tel: +1 206 526 6950, Fax: +1 206 526 4576
Email: david.mckinnie@noaa.gov

Dr Edward YOUNG
Assistant Regional Director
NOAA National Weather Service Pacific Region
Grosvenor Center, Mauka Tower
737 Bishop Street, Suite #2200
Honolulu, HI 95813
Tel: 1 808 532 6412, Fax: 1 808 5325569
Email: Edward.young@noaa.gov

ORGANIZATIONS / INSTITUTIONS

ASIAN DISASTER PREPAREDNESS CENTER (ADPC)

Mr Arjunapermal SUBBIAH
Director of Climate Risk Management Division
Asian Disaster Preparedness Center
58 Moo 9, Klong Nueng, Klong Luang
Pathumthani, Thailand 12120
Tel: +(6681) 755 5471, Fax: +(662) 524 5350
Email: subbiah@adpc.net

ASIAN DISASTER REDUCTION CENTER (ADRC)

Ms Akiko NAKAMURA
Researcher, Asian Disaster Reduction Center
Hitomiraikan 5F 1-5-2 Wakinohamakaigan-dori
Chuo-ku Kobe 651-0073 JAPAN
Tel: +81 78 262 5540, Fax: +81 78 262 5546
Email: nakamura@adrc.or.jp

INTERNATIONAL FEDERATION OF RED CROSS AND RED CRESCENT SOCIETIES

Mr. Youcef AIT CHELLOUCCHE
Disaster Manager, IFRC - Red Cross
P.O. Box 42475, Nairobi, Kenya
Tel: +254-733-888040
Email: youcef.aitchellouche@ifrc.org

UNIVERSITY OF HAWAII SEA LEVEL CENTER/ GLOBAL SEA LEVEL OBSERVING SYSTEM (UHSLC/GLOSS)

Dr Bernard KILONSKY
Department of Oceanography Univ. of Hawaii,
2770 Lai Road, Honolulu, Hawaii 96816 USA
Tel: +1 808 956 6574, Fax +1 808 956 2352
Email: kilonsky@hawaii.edu

UNITED NATIONS INTERNATIONAL STRATEGY FOR DISASTER REDUCTION (UN/ISDR)

Stefanie DANNENMANN
Programme Officer
UN/ISDR-PPEW,
UN Campus, Hermann-Ehlers-Strasse 10
D-55113 Bonn, Germany
Tel: +492288150304
Email: Dannenmann@un.org

Patrick KRATT
Associate Expert, United Nations International Strategy for Disaster Reduction (UN/ISDR)
Rajdamnern Nok Avenue
Bangkok 10200, Thailand
Tel: +66 (0)2 288 2745
Email: kratt@un.org

Noroarisoa RAKOTONDRANDRIA
Regional Programme Officer, UN/ISDR
Block T, 328, P.O. Box 47074, Gijin (UN Complex), Nairobi, Kenya
Tel: 254-207624568, Fax: 254-207624726
Email: noroarisoa.Rakotondrandria@unep.org

OCHA

Mr Pierre Gelas
Regional Disaster Response Advisor
P.O. Box 30218
Nairobi, Kenya
Tel: +254 20 621005, Fax: +254 20 622632
Email: Pierre.gelas@regionalOCHA.org

UNDP

Mr David KARUTI
Program Officer
UN Avenue Gigiri
Nairobi, Kenya
Tel: +254-20-227627
Email: david.mwende@undp.org

UNU-EHS

Dr Juan Carlos VILLAGRAN DE LEON
Gitews Capacity Building
UNU Bonn, Germany
Tel: +0228/815-0210
Fax: +0228/815-0299
Email: villagran@ehs.unu.edu

WORLD AGENCY OF PLANETARY MONITORING & EARTHQUAKE RISK REDUCTION (WAPMERR)

Mr Adel KARAS
Regional Director, Africa, Asia & Middle East
Post Box No. 33280 Dubai UAE
Tel: +9714 332 2299, Fax: +9714 332 9988
Email: a_karas@wapmerr.org

Dr Viacheslav GUSIAKOV
Head Of Research & Development
World Agency of Planetary Monitoring and Earthquake Risk Reduction (WAPMERR)
Pr. Lavrentieva 6
Novosibirsk 630090, Russia
Tel: +7(3832)30-70-30, Fax: +7(3832)30-87-83
Email: gvu@sscc.ru

