



International Coordination Group for the Tsunami Warning System in the Pacific

Twentieth Session

Viña del Mar, Chile

3–7 October 2005

Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

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Abstract

The Twentieth Session of the International Coordination Group for the Tsunami Warning System in the Pacific was held in Viña del Mar, Chile, 3–7 October 2005 under the Chairmanship of Dr François Schindelé. It was attended by 44 participants from twenty ICG/ITSU Member States, six organizations, and three observers. The Session reviewed progress made during the inter-sessional period 2003–2005 and drafted its work plan for the period 2006–2007. This work plan will focus on (i) continued support for the International Tsunami Information Centre (ITIC); (ii) planning, conduct and assessment of a Pacific-wide Tsunami Warning exercise in May 2006; (iii) support for ICG/ITSU participation in the ICG/IOTWS inter-sessional Working Groups established at ICG/IOTWS-1; (iv) completion and assessment of the Assessment Questionnaire for ICG/ITSU Member States; (v) completion of the Integrated Tsunami Data Base (ITDB); (vi) support for development of the TsunamiTeacher – translations into French and Spanish; and (vii) support for the Working Group on the Central American Pacific Coast Tsunami Warning System (CAPC-TWS). The Group requested a budget of US\$ 180,000 for the biennium 2006–2007 to accomplish the work plan; noted that only \$64,000 is presently funded, and that Member States will provide approximately \$1,290,000 in Extra-budgetary Support. The Group decided to rename the “International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU)” to the “Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)” to align its name with the other tsunami warning and mitigation systems and their governing bodies established under the auspices of the IOC; to revise the Terms of Reference for the ICG/ITSU to align them with the approaches adopted for other tsunami warning and mitigation systems and accommodate the unique role of the ITIC; to designate that the IOC’s ITIC shall assume the role of Secretariat for the ICG/PTWS, that the Director and Associate Director of ITIC also officially hold the titles of the Director and Associate Director of the IOC Secretariat for the ICG/PTWS, and serve as ex-officio office holders of the ICG/PTWS along with the past-Chair of the ICG/PTWS. The Group also decided to form inter-sessional working groups on (i) seismic measurements, data collection and exchange; (ii) sea-level measurements, data collection and exchange; (iii) tsunami hazard identification and characterization, including modelling, prediction and scenario development; (iv) resilience building and emergency management; and (v) interoperability of regional, sub-regional and national Tsunami Warning and Mitigation Systems in the Pacific. The Group further decided to (i) establish an inter-sessional working group on the medium term strategy for the Pacific Tsunami Warning and Mitigation System; (ii) recommend that an end-to-end tsunami exercise be carried out for the Pacific Ocean during the second week of May 2006 and form a task team to design and carry out the exercise; and (iii) recommend GLOSS explore the possibilities of using the international channels of the global Geostationary Meteorology Satellite system and request WMO to allow the use of the GTS to transmit sea-level data from GLOSS multiple purpose sea-level stations to regional, sub-regional and national tsunami warning centres. The Group thanked Dr François Schindelé and Dr Charles McCreery for having served six years in the positions of Chairman and Vice-Chairman of ITSU, respectively. Capt. Rodrigo Nuñez (Chile) and Mr Fred Stephenson (Canada) were elected as Chairman and Vice-Chairman respectively by the Group. The Group decided to organize its Twenty-first Session in 2006, planned for the last week of April and accepted the offer of Australia to host the Twenty-first Session. The Group also recommended that on the occasion of the next election of officers, to elect two Vice-Chairpersons, following the example of ICG/IOTWS.

(SC-2006/WS/8)

* An executive summary of this report is also available in English, French, Russian and Spanish.

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1. OPENING

1 The Twentieth Session of the International Coordination Group for the Tsunami Warning System in the Pacific was held in Viña del Mar, Chile, from 3 to 7 October 2005 under the Chairmanship of Dr François Schindelé.

2 The Group was addressed by the Mayor of Viña del Mar, Ms Virginia Reginato. In her opening address Ms Reginato recalled the big loss and sad images that were seen around the world caused by the Indian Ocean tsunami of 26 December 2004. On that occasion nature had shown its most cruel and rough side to which the world could not be indifferent and from which lessons had to be learnt. The lesson was the need for prevention and preparation of our communities in order to act efficiently in an emergency situation. She stated that we cannot avoid natural phenomena but we can mitigate its effects. To do this, education, information and simulation exercises are fundamental, as well as training for professionals. Ms Reginato informed the Group that Viña del Mar had approached this matter properly and without being alarmists. She said that Viña del Mar is the only city in Chile that has internationally approved signs for tsunami events. In addition, the Viña del Mar City Hall has a prevention plan for tsunami alerts and works with students and the community providing information. This is made possible thanks to the consciousness of being a coastal city. The Mayor thanked the Naval Hydrographic and Oceanographic Service, SHOA and the National Emergency Office, for their permanent support. Ms Reginato explained that City Hall and SHOA have worked together to create a new consciousness about these matters in the community. Ms Reginato closed by expressing the hope that the Meeting would be very profitable, with the exchange of ideas, experiences and work methodologies.

3 The full version of Ms Reginato's speech is available in [Annex III](#).

4 Then Capt. Roberto Garnham, Director of SHOA welcomed the Group. The full version of Capt. Garnham's speech is available in [Annex III](#).

5 Mr Peter Pissierssens, Head, Ocean Services IOC, speaking on behalf of Dr Patricio Bernal, IOC Executive Secretary, thanked the Government of Chile for the excellent facilities and additional support provided for this Session. Mr Pissierssens recalled that the ICG/ITSU had been established 40 years ago. During that period the Pacific Tsunami Warning System (PTWS) had grown into a family of 28 countries. He recalled that the objectives of the PTWS was to build national capacity to (i) assess national tsunami risk (hazard assessment); (ii) establish national/regional warning centres against local/regional/basinwide tsunamis (warning guidance); and (iii) promote education/preparedness and risk reduction against tsunami hazard (mitigation and public awareness). During the past 40 years the participating countries have built up substantial expertise and experience. Thankfully, we did not have to put this expertise and experience into practice, that is, until the Indian Ocean tsunami of 26 December 2004, when a powerful tsunami in the neighbouring Indian Ocean caused the deaths of over 200,000 people. Taking into consideration the experience of the IOC in the Pacific Region through its ICG/ITSU, the countries of the region had requested IOC to take the lead of the UN efforts in the establishment of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS). Mr Pissierssens thanked the many experts who contributed to the effort of building the IOTWS, either through participating in the post-tsunami field surveys, in the many meetings that have taken place during the past 9 months, or through participation in national tsunami assessment missions. The importance of an effective tsunami warning system, as well as population preparedness has been demonstrated clearly and stated that this might be the right occasion to assess whether the tsunami warning and mitigation system established through the ICG/ITSU is

indeed end-to-end to the “last mile” and operational in all countries of the region. He further noted that the experience during the past 9 months in building the IOTWS had also provided valuable lessons in inter-agency cooperation. In this regard he invited the ICG/ITSU to consider utilizing the same model involving IOC, WMO and ISDR. Finally, he called for the ICG/ITSU to develop a medium-term strategy, taking into consideration the new global situation that followed the Indian Ocean tsunami of 26 December 2004.

6 Dr François Schindelé, Chair ICG/ITSU, addressed the Group. Dr Schindelé thanked the Government of Chile for hosting this Twentieth Session. He expressed his appreciation for the fact that this Session was attended by 20 of the 28 ITSU Member States, and several organizations. He explained that this Session was special for several reasons: the ICG/ITSU had been established four decades ago, and secondly, the world had been shocked by the images of the devastating tsunami that occurred in the Indian Ocean tsunami of 26 December 2004. Whereas few people knew what a tsunami was before that date, most people in the world now have a basic knowledge and awareness of the event. Dr Schindelé also recalled the story of the little girl who, because she had just learned about tsunamis in school, had been able to save hundreds of people of her village when she saw the sea withdrawing just prior to the tsunami hitting the shore. This proved that mitigation based on education works. He further noted that the IOC and tsunami experts who had been involved in ICG/ITSU for many years were called upon to assist with the development of the IOTWS. Dr Schindelé closed by inviting the participants to actively participate in the Session during this important event.

7 **The Group observed** one minute of silence to commemorate the victims of the Indian Ocean tsunami of 26 December 2004.

2. ORGANIZATION OF THE SESSION

2.1 ADOPTION OF THE AGENDA

8 **The Group adopted** the Agenda ([Annex I](#), hereto) and Timetable (Doc. IOC/ITSU-XX/1 add. rev.).

2.2 DESIGNATION OF RAPPORTEUR

9 **The Group decided** that there was no need to designate a Rapporteur and **agreed** that input to the Summary Report of the Session, to be adopted under Agenda item 15 will be the responsibility of the Chairman, Vice-Chairman, Technical Secretary and participants introducing an Agenda item.

2.3 SESSION TIMETABLE AND DOCUMENTATION

10 The Technical Secretary, Mr Peter Pissierssens, introduced the session’s Timetable (Doc. IOC/ITSU-XX/1 Add.Rev.) and Provisional List of Documents (Doc. IOC/ITSU-XX/4 Prov.), attached as [Annex V](#). He apologized that documentation had been provided quite late, explaining that the heavy workload due to the Indian Ocean tsunami follow-up had left very little time for the ITSU-XX preparations. In addition, he explained, that the IOC-XXIII in June 2005, the ICG/IOTWS-I (August 2005) and the JCOMM-II (September 2005) had made decisions that would have an impact on ITSU’s work and therefore had to be taken into consideration in the ITSU-XX Agenda. He reported that all working documents had been posted on the ITSU web site (<http://ioc.unesco.org/itsu>) for consultation and downloading. He called on the participants to

carefully read the ITSU-XX Annotated Agenda (Doc. IOC/ITSU-XX/2 Prov. Rev.) as this document would provide the necessary guidance for discussions during the Session.