Mr Igor MARININ
Project Manager, WAPMERR
Lavrentieva 6
Novosibirsk 630090, Russia
Tel: +7-383-330-8460, Fax: +7-383-330-7070
Email: igor.marinin@inbox.ru

WORLD METEOROLOLGICAL ORGANIZATION (WMO)

Mr Stephen NJOROGE
Program Officer
WMO Subregional Office
P.O. Box 76523
Nairobi, Kenya

SECRETARIAT

IOC/UNESCO

Patricio BERNAL
Executive Secretary IOC/ADG
1 rue Miollis Paris 75015 France
Tel: +33 1 45 68 39 83, Fax: +33 1 45 68 58 12
Email: p.bernal@unesco.org

Peter KOLTERMANN
Head of IOC Tsunami Unit, Tsunami Office
1 Rue Miollis 75732 Paris CEDEX 15,
Tel: +33 1 45 68 40 15, Fax: +33 1 45 68 58 10,
Email: p.koltermann@unesco.org

Tony ELLIOTT
Head of ICG/IOTWS Secretariat
IOC Perth Regional Office
P.O. Box 1370, West Perth Australia 6872
Tel: 618 9226 0191, Fax: 61 8 9263 2211
Email: t.elliott@unesco.org

Jane CUNNEEN
ICG/IOTWS Secretariat
IOC Perth Regional Office
P.O. Box 1370, West Perth WA 6872 Australia
Tel: +61 8 9226 0191, Fax: +61 8 9263 2211
Email: j.cunneen@unesco.org

Laura KONG,
Director, IOC International Tsunami Information Centre
737 Bishop St., Ste. 2200 Honolulu, Hawaii 96813 USA
Tel: +1 808 532 6423, Fax: +1 808 532 5576
Email: l.kong@unesco.org

Mika ODIDO
Head Of IOCWIO/ODINAFRICA Projects Office
UNESCO/IOC UN Complex Gigiri Block C
P.O. Box 30592, Nairobi , Kenya
Tel: +254 20 7623830, Fax: +254 20 7622750
Email: m.odido@unesco.org

Michael ROTTMANN,
Special Coordinator, IOTEWS
UNESCO Jakarta Office, UNESCO House
Jl Galuh II, No15
Kebayoran Baru, Jakarta 12110,
Tel +62 8161936327, Fax +62 2172796489,
Email: m.rottmann@unesco.org

Ulrich WOLF
Programme Specialist SC/IOC Tsunami Office
1 Rue Miollis 75732 Paris CEDEX 15
Tel: +33 1 45 68 39 29, Fax: +33 1 45 68 58 10
Email: u.wolf@unesco.org

OBSERVERS

Col Shem AMADI
Director, Regional Disaster Management Centre
P.O. Box Nbi, Nairobi, Kenya
Tel: +254-20-4343083
Fax: +254-20-4343072
Email: amadi@rdmcoe.org

Mr Edward AMONI
Senior Meteorologist
Kenya Meteorological Department
P.O. Box 30259, Nairobi, Kenya
Tel: +254-20-3867880
Email: amoni@meteo.go.ke

Mr Ranjith GEORGE
NOAA-IOTWS Tsunami Notification Program Coordinator
No. 14, 2nd Main Rd, Sankey Rd
Sadashivanagar, Bangalore 560003, India
Tel: +91-80-66281700; Fax: +91-80-41123882
Email: ranjithgeorge@noaa.gov

Dr Ouma GILBERT
Meteorologist, ICPAC
Dagoretti Corner, Nairobi Box 10304
Kenya

Tel: 254-020-3878340, Fax: 254-020-3878343
Email: gouma@icpac.net

Ms Gladys KIANJI
Seismologist, University of Nairobi
P.O. Box 30197 00100 Nairobi
Kenya
Tel: 254-20-4449004, Fax: +254 020 4449539
Email: kianji@yahoo.com; kianji@uoubi.ac.ke

Mr Jonathan MTURI
Chairman
Kenya Railways Corporation
P.O. Box 88471
Mombasa, Kenya

Mr Ali MOHAMED
NEPAD Coastal & Marine Secretariat
P.O. Box 46270
Nairobi, Kenya
Tel: +254-20-2733735
Fax: +254-20-2733725
Email: ali@nepadkenya.org

Mr Humphrey MWASHUKE
Senior Safety Officer
Kenya Ports Authority
P.O. Box 95609
Mombasa, Kenya

Mr David MWARUMA
Senior Meteorologist
Kenya Meteorological Department
P.O. Box 98512, Mombasa 80100
Kenya
Tel: +254-41-3433789
Email: dmwaruma@yahoo.com

Ms Julie NJERI
Kenya Tourist Board
P.O. Box 30630-00100
Nairobi, Kenya
Email: julie@kenyatourism.org

Ms Cathryn PRIMROSE
Senior Oceanographer
Fugro Oceanor AS,
Pir-Senteret Trondheim
Norway N-7462
Tel: 47 7354 5211, Fax: 47 7354 5201
Email: c.primrose@oceanor.com

Mr Kennedy SHIKAMI
Senior Fisheries Officer
Fisheries Dept.
Mombasa, Kenya
Tel: +254-41-90423
Email: shikamik@gmail.com

Mr Johnson TYCHSEN
Director, GEUS
10 OESTERVOLDGADE
Copenhagen 1350
Denmark
Tel: +45 3814 2152
Fax: +45 3814 2050
Email: johntychsen@yahoo.com

LOCAL STAFF

Ms Alice KAZUNGU
Administrative Assistant, KMFRI, P.O. BOX 81651, Mombasa, Kenya
Tel: (041) 475157
Email: akazungu@knmfi.co.ke

Mr Liston KIMBIO
Office Assistant, KMFRI, P.O. BOX 81651, Mombasa , Kenya, Tel: +(041) 475157
Email: akazungu@kmfri.co.ke

Ms Hellen LUVISIA
Secretary, Kenya Meteorological Department,
P.O. Box 30250, Nairobi, Kenya
Tel: +254-20-3867880, Fax: +254-20-3876955

Mr Julius MAJISU
Driver, Kenya Meteorological Department,
P.O. Box 30250, Nairobi, Kenya
Tel: +254-20-3867880, Fax: +254-20-3876955

Mr Hesbon MUKONO
Driver, Kenya Meteorological Department,
P.O. Box 30250, Nairobi, Kenya
Tel: +254-20-3867880, Fax: +254-20-3876955

Ms Gertrude MURIUKI
Engineer, Kenya Meteorological Department,
P.O. Box 30259, Nairobi, Kenya
Tel: +254-20-3867880,
Fax: +254-20-3876955

ANNEX XIII

LIST OF ACRONYMS

ADPC	Asian Disaster Preparedness Center
AFTN	Aeronautical Fixed Telecommunications Network
ASEAN	Association of Southeast Asian Nations
ATWS	Australian Tsunami Warning System
AUD	Australian Dollars
BMG	Badan Meteorologi and Geofisika (Indonesian Bureau of Meteorology)
CB	Capacity Building
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
CLIVAR	Climate Variability and Predictability
DART	Deep Ocean Assessment & Reporting of Tsunamis
EMWIN	Emergency Managers Weather Information Network
EU	European Union
FDSN	Federation of Digital Broadband Seismograph Networks
GA	Geoscience Australia
GDPFS	Global Data-Processing Meteorological Centre
GEOSS	Global Earth Observation System of Systems
GLOSS	Global sea Level Observing System
GMDSS	Global Maritime Distress & Safety System
GOOS	Global Ocean Observing System
GOS	Global Observing System
GTS	Global Telecommunication System
ICG	Intergovernmental Coordination Group
ICG/IOTWS	Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning & Mitigation System
ICG-I	Intergovernmental Coordination Group Meeting I – Perth, August 2005
ICG-II	Intergovernmental Coordination Group Meeting II – Hyderabad, December 2005
ICG-III	Intergovernmental Coordination Group Meeting III – Bali, July 2006
ICG-IV	Intergovernmental Coordination Group Meeting IV – Mombasa, February 2007
ICG/PTWS	International Coordination Group for the Pacific Tsunami Warning System
IFRC	International Federation of Red Cross & Red Crescent Societies
IMO	International Maritime Organization
IO	Indian Ocean
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOGOOS	Indian Ocean GOOS
IOTWS	Indian Ocean Tsunami Warning System
ISDR	International Strategy for Disaster Reduction
ITIC	International Tsunami Information Center (IOC/UNESCO)
ITU	International Telecommunications Union
JMA	Japan Meteorological Agency
JTIC	Jakarta Tsunami Information Centre (IOC/UNESCO)