11 The List of Participants is presented in [Annex VI](#).

2.4 LOCAL ARRANGEMENTS

12 The Chair of the Local Organizing Committee, Lt. John Fleming informed the participants on local arrangements.

2.5 ESTABLISHMENT OF SESSIONAL WORKING GROUPS

13 **The Group established** three intra-sessional working groups to work on (i) Programme and Budget 2006–2007 under Agenda item 12 (Chaired by Canada); (ii) ITSU Strategic Planning and Governance under Agenda item 4.1 (Chaired by Australia); and (iii) Planning and Terms of Reference of a Pacific-wide Tsunami Drill under Agenda item 4.5 (Chaired by the PTWC Director, Dr Charles McCreery).

3. PROGRESS IN THE PROGRAMME IMPLEMENTATION

3.1 REPORT OF THE CHAIRMAN ON INTER-SESSIONAL ACTIVITIES

14 The Chairman, Dr François Schindelé introduced this item referring to Document IOC/ITSU-XX/6 (Report of the Chairman) and reported on the inter-sessional activities of the ICG/ITSU focusing on the significant improvement in the programme.

15 In his report the Chairman noted that the activities related to the establishment of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS) had occupied most of the Officers and Secretariat's time. Nevertheless, several ITSU documents such as the 'Communications Plan of the Tsunami Warning System in the Pacific', and the English version of the 'Great Waves' had been updated. In order to assist in the establishment of the IOTWS, the Chair informed that France had assisted IOC by offering his part-time secondment for a period of six months.

16 The Chairman noted that during the inter-sessional period, three Member States had joined the ICG/ITSU, bringing the total number of Member States to 28. El Salvador joined the ICG/ITSU in 2003 and Malaysia and Viet Nam joined the ICG/ITSU in 2005. Panama has mentioned its interest to join the Group.

17 The Chairman listed the substantial number of meetings that he attended during the inter-sessional period. IOC had been invited by Mr M. Jarraud, WMO Secretary-General, to participate in a press conference organized by WMO on disaster risk reduction through early warning. Dr Schindelé presented the IOC activities on that issue, and responded to questions from the press (5 January 2005, Palais des Nations, Geneva).

18 The Chairman participated in the JCOMM Management Committee (9–12 February 2005, Paris) presenting the status report of the ICG/ITSU activities and described the strategy of a tsunami warning system. He focused on the role of GLOSS as a global sea-level network for a tsunami monitoring and warning system. One of the conclusions of this meeting, in addition to the cooperation between WMO and IOC, was that future tsunami warning systems must be developed as part of a more comprehensive natural marine hazards warning system, encompassing storm surges, tropical cyclones extreme waves, etc.

- 19 The Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) invited the ITSU Chairman to the plenary session of its Working Group B (21 February 2005, Vienna, Austria). The ITSU Chair presented a keynote lecture and provided information on the ICG/ITSU, the characteristics of the tsunami phenomena and the strategy of the Pacific Tsunami Warning System. As a result, the CTBTO offered to send to PTWC and NWPTAC data of seismological and hydroacoustic stations to improve the speed of detecting major earthquakes in the Pacific and in the Indian Ocean.
- 20 At the Ninth Session of the Group of Experts for GLOSS (24–25 February 2005, Paris), the Chairman presented the need for a comprehensive global real-time sea-level network that can detect and monitor tsunamis, in particular in the Indian Ocean. Dr François Schindelé and Dr Mark Merrifield introduced the discussion on ITSU-GLOSS coordination. The principal question was whether GLOSS could and should evolve in the direction of providing tsunami and storm-surge warning capabilities, based essentially on existing sea-level monitoring capabilities. The Session adopted a Communiqué concerning the contribution by GLOSS and its core network of sea-level stations to tsunami and multi-hazard warning systems, that says
- “...GLOSS is interested in making the operational capability of its Core Network available as a basic element of GEOSS, especially to meet the needs for disaster reduction. In so doing, GLOSS can contribute to the realization of effective tsunami warning systems in the Indian Ocean, Caribbean and Mediterranean Seas, and other regions of the world, as an integral part of a multi-hazard aspect of GEOSS. In this context, GLOSS is prepared to work with the International Coordinating Group for the Pacific Tsunami Warning System (ICG/PTWS) and others as appropriate—as the capability for tsunami warning expands to the globe—to define requirements for new GLOSS stations and/or upgrades to existing GLOSS stations”.*
- Dr Schindelé stated that the operation and maintenance part of the GLOSS network in the Pacific must be coordinated by ITSU and GLOSS, through IOC.
- 21 The Chairman further participated in the First and Second coordination meetings for the development of a Tsunami Warning and Mitigation System for the Indian Ocean, held at UNESCO’s Paris Headquarters from 3 to 8 March 2005, and Grand-Baie, Mauritius between 14 and 16 April 2005, respectively. At, or immediately after the Mauritius meeting, eighteen countries requested IOC to organize national tsunami assessment missions. Sixteen missions were implemented between May and August 2005. The Officers (ITSU Chairman, Vice-Chairman and ITIC Director) as well as Mr Masahiro Yamamoto from JMA were the tsunami technical experts in the team consisting of experts from ISDR, WMO, and IOC.
- 22 During the Sixth Session of WESTPAC (23–25 May 2005, Nha Trang, Viet Nam), a special ITSU Session was organized, in response to WESTPAC’s request. The ITSU Chairman presented a short report on the ITSU activities at that meeting.
- 23 During the IGOS Geohazards Workshop (27–29 June 2005, Orléans, France) the Chairman presented the IOC Tsunami Warning and Mitigation Programme and its status in the Pacific and Indian Ocean. The IGOS (Integrated Global Observing Strategy) is an international partnership established in June 1998, which brings together a number of international organizations concerned with the observational component of global environment issues, from both a research and operational perspective). The Chairman participated in the Science Working Group Session and presented the needs on geological research about the major earthquakes to assess the tsunami hazard.

24 The Chairman also participated in the Twenty-third Session of the IOC Assembly (21–30 June 2005, UNESCO Headquarters, Paris) where several important resolutions had been adopted related to regional tsunami warning and mitigation systems in the Indian Ocean, Caribbean and adjacent regions, and the Northeast Atlantic and Mediterranean region, and also considered the need of a global framework. With regard to the development of a Northeast Atlantic and Mediterranean region system, the Chairman had also participated in several meetings organized by the European Commission and France.

25 During the IAEA International Workshop on External Flooding Hazards at Nuclear Power Plant Sites (29 August to 2 September 2005, Kalpakkam, India) the Chairman presented a keynote lecture on the UNESCO/IOC Tsunami Warning and Mitigation Programme and its status in the Pacific and Indian Ocean. Dr Schindel  participated in the panels ‘Methodologies and Techniques for Tsunami Hazard Assessment’ and ‘Tsunami Warning Systems and NPP (Nuclear Power Plants) Operational Safety’.

26 In his concluding remarks, Dr Schindel  stressed that several main issues related to the improvement of the PTWS should be discussed during the current Session and decisions taken:

- after a large or major earthquake, how long do we accept to wait for the confirmation that a tsunami has been generated and what is its magnitude? Whereas the answer used to be “2 hours”, the Indian Ocean tsunami of 26 December 2004 event and media awareness have made that the accepted maximum is now between ½ hour and 1 hour. Accordingly, the data of the sea-level stations must be sent at least every 20 minutes and the sea-level network must be enhanced in numerous areas, with additional stations, or through upgrading of existing stations, such as those of the GLOSS network. The early detection of major tsunamis must be one of the priorities;
- organizing international tsunami exercises and drafting terms of reference for these exercises: These exercises will help us all to assess our country’s “tsunami readiness” and to improve our systems as necessary.

27 The Chairman urged Member States to actively participate in the activities of the ICG/ITSU. He further noted that possibly by the end of 2006, many governments and authorities will have forgotten about the tsunami danger. IOC, its ICG/ITSU and other intergovernmental groups must accept the responsibility to keep society informed on the tsunami risk and they must continue their efforts to implement and maintain tsunami warning systems, nationally, regionally, and at the global level. This is a challenge, and the experience in the Pacific shows that after 40 years without a Pacific-wide tsunami, several organizations and governments have forgotten that a tsunami can impact their coasts at any time.

28 Based upon his personal experience of 10 years as Vice–Chairman and Chairman of ITSU, Dr Schindel  provided the following recommendations:

- Develop in your country tsunami programmes in accordance with the ITSU Mitigation Strategy (Hazard Assessment, Warning Guidance and Preparedness), improve the efficiency of the National Tsunami Warning Centre, implement a National Tsunami Coordination Committee, and increase cooperation between the government and the stakeholders, including the scientists and the emergency managers;
- Enhance the national sea-level real-time network and make available those data to the PTWS;

- Develop a regional and international cooperation with the same policy;
- Implement recent technologies for tsunami hazard assessment and tsunami warning guidance, as the tsunami forecasting method and the geodetic real-time network, and develop necessary cooperation with relevant national and international organizations;
- Organize national tsunami exercises, conferences, symposiums, workshops, trainings on tsunamis at the national, regional and local level.

29 Australia informed the Group of its decision to invest in a substantial amount of new equipment in both Australia, as well as the Pacific Small Island States to fill the gap in observation capabilities. Australia will also make the collected data available through the PTWS.

30 **The Group congratulated** its Chairman for the continuous attention to the programme's needs and accepted his report on inter-sessional activities. The Chair invited other countries, which currently were not Member States of the IOC and/or the ICG/ITSU to urgently join IOC and ICG/ITSU in order to benefit from the wealth of expertise of the ICG/ITSU, as well as its free products and services.