LIPI	Indonesian Institute of Sciences
NHK	Japan Broadcasting Corporation
NMC	National Meteorological Centre
NMHSs	National Meteorological & Hydrological Services
NRSA	National Remote Sensing Agency, India
NTWC	National Tsunami Warning Centre
OCHA	Office for the Coordination of Humanitarian Affairs
PPEW	Platform for the Promotion of Early Warning
PTWC	Pacific Tsunami Warning System
RMSCs	Regional Specialized Meteorological Centre
RTIC	Regional Tsunami Information Centre
RTH	Regional Telecommunication Hub
RTWP	Regional Tsunami Watch Provider
TEWS	Tsunami Early Warning System
TIC	Tsunami Information Centre
TWI	Tsunami Watch Information
TWS	Tsunami Warning System
UN	United Nations
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic & Social Commission for Asia & the Pacific
UNESCO	United Nations Educational, Scientific & Cultural Organization
UNGA	United Nations General Assembly
UNU-EHS	United Nations University, Institute for Environment and Human Security
WAPMERR	World Agency of Planetary Monitoring & Earthquake Risk Reduction
WG	Working Group
WMC	Word Meteorological Centre
WMO	World Meteorological Organization

In this Series *Languages*

Reports of Governing and Major Subsidiary Bodies, which was initiated at the beginning of 1984, the reports of the following meetings have already been issued:

1.	Eleventh Session of the Working Committee on international Oceanographic Data Exchange	E, F, S, R
2.	Seventeenth Session of the Executive Council	E , F, S, R,Ar
3.	Fourth Session of the Working Committee for Training, Education and Mutual Assistance	E, F, S, R
4.	Fifth Session of the Working Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S, R
5.	First Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions	E, F, S
6.	Third Session of the *ad hoc* Task team to Study the Implications, for the Commission, of the UN Convention on the Law of the Sea and the New Ocean Regime	E, F, S, R
7.	First Session of the Programme Group on Ocean Processes and Climate	E, F, S, R
8.	Eighteenth Session of the Executive Council	E, F, S, R, Ar
9.	Thirteenth Session of the Assembly	E, F, S, R, Ar
10.	Tenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific	
11.	Nineteenth Session of the Executive Council, Paris, 1986	E, F, S, R, Ar
12.	Sixth Session of the IOC Scientific Committee for the Global Investigation of Pollution in the Marine Environment	E, F, S
13.	Twelfth Session of the IOC Working Committee on International Oceanographic Data Exchange	E, F, S, R
14.	Second Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Havana, 1986	E, F, S
15.	First Session of the IOC Regional Committee for the Central Eastern Atlantic, Praia, 1987	E, F, S
16.	Second Session of the IOC Programme Group on Ocean Processes and Climate	E, F, S
17.	Twentieth Session of the Executive Council, Paris, 1987	E, F, S, R, Ar
18.	Fourteenth Session of the Assembly, Paris, 1987	E, F, S, R, Ar
19.	Fifth Session of the IOC Regional Committee for the Southern Ocean	E, F, S, R
20.	Eleventh Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Beijing, 1987	E, F, S, R
21.	Second Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Arusha, 1987	E, F
22.	Fourth Session of the IOC Regional Committee for the Western Pacific, Bangkok, 1987	E only
23.	Twenty-first Session of the Executive Council, Paris, 1988	E, F, S, R