31 **The Group welcomed** El Salvador (joined in 2003), Malaysia and Viet Nam (joined in 2005) to the ICG/ITSU, bringing the total number of ICG/ITSU Member States to 28.

3.2 NATIONAL REPORTS

32 Through Circular Letter No. 2165 of 25 July 2005, Member States had been invited to this Session and were also requested to submit National Reports not later than 1 September 2005, so as to provide participants sufficient time to read the reports.

33 The Chairman reported that twenty-one (out of 28 ICG/ITSU Member States) national reports had been received and been made available through the IOC/ITSU web site. The Chairman expressed his great satisfaction with the number of reports submitted for this Session, stating that this was the highest number ever. He recalled that format guidelines for the submission of National Reports had been made available through the web site as Document IOC/ITSU-XX/Inf.2. He insisted on the importance of knowledge of the occurrence of tsunamis, not only just the damage causing tsunamis. Tsunami Centre operators and scientists need to know where the last tsunamis were recorded and who archives these records.

34 The Chairman further recalled that ITSU-XIX had urged (para. 51) all Member States to add information on tsunami occurrences and observations on sea-level stations to national reports. Through para. 53, ITSU-XIX had requested all Member States to provide, by the end of 2003, a summary (10-15 lines) of their national reports for publication in the *ITSU Newsletter* in early 2004. Dr Laura Kong will inform the Group whether these requests were responded to by the Member States.

35 During their December 2004 meeting, the Officers had decided to (i) continue the publication of event information in the Newsletter on an "as it comes in" basis; and (ii) maintain a compilation of events by year, as well as additional information that was not published in the Newsletter, in the web site. Inclusion of national reports in the annual Newsletter would therefore be discontinued.

36 The Chairman requested Member States to provide brief statements, as necessary, on important issues, proposals to improve the TWSP and national needs.

- 37 Australia informed the Session that its Tsunami Alert System is operated by three Government agencies: the Bureau of Meteorology, Geoscience Australia and Emergency Management Australia. Since the tragic Indian Ocean tsunami of 26 December 2004, Australia is upgrading this system to full warning capability. This will include extensions of networks of seismic and sea-level instruments in the Indian and Pacific Oceans, with a strong network in the South West Pacific in particular. Australia will share all these data with countries in both oceans. Current sea level stations will also be upgraded to real-time reporting and new seismic instruments, and a small number of DART buoys will be deployed in both oceans. These data will be provided to the Pacific Tsunami Warning Centre as part of the strengthening of tsunami warnings in the Pacific Ocean. Australia has also provided funding to the IOC Secretariat in support of its current Regional Programme Office in Perth, Australia. Australia will work closely with all countries in the Pacific, especially the South West Pacific to build capacity for all hazard disaster warnings and mitigation.
- 38 Canada informed the Session that with regard to sea-level network improvements that have occurred since the Indian Ocean tsunami of 26 December 2004, that through a Memorandum of Understanding with the West Coast/Alaska Tsunami Warning Centre (WC/ATWC), GOES platforms are being installed at the three Canadian tsunami warning stations. This will provide WC/ATWC and PTWC with timely access to Canadian water level data. In addition, the Langara Island station is being moved to a nearby location where data analysis has indicated better quality tsunami data will be collected.
- 39 Since the discovery of Episodic Tremor and Slip (ETS) in the Cascadia subduction zone an intensive effort has been underway to record, model and understand this phenomenon. This may lead to identifying windows of enhanced probability for occurrence of large subduction earthquakes. The ETS phenomenon is now being studied at several other subduction zone locations in the Pacific and Indian oceans.
- 40 With regard to GPS Geodetic Real-Time Networks, Canada is installing a prototype network of four stations along the coast of the Canadian segment of the Cascadia subduction zone. The aim is to automatically determine, within minutes, major vertical and horizontal motion at coastal, versus inland GPS stations that would unambiguously indicate tsunami generation. It is hoped that this relatively low-cost technique can become a mainstream tool of tsunami warning systems worldwide.
- 41 Canada is presently implementing a Tsunami Warning System (all hazards) for the Atlantic Coast of Canada. This new warning system is being implemented jointly with the United States and will utilize the WC/ATWC for disseminating Tsunami Warnings.
- 42 Chile reported that the Chilean Tsunami Warning System, controlled by SHOA, is working through appropriate local, regional and international coordination mechanisms. National exercises have been organized in Arica, the first city in implementing an evacuation plan using signs. Signs have also been installed in Viña del Mar. At the international level, exercises have been organized with Peru and Ecuador. These were quite successful and have increased regional cooperation. Also, Chile will soon deploy a second Deep-ocean Assessment and Reporting of Tsunamis (DART) buoy before the end of 2005 or in early 2006, in an area near Concepción Bay. The data provision from Chilean tide gauges was improved this year, by increasing the baud rates of transmission.
- 43 France informed the Session that, since the tragedy of the Indian Ocean tsunami of 26 December 2004, the French Government of Polynesia decided to organize tsunami warning drills to test *in situ*, the tsunami warning plan with local authorities, state administrators,

municipalities, police, fireman, and the coastal population. The goal of these exercises was to identify potential communication problems during the warnings that might occur between the Civil Defense and local authorities. For this exercise, a realistic scenario of tsunami generated by an 8.5 magnitude earthquake located in Chile was chosen, and the CPPT (Centre Polynésien de Prévention des Tsunamis) and the Civil Defense transmitted one message per hour to local authorities, involving practical actions. Also, new communication systems (SMS, GSM, pre-recorded messages) have been tested; but these new means of transmission are very long, and they will not be re-used. Consequently, a new system of warnings are planned to be installed in the very near future. It will be a system of sirens, telemetered by satellite (INMARSAT C) with the central command in the Civil Defense Headquarters. He further reported that Tsunami inundation, following a magnitude 8.0 in the Tonga-Kermadec trench had been calculated for the area of the International Airport of Tahiti. Following these simulations, a warning plan was elaborated by the Air Flight Civil Agency for rerouting planes, the evacuation of the airport, and technical supplies.

44 France further announced that a free software has been developed, with the goal to obtain a robust magnitude (and scalar seismic moment), in case of big earthquakes. This programme just needs seismic in SAC format, and hypocenter coordinates, then it computes the average magnitude with the standard error. It has been tested with more than 100 IRIS stations. This software is a part of the Utility Programmes of STK (Seismic ToolKit) Software. It is freely available (<http://freashmeat.net/projects/seismictoolkit-STK>) (see also Agenda item 5.4).

45 Japan informed the Group that the Japan Meteorological Agency (JMA) issued tsunami warnings and/or advisories nine times from September 2003 to August 2005. On 25 September 2003, an earthquake with the magnitude 8.0 occurred off Kushiro, east Hokkaido. The JMA issued a tsunami warning 6 minutes after the earthquake. The first tsunami arrived on the coasts of Hokkaido in 16 minutes and run-up heights of more than 4 m were observed by a field survey. Two people were killed by the tsunami. In the case of the earthquake, west off Fukuoka Prefecture, on 20 March 2005, the JMA issued a tsunami advisory in 4 minutes and the tsunami bulletin was issued to neighbouring countries at almost the same time. This was the first information to the countries around the Sea between the Asian continent, the Korean Peninsula and the Japanese Archipelago. This service was initiated as a part of the function of the Northwest Tsunami Advisory Centre in 2001. However, in this case no tsunami was observed.

46 The JMA established the Northwest Pacific Tsunami Advisory Centre (NWPTAC) and commenced provision of information as the Northwest Pacific Tsunami Advisory (NWPTA) on 28 March 2005.

47 The JMA also started to provide tsunami advisory information to countries around the Indian Ocean on 31 March 2005 on an interim basis for mitigation of tsunami disasters until full operation of a tsunami early warning system in the Indian Ocean region.

48 The Republic of Korea informed the Group that the Government had decided to expand its activities in the field of earthquake monitoring in order to meet the requirements of the Korean people and, as a result, a new division has been established within the Korea Meteorological Administration (KMA). In addition, the KMA has developed a “one-stop” Earthquake and Tsunami Dissemination System which enables timely sending of warning messages to disaster prevention agencies and mass media through PC communication, fax, e-mail, SMS (short message service) and television, by automatically analyzing the epicenter and magnitude of earthquakes and generating the warning message.

- 49 The Republic of Korea further informed the Group that KMA plans to install one real-time ocean bottom seismometer (in the sea between the Korean peninsula and the Japanese archipelago) and one borehole type seismometer (on Ulleung-Do in that sea) in 2006.
- 50 The Republic of Korea stressed that KMA would share the data collected with other countries once the seismometers have been installed.
- 51 New Zealand informed the Group that the Indian Ocean tsunami of 26 December 2004 had, like elsewhere in the world, placed new emphasis on the issue of tsunami risk and preparedness in New Zealand. The New Zealand Government has recognized the country's vulnerability to tsunamis and subsequently commissioned two important strands of work with the view of reviewing and improving New Zealand's capacities in relation to this risk:
- A report on the risk of tsunami for New Zealand, and New Zealand's preparedness to deal with the risk. This report is currently in a draft format and is due in December 2005;
 - Improvements to the system of sea-level gauges in New Zealand to allow better detection and confirmation of tsunamis through a purpose built tsunami detection and warning system based on seismic stations and strategically placed sea-level gauges. This work is also in progress. The existing network of sea-level gauges is contained in the National Report.
- 52 New Zealand further pointed out that, as the responsible agency for the passing and dissemination of official tsunami warnings, the Ministry of Civil Defence & Emergency Management maintains an established National Warning System. Work is being carried out to improve the effectiveness of this system. This work focuses on better ways to get the alert information to the system, and secondly, on better ways to disseminate warnings to agencies and the public. This work will be completed in the first half of 2006, and should appropriately coincide with the international tsunami exercise that will result from this Session. New Zealand expressed the great interest of his country in participating in the planning of that exercise.
- 53 The Russian Federation explained that tsunami monitoring, prediction and warning for the Pacific coasts of Russia are now provided by the Tsunami Warning System (TWS) centres of ROSHYDROMET in Yuzhno-Sakhalinsk and Petropavlovsk-Kamchatsky. These are working in close cooperation with the regional structures of the Ministry for Emergency Situations and the Ministry for Communications and Information of the Russian Federation, seismic stations of the Geophysical Services of the Russian Academy of Sciences and local hydrometeorological stations of ROSHYDROMET. The Russian TWS centres cooperate efficiently with the TWS centres of other countries. The Russian Tsunami Warning System is an important part of the International Tsunami Warning System for the Pacific (ITSU), operating under the umbrella of the IOC. The Russian subsystem as a whole and the Russian TWS centres are guided by regulations and instructions at the federal and local level.
- 54 The main problem of the existing Tsunami Warning System in Russia is the lack of high-quality digital tsunami recorders. Several recorders should be deployed along the coasts of the Kuril Islands, Kamchatka and the Komandor Islands. Also, it will be quite important to install open-ocean bottom pressure stations offshore from Kamchatka and the Kuril Islands. These stations will be especially important for the region of the Central Kuril Islands, a region with a large seismic gap and a high probability of the next destructive tsunamigenic earthquake (with $M_w = 8.5-8.7$). Another problem to be solved is a widely spaced network of seismic stations and out-of-date instruments that are still used in these stations.

55 Since the destructive Indian Ocean tsunami of 26 December 2004, a programme of measures for the modernization of the National Russian TWS has been developed as part of the federal programme aimed at the reduction of risks and mitigation of the consequences caused by natural disasters. Measures for the improvement of the TWS include: (i) the installation of several broad-band digital seismometers; (ii) introduction of local seismic station networks; (iii) installation of modern pressure gauges for sea-level observations; (iv) reconstruction of tide gauge observation sites; (v) designation of modern technologies for data processing at the TWS Centres; (vi) designation of modern communication means for data exchange; (vii) development of software for the computation of tsunami dynamic characteristics and others. The modernization of the Russian TWS will be an important achievement and will serve to increase the safety of the population along the coasts of the Pacific Ocean as a whole.

56 The United States of America informed the Group that the US National Tsunami Programme is closely linked with the Tsunami Warning Programme for the Pacific, and the US programme has consistently made advances at a measured pace. However, since the Indian Ocean tsunami of 26 December 2004, the US programme, as did others, shifted gears. He described some of the changes:

- staffing increases at both PTWC and WC/ATWC to facilitate a 24x7 presence of duty analysts in their operations centres (analysts currently respond from their nearby quarters or homes during after hours);
- expansion of the WC/ATWC area of responsibility to include the US East and Gulf Coasts and the Atlantic coast of Canada;
- expansion of the PTWC area of responsibility to include, on an interim basis, the Indian Ocean and Caribbean Sea;
- expansion over the next two years of the Pacific network of Deep Ocean Assessment and Reporting of Tsunami (DART) gauges from 6 to 32;
- accelerated development of tsunami forecast models that utilize the coastal and DART data as input;
- enhancements to National Ocean Service (NOS) coastal sea-level gauges to provide one-minute-sampling, and transmissions every six minutes (from six-minute samples transmitted every hour);
- plans and funding for an upgrade of PTWC's local seismic network in Hawaii;
- expansion of the USGS seismic network in the Caribbean;
- increased staffing of ITIC from 1.8 to 4.8 employees;
- additional funding in the amount of US\$ 80K to support tsunami activities in the Pacific and Caribbean. ITIC will use US\$ 45K to support capacity building in the Pacific in Calendar Year 2005;
- an additional US\$ 75K for assessment of needs in the Pacific and Indian Oceans; and
- increased staffing at the NGDC.

57 The United States of America noted that the US National Tsunami Hazard Mitigation Programme efforts continue to meet the goals of the founding recommendations to:

- Produce Inundation Maps;

- Improve Seismic Networks;
- Deploy Tsunami Detection Buoys;
- Develop Hazard Mitigation Programmes;
- Develop State/NOAA Co-ordination and Technical Support.

58 He explained that the National Tsunami Hazard Mitigation Programme (NTHMP) received approximately US\$ 4.3 M in the financial years 2003, 2004 and 2005. Following the Indian Ocean tsunami of 26 December 2004, the NTHMP was expanded from the original five Pacific States to a total of 28 US coastal States, territories and commonwealths. Efforts are underway to incorporate the additional members and develop a governance structure that will accommodate the larger membership.

59 China informed the Group that it had formulated and announced the National Contingency Plan for tsunami, storm surge and sea ice in 2005. This was the first contingency plan for maritime hazards in China.

60 China had enlisted a plan to enhance its technical capability as a national project in the eleventh 5-year plan covering year 2006 to 2010. On the other hand, China is also planning to increase the number of island tide gauge stations, enhance the collection of ocean monitoring data using buoys in the South China Sea, and enhance the communication system for collection of ocean monitoring data.

61 Ecuador explained that the country has developed inundation maps for the most populated coastal cities using the Yamaguchi Method. In early 2004, with the support of the International Tsunami Information Centre, the first digital flood map in Ecuador was produced for the city of Esmeraldas.

62 Ecuador currently receives alerts from the Pacific Tsunami Warning Centre by Internet or by fax, and also has a coordinated system with Peru and Chile to conduct tsunami drills and exercises in the Southeast Pacific. This alert is disseminated to the population using the Navy's capabilities on communication systems with very good results. However, despite the existence of these foreign alert systems, he explained that Ecuador currently did not have a National Tsunami Alert System. The Oceanographic Institute of the Navy is working with the Vulcanology, Geology and Geodynamic Centre of the University San Francisco de Quito to develop a local Tsunami Watch Centre based on early detection of seismic events near the Ecuadorian coast.

63 Ecuador stressed that one of the most important issues that the Oceanographic Institute has been working on is the preparedness of the community to react to a tsunami event. In this regard, a project called 'Educational Awareness Project of Ecuadorian Coastal Areas' has been implemented. Unfortunately, according to assessments made as part of this project, the capacity of the population to react to a tsunami event was not satisfactory. In this regard there is a substantial need to increase and expand the education and awareness of coastal populations with new educational methods, such as Interpretation Centres for Tsunamis.

64 Peru recalled that the last tsunami in his country had taken place in June 2001 in Camana and stressed the importance of research of this phenomenon. Peru summarized the achievements in this regard as follows: (i) preparation of maps indicating vulnerability, hazard and population. Sixty-one inundation maps have been prepared and can be downloaded (<http://www.dhn.mil.pe>). (ii) the DHN (Dirección de Hidrografía y Navegación, responsible for the tsunami warning in Peru) in cooperation with the PTWC has installed two tsunami warning stations (Handar Automatic Stations) in the north and south of Peru this year. (iii) the DHN continues tsunami

communication exercises with the Servicio Hidrográfico y Oceanográfico de la Armada de Chile (SHOA) since 2002.

65 The Philippines informed the Group that it is adopting a three-prong approach in its tsunami risk mitigation programme consisting of (i) hazards and risks mapping; (ii) education and awareness promotion; and (iii) establishment of a local tsunami warning system. The latter would require the upgrading of the communication and monitoring capabilities of PHIVOLCS, the agency responsible for providing earthquake and tsunami warning information to the public. The national seismic network has been recently upgraded through a grant from the Japanese Government and the provision of modern seismic instrumentation greatly improved the speed of parameter determination which is very important for tsunami warning purposes.

66 The institute is also planning to establish a ten-station tsunami detection network in the near future. The tsunami detection stations will make use of “tsunami wet sensors” instead of expensive deep pressure sensors and buoys to ensure its sustainability. The idea is to put these tsunami detection stations as near as possible to tsunami source regions to provide for earlier detection and longer lead time. The intention is not to protect coastal communities directly fronting the tsunami source region, because the lead time is too short, but to protect those communities that are far enough and have lead times greater than 15 minutes. The communities that are close to the tsunami source region can make use of the natural signs such as strong ground shaking that will alert people that it is time to move to higher ground. For distant communities which are too far to feel the strong ground shaking, the tsunami detection stations will be very useful for providing warning. The Philippines recently received funding from the Government of Finland to establish one station on an island fronting the Manila Bay to protect the highly populated coastal towns and cities of Metro Manila.

67 The Philippines will be hosting a training workshop for tsunami modelling in November 2005 that will be attended by participants from developing countries in the Indian Ocean, Southeast Asia, and some Pacific countries. The training workshop will be funded by ITIC and IASPEI with PHIVOLCS providing the venue, logistics, local transportation support and lodging facilities at its main office in Quezon City. The training workshop is designed to teach basic skills to participants to enable them to initiate run-up and inundation modelling. It is expected that their new experience and skills will help enhance their countries’ tsunami hazard and risk mapping capabilities.

68 Samoa informed the Group that, at present, the national capability for identifying or characterizing tsunamigenic events in the immediate local source area is weak. The Samoa Meteorology Division (SMD) utilizes the single GSN seismic station to calculate the magnitude and location of local seismic events (using the DIMAS2003 single station software), and base their decision on whether to issue a tsunami watch/warning using the information produced. This protocol is relatively unreliable. The SMD relies heavily on tsunami information bulletins issued by the Pacific Tsunami Warning Centre (PTWC), and bases their decision on whether to undertake national procedures to issue a public watch or warning using that information. This protocol of reliance on PTWC is only effective for teletsunamis, and not for tsunamis generated in local geologic settings.