24.	Twenty-second Session of the Executive Council, Paris, 1989	E, F, S, R
25.	Fifteenth Session of the Assembly, Paris, 1989	E, F, S, R
26.	Third Session of the IOC Committee on Ocean Processes and Climate, Paris, 1989	E, F, S, R
27.	Twelfth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Novosibirski, 1989	E, F, S, R
28.	Third Session of the Sub-Commission for the Caribbean and Adjacent Regions, Caracas, 1989	E, S
29.	First Session of the IOC Sub-Commission for the Western Pacific, Hangzhou, 1990	E only
30.	Fifth Session of the IOC Regional Committee for the Western Pacific, Hangzhou, 1990	E only
31.	Twenty-third Session of the Executive Council, Paris, 1990	E, F, S, R
32.	Thirteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, New York, 1990	E only
33.	Seventh Session of the IOC Committee for the Global Investigation of Pollution in the Marine Environment, Paris, 1991	E, F, S, R
34.	Fifth Session of the IOC Committee for Training, Education and Mutual Assistance in Marine Sciences, Paris, 1991	E, F, S, R
35.	Fourth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1991	E, F, S, R
36.	Twenty-fourth Session of the Executive Council, Paris, 1991	E, F, S, R
37.	Sixteenth Session of the Assembly, Paris, 1991	E, F, S, R, Ar
38.	Thirteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Baja California, 1991	E, F, S, R
39.	Second Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1992	E only
40.	Twenty-fifth Session of the Executive Council, Paris, 1992	E, F, S, R
41.	Fifth Session of the IOC Committee on Ocean Processes and Climate, Paris, 1992	E, F, S, R
42.	Second Session of the IOC Regional Committee for the Central Eastern Atlantic, Lagos, 1990	E, F
43.	First Session of the Joint IOC-UNEP Intergovernmental Panel for the Global Investigation of Pollution in the Marine Environment, Paris, 1992	E, F, S, R
44.	First Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1992	E, F, S
45.	Fourteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Paris, 1992	E, F, S, R
46.	Third Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Vascoas, 1992	E, F
47.	Second Session of the IOC Sub-Commission for the Western Pacific, Bangkok, 1993	E only
48.	Fourth Session of the IOC Sub-Cornmission for the Caribbean and Adjacent Regions, Veracruz, 1992	E, S
49.	Third Session of the IOC Regional Committee for the Central Eastern Atlantic, Dakar, 1993	E, F
50.	First Session of the IOC Committee for the Global Ocean Observing System, Paris, 1993	E, F, S, R
51.	Twenty-sixth Session of the Executive Council, Paris, 1993	E, F, S, R
52.	Seventeenth Session of the Assembly, Paris, 1993	E, F, S, R
53.	Fourteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Tokyo, 1993	E, F, S, R
54.	Second Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1993	E, F, S
55.	Twenty-seventh Session of the Executive Council, Paris, 1994	E, F, S, R
56.	First Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Melbourne, 1994	E, F, S, R
57.	Eighth Session of the IOC-UNEP-IMO Committee for the Global Investigation of Pollution in the Marine Environment, San José, Costa Rica, 1994	E, F, S
58.	Twenty-eighth Session of the Executive Council, Paris, 1995	E, F, S, R
59.	Eighteenth Session of the Assembly, Paris, 1995	E, F, S, R
60.	Second Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E, F, S, R