69 Tsunami mitigation efforts in Samoa are still at their infancy stage. There exists no national seismic network, although plans to establish this network utilizing foreign aid are underway. A proposal has been submitted to JICA (Japan International Cooperation Agency) for the deployment of a short-term Senior JICA Volunteer with 15 years experience in the field of seismology, to assist local authorities in planning the establishment of a national seismic network, as well as National Tsunami and Seismic Operational Response Plans. Assuming this

initiative goes as planned, the next step for Samoa would be to submit proposals to either Japan or other interested donors for the actual implementation of these plans. National efforts are currently underway in the development of a national tsunami operational response plan under the World Bank-funded Samoa Infrastructure Asset Management Project, Phase II, but mainly in the context of capacity and awareness building. Efforts at the regional level to establish a South Pacific Tsunami Warning Centre are currently underway, of which Samoa is involved in. Overall, Samoa still has a long road to walk in the area of developing efficient and effective tsunami early warnings and hazard mitigation systems.

70 **The Group urged** all Member States to add information on tsunami occurrences and observations on sea-level stations to national reports.

71 **The Group expressed** its gratitude to the Member States that had submitted national reports and **thanked** the Secretariat for making the reports available on-line.

72 **The Group decided** that all national reports will henceforth be published electronically through the ITSU website and will no longer be published in hard copy through the *Tsunami Newsletter*.

3.3 ITIC DIRECTOR'S REPORT

73 The ITIC Director introduced this item referring to Document IOC/ITSU-XX/8 on the activities of the ITIC during the inter-sessional period. Dr Laura Kong provided a brief summary on the meetings ITIC attended and on the projects and activities, and new products and services that the ITIC was involved in. She thanked the USA for continuing to support the ITIC and noted its increased contributions to the ITSU through increased staffing of the IOC-ITIC. She reported that in July and August 2005, the NOAA NWS added three full-time staff members to the ITIC, and that with these staff, she hoped to be able to improve its services to every Member State.

74 Dr Kong recalled that the ITSU Officers met in Honolulu for the scheduled inter-sessional meeting only two weeks before the Indian Ocean tsunami of 26 December 2004, and at this meeting discussed a number of issues and priorities which came immediately to the forefront just a few weeks later. These included the update of the *ITSU Master Plan*, to better emphasize the importance of a comprehensive approach to tsunami mitigation as advocated at ITSU-XIX, and the inter-sessional working group on such, and to include the many new technologies, methodologies, and data streams which have resulted in significant improvements in the quality and reliability of the tsunamigenic evaluation and a reduction in the initial response time required by PTWC, so as to provide Member States information within 10-20 minutes of the event's occurrence.

75 Dr Kong recalled further that the ITSU Officers also took the opportunity to meet with the IOC/GLOSS Group of Experts Chairman, Dr Mark Merrifield, Director of the University of Hawaii Sea Level Centre (UHSLC), to initiate discussions for closer coordination and collaboration with GLOSS and the UHSLC for sea-level station upgrades and maintenance. That initial meeting proved to be a catalyst for immediate upgrades in sea-level stations in the Indian Ocean to meet near real-time tsunami monitoring needs starting already in January 2005.

76 She reported that the ITIC has been deluged with information requests that started within hours after the Indian Ocean tsunami of 26 December 2004. She stated that in the first two weeks after the tsunami, the ITIC received about 500 e-mail messages to its general e-mail addresses, and the ITIC Director individually received more 1,200 messages. The ITIC Director in turn responded with more than 1,000 emails. The ITIC received more than 300 media or other

information requests by phone, fax, and by written communication. During 2005, the ITIC revised its Great Waves brochure to recognize the global nature of the tsunami risk, include information on the Indian Ocean tsunami, and to emphasize the importance of a comprehensive approach to tsunami mitigation that involved sustained programmes in hazard risk assessment, warning guidance, and preparedness and education. Altogether, 100,000 copies of the informational pamphlet were printed and distributed around the world to government agencies, organizations, and the public.

77 During the inter-sessional period from October 2003 through 2004, prior to the Indian Ocean tsunami of 26 December 2004, the ITIC Director participated in a number of activities in support of enhancing tsunami warning and mitigation systems in the Pacific. These included conferences and workshops on early warning, activities in the Caribbean, and activities in support of the southwest Pacific to build awareness and capacity, and in the northwest Pacific where a sub-regional tsunami advisory centre was initiated by the Japan Meteorological Agency (JMA).

78 In 2005, in the aftermath of the Indian Ocean tsunami of 26 December 2004, the ITIC Director travelled extensively globally on behalf of the IOC to provide information on the comprehensive tsunami mitigation efforts that are a part of the ICG/ITSU and the Tsunami Warning System in the Pacific, and on the status of the IOC's effort in coordinating the implementation of the Indian Ocean Tsunami Warning and Mitigation System. At the same time, activities continued in support of the Pacific. In total, the ITIC Director participated in 20 meetings in 2005, with five focusing on activities related to the Pacific. She referred to the ITIC Directors Report for a descriptive summary of each meeting.

79 The ITIC Director was invited to give the N.K. Panikkar Memorial Lecture at the Twenty-third Session of the IOC Assembly in June 2005. In her speech, entitled 'People-Centred Tsunami Early Warning Systems: The Challenge of Building Preparedness at the National and Local Levels,' she stressed that while technology has certainly aided in the delivery a more reliable warning, the effectiveness of the warning and response was ultimately dependent on the abilities of people to communicate and motivate their fellow citizens to take action.

80 The ITIC Director then gave a brief summary on the progress in the many ITSU inter-sessional activities, deferring detailed discussion on a number of topics to later in the ITSU-XX meeting agenda and noting that summaries of each were included as part of the ITIC Director's Report. Specifically, the topics included the Working Group on a Comprehensive Tsunami Hazard Reduction Programme (Section 3.5); the Global Historical Database (Section 3.6) and the Cooperation with the WDC-SEG (Section 9.5); The ITSU Communications Plan (Section 4.4); Sea-Level and Seismic Observations and Data Communications (Section 5); the ITSU Training Programme (Section 6); ITSU Publications and Awareness Tools (Section 7); Tsunami Warning System Initiatives in the Northwest Pacific (Section 8.1); Central America —Pacific Coast (Section 8.2); Southwest Pacific (Section 8.3); the Caribbean (Section 8.5); and the South China Sea (Section 8.1); and on the cooperation between the ITIC and ISDR (Section 9.2) and SOPAC (Section 9.6).

81 Additionally, the ITIC Director presented a summary on new activities, projects, and products which have become available in the past year. These include revised and customizable IOC publications, videos on Hawaii Tsunami Warnings, Tsunami Data Preservation Plans (handout), the Sea-Level Station Inventory XML web service tool (handout), the IOC TsunamiTeacher Training Toolkit (handout), and media awareness building and disaster-preparedness children's game cooperation with the ISDR. She indicated that the videos and

Great Waves were available at the meeting, and were also available in bulk upon request to the ITIC.

82 The ITIC Director presented information on the Alert Services, referring to the ITIC Director's Report for details. The ITIC has developed and is making available several additional services to government officials in charge of tsunami warning for their countries. These include: (i) a public list serve that immediately sends an e-mail to all subscribers upon receiving a message from the PTWC, WC/ATWC, and JMA; (ii) a real-time earthquake display and alerting system (CISN) developed by the US Geological Survey (USGS) in partnership with California Institute of Technology and the State of California Emergency Services; and (iii) a heads-up SMS text messaging service for PTWC tsunami messages through the RANET Project.

83 Finally, the ITIC Director thanked the ITSU Member States for their support. She noted that over the past 40 years, the ITIC has built up tremendous expertise and experience in all aspects of tsunami warning and mitigation, and stands ready to work with every nation to implement an effective tsunami warning and mitigation system that will save lives and property.

84 The United States of America reiterated their strong commitment to support ITIC and informed the Group that this support would continue during the next inter-sessional period, while recognizing that a revision of the Terms of Reference was being considered by the Group (see Agenda item 4.1).

85 Malaysia expressed its great appreciation for the information provided through the ITIC web site which had proved extremely valuable in informing the Malaysian people on tsunamis. Malaysia also informed the Group that the guidance provided by ITIC had helped considerably with the planning process towards a Malaysian Tsunami Warning Centre.

86 The Representative of SOPAC thanked ITIC and its Director for assisting in the organization of the South Pacific Tsunami Awareness Workshop (SPTAW), 1–3 July 2004.

87 **The Group requested** ITIC to compile a summary of communications posted on the tsunami bulletin board immediately after the Indian Ocean tsunami of 26 December 2004. The focus would be on the official tsunami information messages that were sent by the PTWC and science and other response information posted to the Tsunami Bulletin Board starting immediately after the PTWC Tsunami Information Bulletin. The ITIC will make this compilation and publish this widely through its Tsunami Newsletter and the Tsunami Bulletin Board.

88 **The Group strongly supported** the development of a “video snippets” collection.

89 **The Group expressed** its appreciation for the excellent work done by the ITIC Director and Associate Director, assisting in the implementation of the ITSU-XIX Work Plan.

90 **The Group expressed** its high appreciation for the work carried out by ITIC since its establishment, and **expressed** gratitude especially to its Director for her hard work after the Indian Ocean tsunami of 26 December 2004, noting that ITIC's participation in this process had been of key importance.

91 **The Group thanked** the United States of America for its long-time support of ITIC and **urged** the United States to continue and expand this support, especially in view of the new global reality following the Indian Ocean tsunami of 26 December 2004 and its impact on, and demands from the PTWS.

- 92 **The Group thanked** Chile for its continued support and Mr Emilio Lorca for his energetic involvement in ITSU as the ITIC Associate Director.

3.4 PTWC DIRECTOR'S REPORT

- 93 The PTWC Director, Dr Charles McCreery gave his report on the activities of PTWC during the inter-sessional period and on assorted issues related to tsunami warning operations. He referred to Document IOC/ITSU-XX/9 (Richard H. Hagemeyer Pacific Tsunami Warning Centre Director's Report).

- 94 He noted that PTWC only needed to issue one series of warning messages for the September 2003 Mw=8.1 earthquake off the east coast of Hokkaido, Japan. Otherwise, the PTWC had issued 81 Tsunami Information Bulletins for large earthquakes with no regional or distant destructive tsunamigenic potential, and 661 earthquake messages for smaller earthquakes.

- 95 He noted that while some of the inter-sessional US activities related to PTWC were a part of the normal incremental improvement, many were a result of the US response to the Indian Ocean tsunami of 26 December 2004 tragedy and subsequent funding of accelerated improvements.

- 96 He described changes to the seismic data PTWC receives in support of tsunami warning. The PTWC has begun an upgrading of its Hawaii seismic network that includes the deployment of broadband seismometers and accelerometers throughout the Hawaiian Island archipelago. These data will permit more rapid and accurate hypocenters and magnitudes for local Hawaii earthquakes. He also explained that PTWC had been given permission on a test basis and was working to receive seismic and hydroacoustic data from the International Monitoring System of the Comprehensive Nuclear Test Ban Treaty Organization. These data should substantially improve PTWC's seismic coverage and reliability.

- 97 He also described on-going changes to PTWC's sea-level monitoring network. Gauges along US coasts operated by the US National Ocean Service are in the process of being upgraded to provide one-minute sampling with transmissions every 6 minutes. Other coastal gauges across the Pacific operated by the PTWC and by the University of Hawaii Sea-Level Centre are being upgraded to one-minute sampling and 15-minute transmissions. Further, PTWC, with assistance from El Salvador and Nicaragua, had added gauges at Corinto, Nicaragua and at Acajutla, El Salvador to cover a gap in Central America. Data from gauges in Japan operated by the Japan Meteorological Agency will be sent on a 15-minute schedule with 1-minute sampling, and additional stations added. Data from gauges along the Pacific coast of Canada will soon be made available in near real-time. In addition, the US network of Deep Ocean Assessment and Reporting of Tsunamis (DART) gauges has been expanded from 6 sites to 10, with plans to expand to 32 over the next two years. Further, PTWC is receiving data from a Chilean DART gauge operated off the coast of northern Chile by SHOA.

- 98 The PTWC Director explained that the new data will help PTWC warnings be more accurate by using them to constrain numerical tsunami forecast models. The SIFT model that worked very well in a demonstration mode for a tsunami from the Aleutian Islands to Hilo, Hawaii, in November 2003 continues to be developed by the US Pacific Marine Environmental Laboratory (PMEL), but now at an accelerated pace. This forecast tool is available now to PTWC through a web site, but will be physically transferred to both PTWC and the West Coast/Alaska Tsunami Warning Centre (WC/ATWC) in the next year. Inundation models for 74 impact sites along US coasts are to be completed by 2009. Should other countries have or

develop inundation models for segments of their coasts these can, in principle, also be incorporated into the SIFT forecast model.

99 He noted that the PTWC and WC/ATWC staffs are being increased from 7.8 and 6.5, respectively, to 15 at each Centre, and that PTWC had added a building at its site to accommodate the new personnel. The increased number of staff will facilitate there always being at least one person on duty in each Centre to respond most quickly to the occurrence of any large potentially tsunamigenic earthquakes. Duty staff previously responded to earthquakes from their homes or government quarters during after-hour periods. The additional staff will also facilitate an improved level of service in most other regards.

100 Lastly, the Director indicated that in response to discussions at ITSU-XIX (Summary Report para. 72), an enhanced set of forecast or warning points had been implemented to include all countries in the Pacific and to provide denser coverage in certain areas where there were gaps. The complete set of points is given in his written report (Doc. ITSU-XX/9). He also noted, in follow-up to the ITSU-XIX discussions, that PTWC is still expecting to add more graphical products, and that this will become necessary to disseminate forecast model information.

101 Following the report, Australia inquired about the graphical dissemination of forecast model results and whether the inundation forecast models might be run by the Member States. The Director replied that this was at least conceptually possible, with PTWC providing boundary conditions for the inundation models based on their latest basin-wide forecast. Canada inquired whether, in the November 2003 event, a forecast had been produced for any sites other than Hilo, Hawaii. The Director explained he did not know but would check with PMEL.

102 The Chairman then asked if Japan might provide data from its cabled deep ocean sensors to PTWC, and Japan responded affirmatively.

103 The Group was informed that Japan has installed two sets of cabled deep ocean sensors. The PTWC and Japan are currently discussing how the data from these systems will be made available to PTWC.

104 **The Group expressed** its appreciation for the excellent work done by the PTWC and its Director, Dr Charles McCreery.

3.5 REPORT FROM THE WORKING GROUP ON A COMPREHENSIVE TSUNAMI HAZARD REDUCTION PROGRAMME

105 The ITIC Director introduced this Agenda item. Dr Kong reported on the progress of the Working Group during the inter-sessional period. Reference was made to Recommendation ITSU-XIX.1 (Working Group on a Comprehensive Tsunami Reduction Programme). It was recalled that the Group's main task was "*to prepare a pilot implementation programme for the Pacific...*". The Terms of reference for such a pilot projects were included in the Recommendation.

106 The ITIC Director, as the Chair of the Inter-sessional Working Group on a Comprehensive Tsunami Hazard Reduction Programme, reported on this Agenda item. Dr Kong recognized the *ITSU Master Plan* is already discussing many of the components that must be acted upon, and recalled the important contributions of the US National Tsunami Hazard Mitigation Programme (NTHMP) in building a proactive constituency of warning centre operators, research scientists, and emergency managers working together at various levels of government to reduce tsunami impact through a comprehensive programme of hazard risk

assessment, warning centre guidance, and preparedness and education. She further stated the NTHMP to be a good example of a comprehensive programme, but noted equally that very good end-to-end systems are also in place in Japan, Chile and Tahiti.

107 She noted that in coordinating the implementation of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS), the IOC has advocated strongly for a Comprehensive Tsunami Hazard Reduction Programme, and referred to the ITIC Director's Report for further discussion. She indicated that strong United Nations partnerships between the IOC (warning guidance, hazard assessment, mitigation), the ISDR (public awareness, preparedness), and the WMO (GTS communication, multi-hazard approach). In this regard, the Working Group's task to develop a 'pilot implementation plan' was immediately acted upon as a result of the Indian Ocean tsunami of 26 December 2004—a plan drafted describing the capacity requirements of each component, the cost estimates for both an immediate ramp-up interim phase and the longer-term full capacity implementation along with a timeline for deployment. And as indicated in the Working Group's Terms of Reference, the ISDR was fully involved in the effort to identify the action components of the end-to-end tsunami hazard reduction.

108 In building the IOTWS, the Director stated that an important step was to first assess the existing facilities and capacities for tsunami mitigation and then identify and prioritise the capacity building that would be required to reach a minimum level of tsunami preparedness. She recalled the importance and utility of the Assessment Questionnaire for gathering the important information, and reported that the ITSU Officers had discussed the high similar value it may have in the Pacific. She reported that the ITSU Technical Secretary had distributed the Assessment Questionnaire to all ITSU Member States for completion prior to ITSU-XX, and that similar to the Indian Ocean, she proposed to Member States that it be followed up by a country or sub-region visit by an international expert team which would provide both training through the ITP-International and recommendations for action by the country.

109 **The Group expressed** the important value of the Questionnaire, but **recognized** costs to be a factor and **suggested** the use of nearby regional experts as one way to reduce costs.

110 **The Group recommended** that the questionnaire should be used in two ways: (i) for countries who have not yet established a National Tsunami Warning System (TWS), the questionnaire could be used in a process similar to that used in the Indian Ocean region; (ii) for countries that have established a national TWS, it can be used to regularly assess national capacities, arrangements and requirements.

3.6 REPORT ON THE GLOBAL HISTORICAL TSUNAMI DATABASE PROJECT

111 Dr V. Gusiakov, Head, Tsunami Laboratory in Novosibirsk, introduced this Agenda item and referred to Document IOC/ITSU-XX/10 (Summary Report on the Global Tsunami Data Base Project Implementation). Dr Gusiakov reported specifically on the status of implementation of Recommendation ITSU-XIX.3 (Global Historical Tsunami Database Project). Reference was also made to Agenda item 9.4 (Cooperation with WDC-A, Solid Earth Geophysics).

112 Dr Gusiakov recalled that in 2003, the ITIC, the WDC/NOAA (Boulder, Colorado, USA) and the NTL/ICMMG (Novosibirsk, Russia) developed a plan to compile a unified and comprehensive Global Tsunami Data Base (GTDB) by merging two existing tsunami databases maintained separately by the WDC/NGDC and the NTL/ICMMG. The benefits of having such a single, unified product would be as follows: (i) this product would reduce confusion for end-users looking for a reliable source of information on historical tsunamis; (ii) many discrepancies and uncertainties in parameters of historical tsunamigenic events that still existed in both the

HTDB and WWTD databases would be resolved. The first draft of the proposal was developed in June 2003 and was discussed at the first working meeting on the GTDB Project that was held on 8 July 2003 in Sapporo, Japan, before the IUGG Tsunami Symposium. A general plan of action was discussed at this meeting, including the need for a new database format and the close cooperation with the HTDB regional coordinators. The detailed proposal on the GTDB Project was presented to the ITSU-XIX (29 September–3 October 2003, Wellington, New Zealand.), was positively received by the Member States and resulted in a special recommendation (Recommendation ITSU-XIX.3). This recommendation tasked the project participants (ITIC, WDC/NGDC, and NTL/ICMMG) to implement the GTDB Project in 2004-2005 with financial support provided jointly by the NWS/PR and IOC. It was recommended that the official copy of the database would be housed and maintained at the WDC/NGDC in the Oracle RDBMS from where the data could be accessed via web-based HTML forms and ArcIMS interactive maps, as well as exported to different formats specified by the ITIC for the use by tsunami warning centres and other potential users. The offline, stand-alone application (WinITDB graphic shell) would continue to be supported and updated by adding a new software calculation of Tsunami Travel Times (TTT). This would take into account that some users might not have easy access to the Internet, and it would respond to the need for access to the historical data in an “off-line” mode.