CONTINUED ON INSIDE OF BACK COVER

61.	Third Session of the IOC-WMO Intergovernmental WOCE Panel, Paris, 1995	E only
62.	Fifteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Papetee, 1995	E, F, S, R
63.	Third Session of the IOC-FAO Intergovernmental Panel on Harmful Algal Blooms, Paris, 1995	E, F, S
64.	Fifteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange	E, F, S, R
65.	Second Planning Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1995	E only
66.	Third Session of the IOC Sub-Commission for the Western Pacific, Tokyo, 1996	E only
67.	Fifth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, Christ Church, 1995	E, S
68.	Intergovernmental Meeting on the IOC Black Sea Regional Programme in Marine Sciences and Services	E, R
69.	Fourth Session of the IOC Regional Committee for the Central Eastern Atlantic, Las Palmas, 1995	E, F, S
70.	Twenty-ninth Session of the Executive Council, Paris, 1996	E, F, S, R
71.	Sixth Session for the IOC Regional Committee for the Southern Ocean and the First Southern Ocean Forum, Bremerhaven, 1996	E, F, S,
72.	IOC Black Sea Regional Committee, First Session, Varna, 1996	E, R
73.	IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Fourth Session, Mombasa, 1997	E, F
74.	Nineteenth Session of the Assembly, Paris, 1997	E, F, S, R
75.	Third Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1997	E, F, S, R
76.	Thirtieth Session of the Executive Council, Paris, 1997	E, F, S, R
77.	Second Session of the IOC Regional Committee for the Central Indian Ocean, Goa, 1996	E only
78.	Sixteenth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific, Lima, 1997	E, F, S, R
79.	Thirty-first Session of the Executive Council, Paris, 1998	E, F, S, R
80.	Thirty-second Session of the Executive Council, Paris, 1999	E, F, S, R
81.	Second Session of the IOC Black Sea Regional Committee, Istanbul, 1999	E only
82.	Twentieth Session of the Assembly, Paris, 1999	E, F, S, R
83.	Fourth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 1999	E, F, S, R
84.	Seventeenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Seoul, 1999	E, F, S, R
85.	Fourth Session of the IOC Sub-Commission for the Western Pacific, Seoul, 1999	E only
86.	Thirty-third Session of the Executive Council, Paris, 2000	E, F, S, R
87.	Thirty-fourth Session of the Executive Council, Paris, 2001	E, F, S, R
88.	Extraordinary Session of the Executive Council, Paris, 2001	E, F, S, R
89.	Sixth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions, San José, 1999	E only
90.	Twenty-first Session of the Assembly, Paris, 2001	E, F, S, R
91.	Thirty-fifth Session of the Executive Council, Paris, 2002	E, F, S, R
92.	Sixteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Lisbon, 2000	E, F, S, R
93.	Eighteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Cartagena, 2001	E, F, S, R
94.	Fifth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2001	E, F, S, R
95.	Seventh Session of the IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE), Mexico, 2002	E, S
96.	Fifth Session of the IOC Sub-Commission for the Western Pacific, Australia, 2002	E only
97.	Thirty-sixth Session of the Executive Council, Paris, 2003	E, F, S, R
98.	Twenty-second Session of the Assembly, Paris, 2003	E, F, S, R
99.	Fifth Session of the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean, Kenya, 2002 (* Executive Summary available separately in E, F, S & R)	E*
100.	Sixth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, St. Petersburg (USA), 2002 (* Executive Summary available separately in E, F, S & R)	E*
101.	Seventeenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Paris, 2003 (* Executive Summary available separately in E, F, S & R)	E*
102.	Sixth Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2003 (* Executive Summary available separately in E, F, S & R)	E*
103.	Nineteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Wellington, New Zealand, 2003 (* Executive Summary available separately in E, F, S & R)	E*
104.	Third Session of the IOC Regional Committee for the Central Indian Ocean, Tehran, Islamic Republic of Iran, 21-23 February 2000	E only
105.	Thirty-seventh Session of the Executive Council, Paris, 2004	E, F, S, R
106.	Seventh Session of the IOC-WMO-UNEP Committee for the Global Ocean Observing System, Paris, 2005 (* Executive Summary available separately in E, F, S & R); and Extraordinary Session, Paris, 20 June 2005	E*
107.	First Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Perth, Australia, 3–5 August 2005	E only
108.	Twentieth Session of the Intergovernmental Coordination Group for the Tsunami Warning System in the Pacific, Viña del Mar, Chile, 3–7 October 2005 (* Executive Summary available separately in E, F, S & R)	E*
109.	Twenty-Third Session of the Assembly, Paris, 21–30 June 2005	E, F, S, R
110.	First Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Rome, Italy, 21–22 November 2005	E only
111.	Eighth Session of the IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE), Recife, Brazil, 14–17 April 2004 (* Executive Summary available separately in E, F, S & R)	E*
112.	First Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions (ICG/CARIBE-EWS), Bridgetown, Barbados, 10–12 January 2006	E only
113.	Ninth Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), Cartagena de Indias, Colombia, 19–22 April 2006 (* Executive Summary available separately in E, F, S & R)	E S*

114.	Second Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Hyderabad, India, 14–16 December 2005	E only
115.	Second Session of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology, Halifax, Canada, 19–27 September 2005 (Abridged final report with resolutions and recommendations)	E, F, R, S
116.	Sixth Session of the IOC Regional Committee for the Western Indian Ocean (IOCWIO), Maputo, Mozambique, 2–4 November 2005 (* Executive Summary available separately in E, F, S & R)	E*
117.	Fourth Session of the IOC Regional Committee for the Central Indian Ocean, Colombo, Sri Lanka 8–10 December 2005 (* Executive Summary available separately in E, F, S & R)	E*
118.	Thirty-eighth Session of the Executive Council, Paris, 20 June 2005 (Electronic copy only)	E, F, R, S
119.	Thirty-ninth Session of the Executive Council, Paris, 21–28 June 2006	E, F, R, S
120.	Third Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Bali, Indonesia, 31 July–2 August 2006 (*Executive Summary available separately in E,F,S & R)	E*
121.	Second Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Nice, France, 22–24 May 2006	E only
122.	Seventh Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 16–18 March 2005 (* Executive Summary available separately in E, F, S & R)	E*
123.	Fourth Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS-IV), Mombassa, Kenya, 30 February-2 March 2007 (* Executive Summary available separately in E, F, S & R)	E*