Incorporation the TTT software into the WinHTDB graphic shell

113 The software block for TTT calculation was incorporated in the full-scale WinHTDB graphic shell containing the comprehensive earthquake and tsunami catalogues and full set of options for their visualization. In the process of this integration, several major improvements of the TTT algorithm have been made. These improvements include:

- New algorithm for plotting isochrones (that eliminates breaks in lines);
- New option for plotting travel time values at the isochrone lines (in several formats —secs, mins, hours);
- New heuristic methods to prevent isochrones from jumping over the narrow land strips (like the Panama isthmus);
- New dialog window for display settings for plotting point and elliptic sources (allows selection of different colours and width).

114 These new TTT options were incorporated into the WinHTDB graphic shell as a built-in subroutine, having special options in the main menu, thus forming a new shell —WinITDB (Integrated Tsunami Data Base), the latest version of which (5.15 of 31 July 2005) was presented.

115 Version 5.15 of the WinITDB shell can be considered as a prototype of the next generation product —WinITRIS (Integrated Tsunami Research and Information System), that is now under development in the Novosibirsk Tsunami Laboratory. It is supposed that in addition to the TTT software, the system will include the subroutine for dynamic tsunami modelling allowing quick calculation of tsunami generation and propagation from realistic earthquake source within any area of the World Ocean provided with detailed digital bathymetry data.

Extension of the WinITDB graphic shell to the global coverage

116 The WinITDB graphic shell that initially has been developed for the Pacific was extended to cover other tsunamigenic areas of the World Ocean. Extension was made by changing the start-up map from the Pacific region (within 65°S - 65°N and 80°E – 60°W) to the world-wide

map (within 80°S - 80°N and 25°E – 25°E). For user's convenience, four additional regional maps (for the Pacific, Atlantic and Indian Oceans and for the Mediterranean Sea) were added as new options in the 'Area Select' menu.

117 Other major improvements of the WinITDB graphic shell, as compared to the WinHTDB graphic shell, include the following new features:

- New vector layer 'Isolines of Relief' (added to the "Map" sub-menu) that can be overlaid over the shaded relief or used instead of it;
- New dialog window ('Isolines') in the 'Map Settings' pop-up window to set the parameters for isolines display;
- The layer 'Regions' was made active and allows making the selection of the events related to a particular region upon right-mouse click while it is highlighted on the Pacific-wide map. The listing of these events is displayed upon double left-mouse click;
- New option 'Bibliography' (added to the main menu) that provides listing of tsunami bibliography grouped into five sub-options (Historical Catalogs, General Books, Conference Proceedings, Selected Papers, Tsunami web-sites);
- The geographical coverage of the WinITDB graphic shell has been extended to cover the main tsunamigenic areas of the World Ocean (Pacific, Atlantic, Indian Oceans and the Mediterranean Sea).

Development of the PDM graphic shell

118 Within the third direction, a new Windows-based graphic shell PDM (Parametric Data Manager) has been developed. The PDM is an interactive graphic shell (screen form) intended for easy manipulation of parametric (source data, run-up observations) and descriptive (structured text, bibliographical references) data related to historical tsunamigenic events. Its main function is to assist the HTDB administrator in collection, editing and listing of parametric data related to historical tsunamigenic events. It is supposed that the PDM shell will be used by regional coordinators as a major instrumental tool in their work on further improvement of the quality and completeness of historical tsunami data for the World Ocean.

Development of the full 3-D global graphic shell

119 Within the third direction, the prototype of a new, full 3-D graphic shell with the global coverage (GlobalITDB) has been developed. The shell is written in C++, a new powerful programming language, using the NET Framework infrastructure and a new specialized graphic library (GeoGL) specially developed by the NTL programmers for visualization of geophysical data in the full 3-D mode. The basic features of the new shell include:

- support of several basic coordinate systems and map projections used in mapping of geophysical data;
- support of several database formats used for historical data compilation and storage;
- procedures for the full 3-D visualization of the land surface and ocean bottom relief;
- procedures for calculation and display of isoline charts;
- options for interactive rotation of resulted images;
- procedures for overlay of additional information (captions, annotations) on the resulted maps;

- options for saving the resulted user-made maps in different graphic formats.

120 It is supposed that the Global ITDB shell will support manipulations with the built-in subroutines for TTT calculation and numerical modelling of tsunami propagation, as well as procedures of calculation of the long-term tsunami risk for particular coastal areas.

Further updating the regional tsunami catalogs and converting them into the Global Tsunami Catalogue

121 The work undertaken by the NTL/ICMMG in 2004–2005 in this direction includes:

- Development of the new format for GTDB data set (jointly with the NGDC/NOAA and the ITIC);
- Standardization of the Region and Area names in the RUN-UP catalogues;
- Checking and correction of the ‘Type of measurement’ field in the RUN-UP catalog, based on information on existing tide networks in the different areas of the World Ocean;
- Extension and correction of historical data set for the Tonga-Fiji-Vanuatu region based on the data in the regional catalog (Everingham, 1987) provided by Dr B. Pelletier (New Caledonia);
- Forming the Indian Ocean tsunami catalog as a separate catalog (earlier the data for the eastern Indian Ocean were included in the Pacific tsunami catalog) and its extension on the basis of available publications (Berninghausen, 1964, 1966, 1969);
- Compiling the detailed data on the coastal run-up measurements for the Indian Ocean tsunami of 26 December 2004 (more than 450 measurements are currently available).

122 According to the plan discussed at the ITSU-XIX, it was foreseen that Dr Gusiakov would travel to Honolulu and Boulder in February-March of 2004 for joint work with ITIC and NGDC/NOAA for further data compilation, verification and their merging with the NGDC data to form a new GTDB data set. However, due to problems in obtaining a US visa, this visit could not be implemented. It was decided that during the rest of 2004 and in 2005, both groups (NTL/ICMMG and NGDC/NOAA) would work independently, based on their sources of historical tsunami data, and would seek other possibilities for the work for data merging and conversion into the GTDB format.

The GTDB current content

123 In the summer of 2005, using the PDM software as a supporting instrumental tool, the NTL made a conversion of the four existing regional tsunami catalogues (for the Pacific, Atlantic and Indian Oceans and for the Mediterranean Sea) into a single global database (in the *.mdb format) containing historical events and run-up data for the World Ocean. Currently, this database contains 2,258 records covering the period from 1628 BC to present with 2,106 of them having the validity index equal or more than 1. Thus, the database has 152 records with validity 0 that are considered to be false entries. These records are kept in the database to prevent their further re-entry because information on them exists in the literature. Some of these records have their analogs in the main part of the database just with different dates or locations. Distribution of events over the validity index is as follows:

Validity 4 (definite event)	761
Validity 3 (probable event)	400
Validity 2 (doubtful event)	611
Validity 1 (very doubtful event)	334
Validity 0 (false entry)	152

124 Dr Paula Dunbar (WDC-A, Solid Earth Geophysics) reported on the status of the completeness of the Global Tsunami Data Base, and in particular on the project 'Web tools for Remotely Updating Tsunami and Significant Earthquake Data', carried out by the World Data Centre-Boulder, National Geophysical Data Centre. She listed the objectives of the project: (i) Identify Current and New Source References; (ii) Redefine Tsunami and Earthquake Oracle Databases; (iii) Remove Duplicate Events; (iv) Remove Incorrectly Related Earthquake and Tsunami Events; (v) Quality Control (QC) and Expand Tsunami and Earthquake Events; (vi) Add Tsunami Run-up Latitude/Longitude; (vii) Add Paleo Tsunami Data; (viii) Identify Tide gauge, Water Height, Paleo, or DART; (ix) Add References for all Tsunami Run-ups; (x) Improve Data Access and Display Forms and Maps; and (xi) Improve Download Options. Web tools had been developed for a variety of functions from data entry to search and data display. In addition, interactive map capability was developed.

125 Dr Dunbar listed the following activities as planned for the future: (i) Continue Quality-Control of Databases (All entries (event, run-up) must have a Reference); (ii) Implement New Java-Server Pages for QC; (iii) Tsunami-Travel Time Plug-in to Interactive Maps. She also stressed that data will continue to be in the public domain and will not be copyrighted.

126 **The Group expressed** its appreciation for the work carried out by WDC/NOAA (Boulder) and the NTL/ICMMG (Novosibirsk) **but expressed** disappointment that there were still two independent databases. **The Group regretted** further that there were considerable differences between these databases. **The Group reiterated** the importance of, and need for a single, unified database and that this be implemented urgently.

127 **The Group requested** Dr Gusiakov and Dr Dunbar to jointly draft a detailed and realistic work plan and budget to accomplish the goals set during ITSU-XIX for further discussion during Agenda item 9.5.

3.7 REPORT ON THE INTERNATIONAL TSUNAMI SIGNS AND SYMBOLS

128 Past Chairman, Mr Hugo Gorziglia, introduced this Agenda item and referred to Document IOC/ITSU-XX/11 (Signs comparison).

129 Mr Gorziglia recalled that ITSU-XVIII had recognized the need to define appropriate internationally standardized signs and symbols, and a Working Group had been established. ITSU-XIX had agreed: (i) to have a sign 'Tsunami Hazard Zone'; (ii) to have a sign 'Tsunami Evacuation Route'; (iii) to ask ISO for guidance on colours; (iv) to request the IOC Executive Council to submit signs to ISO; (v) that a 'Tsunami Refuge Zone' sign was not needed; and (vi) that international symbols were not needed.

130 Following ITSU-XIX, the following actions were undertaken by the Secretariat:

- 29/10/03: Letter prepared for ISO;
- 14/11/03: Response received from AFNOR: need to revise signs respecting standard ISO 3864-1;

- 20/11/03: E-mail sent to ITSU Chairs, ITIC Director and Associate Director and H. Gorziglia informing them on ISO's reply. The Secretariat recommended revision of signs for submission to ISO and requested ITIC to do the necessary;
- 12 March 2004: Revision received from ITIC;
- 8 April 2004: Secretariat sent revised signs to AFNOR;
- 28 May 2004: Secretariat received comments from AFNOR: comments on shape of signs;
- 1 June 2004: Secretariat forwarded comments to ITIC —Signs need minor adjustment then submission can follow to AFNOR/ISO;
- 22/9/04: The IOC/ITSU Secretariat hired a contractor to finalize signs and submit to ISO for approval (deadline: 2004 Officers meeting);
- 25/10/04: Contractor finalized signs;
- 27/10/04: Signs sent to AFNOR;
- 16/11/04: Response received from AFNOR requesting us to send the application to 'Secretariat du Groupe international responsable de la normalisation des nouveaux signaux de sécurité' (ISO/TC 145/SC 2/GT 1);
- 17/11/04: Signs sent;
- 25/11/04: Reminder sent to ISO to request acknowledgement of receipt;
- 6-10 December 2004: Officers meeting: The Officers requested the Secretariat to continue the discussions with ISO to have the signs adopted as soon as possible;
- 5/1/05: 'Formal' submission of signs through UNESCO official contact at ISO;
- 24/2/05: Reminder sent to ISO by ITSU Chairman (noting the urgency after the Indian Ocean tsunami of 26 December 2004);
- 7/3/05: Response received from ISO: expected that step 9 of procedure should be finished by June 2005;
- 27/6/05: Secretariat sends reminder to ISO;
- 11/7/05: ISO sends message to G. Webber, Chair of ISO/TC 145/SC 2/WG 4;
- 11/7/05: G. Webber responds providing information on parallel submission by Japan and referring to informal discussions in Prague in May between WG4 Secretariat and Japan;
- 15/8/05: Secretariat inquires about status;
- 5/9/05: Response received from G. Webber: "This stage of the process of dealing with applications/proposals for water safety signs involves members of ISO/TC145/SC2/WG4 commenting on the Tsunami proposals. Members are currently commenting on the WG4 documents N066, N067 and N068 listed below. Member's comments will be considered at the next meeting of ISO/TC145/SC2/WG4 on 28–29 September. Members will be considering whether specific proposals go forward to the next stage of the process of comment/vote by national standards bodies. The situation should be clearer after the WG4 meeting".
- 27/9/05: Letter sent by IOC Executive Secretary to G. Webber clarifying procedure of submission ITSU signs.

131 Japan informed the Group that many tsunami signs are currently being used by local governments in Japan. In order to standardize the signs, the Japan Fire and Disaster Management Agency established an expert committee on signs. The Committee had examined the signs in use and carried out a survey to assess which signs were easiest to recognize by the public. Based on the results of this survey, the Agency had adopted signs and submitted these to ISO. Japan had also submitted a sign for identifying evacuation buildings as this was considered necessary.

132 **The Group noted** that, when it had embarked on the design and submission to ISO of signs, it had not expected that the process would be so time consuming. **The Group expressed** concern about this long delay as signs were needed urgently, especially after the Indian Ocean tsunami of 26 December 2004. **The Group regretted** the parallel submission of signs by Japan and **also expressed** its regret that ISO did not consult the IOC in this regard.

133 **The Group instructed** the IOC Secretariat to urgently contact ISO to inquire about their final decision and to inform the ICG/ITSU Member States about the response. **The Group decided** that this matter will be further discussed at ICG/PTWS-XXI.

4. ITSU STRATEGIC PLAN

4.1 DEVELOPMENT OF AN ITSU MEDIUM-TERM STRATEGY

134 The Chairman introduced this Agenda item and referred to IOC Assembly Documents IOC-XXIII/3 Prov. (Annex II: Adopted Resolutions) and in particular to Resolution XXIII-16.

135 Dr Schindelé recalled the devastating impact of the Indian Ocean tsunami of 26 December 2004. He noted that this event had given global attention to the tsunami hazard and clearly shown the need for an effective end-to-end tsunami warning and mitigation system. Although IOC had been given the role as the lead agency for the development of the IOTWS (based upon its extensive tsunami experience in the Pacific), the international community had also stressed the need for the UN agencies and other partners to work together, reinforcing each other's core areas of expertise. This had led to the close collaboration between IOC, WMO and ISDR. The IOC action elements included (i) establishment of a governance system for the IOTWS; (ii) strengthening of a core real-time observational network, based upon the GLOSS sea-level system; and (iii) capacity building. More details on the IOC activities related to the Indian Ocean Tsunami Warning and Mitigation System are detailed in Agenda item 7.

136 The lessons learned from the Indian Ocean tsunami, as well as from the process leading towards the development of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS) needed be taken onboard by ITSU. Whereas the ICG/ITSU in the past had focused on the warning system, hazard assessment and mitigation aspects, there was little cooperation with WMO and ISDR, the Chairman recommended that the ICG/ITSU consider the future of ITSU in the new context of an end-to-end framework and taking into consideration the need to further develop and maintain national systems in a multi-hazard context. The Chairman stated that this new approach, if adopted would require a medium to long-term strategy that takes into consideration governance, technical aspects and capacity building requirements. It also needed to address inter-agency cooperation.

137 **The Group established** a sessional working group to deal with this matter.

138 Recalling Agenda item 3.5, the Chairman also recalled that the national assessment questionnaire developed for the national assessment missions undertaken in the Indian Ocean region, had been sent to all ITSU Member States, but that only seven countries had filled in and

returned the questionnaire. The Chairman recommended that a comprehensive assessment should be made in all ITSU Member States of available resources and to ensure that established national tsunami warning systems were end-to-end including “last mile”.

139 In terms of the ITSU programme’s position within the IOC Structure, the Chair informed the ICG/ITSU that, as from the 2006–2007 biennium, the tsunami activities would be placed within MLA-2 (Main Line of Action 2: Developing operational capabilities for the management and sustainable development of the open and coastal ocean). This new structure was agreed upon by the IOC Assembly during its Twenty-third Session (through Resolution XXIII-16: IOC PROGRAMME AND BUDGET FOR 2006–2007). This MLA is managed by Mr Keith Alverson.

140 **The Group noted** that the drafting of the ITSU strategy would also need to take into consideration the results/relevance of the ITSU review (see Agenda item 4.2). Reference was also made to the *ITSU Master Plan* (See Agenda Item 4.3) and particularly to Agenda item 9.2 (Cooperation with ISDR and WMO).

141 **The Group adopted** [Resolution ITSU-XX.1](#) and [Resolution ITSU-XX-2](#).

142 **The Group adopted** [Recommendation ITSU-XX.1](#).

143 With regard to the Chair of inter-sessional Working Group 1 (Working Group on Seismic Measurements, Data Collection and Exchange) the ICG/ITSU requested its Chair to invite the USA to Chair this Working Group.

144 **The Group recommended** that if requested by individual countries of the Pacific, the IOC should lead an assessment of the requirements and capacity needs for an effective and durable national tsunami warning and mitigation system. As required, donors should be invited to support such IOC-led assessment missions.

145 **The Group further agreed** that the work of the sessional working group on strategic planning and the work of the inter-sessional working groups established by Recommendation ITSU-XX.1 serve as the vehicle for continuously improving the Pacific Tsunami Warning and Mitigation System.

146 **The Group recommended** that the ITSU-XX sessional working group on strategic planning and governance reconvene at the next session of this body to consider cross-cutting matters raised by the intersessional working groups, as well as to advance other matters as so directed by the ICG at its Twenty-first Session.

4.2 ITSU REVIEW

147 The Chairman introduced this Agenda item. Dr Schindel  recalled that ITSU-XVIII had “*acknowledged the need for the programme evaluation and agreed that it should be carried out by a team of external experts knowledgeable in the tsunami programme and the work of international organizations*”. The ITSU-XIX had decided to (i) add Dr George Maul and Dr Paul Leblond to the list of experts; (ii) request the IOC Secretariat to define the Terms of Reference for the Review by 1 December 2003, based upon the GOOS Review Terms Of Reference; (iii) request the Chair and IOC Secretariat to contact the experts and prepare the final list of Review Team members (and Chair of the Review Team) by 31 December 2003; (iv) make the necessary arrangements for the Review Team to implement the Review and submit their

report by May 2004; and (v) invite the Chair of the Review Team to provide a summary report during the IOC Executive Council, 23-29 June 2004, UNESCO Headquarters, Paris.

148 On 1 November 2003, Dr Maul had informed the Secretariat that he could not accept the task. On 1 December 2003, the Terms of Reference (TORs) for the Review were completed jointly by the ITIC Director and the Secretariat and posted on the ITSU web site (published on 15 April 2004 on <http://ioc3.unesco.org/itic/contents.php?id=109>). Further on-line discussions resulted in the acceptance by Dr Costas Synolakis (8 April 2004) of acting as Chair of the Review Team. Other members of the Team would include Assoc. Prof. Dr Ahmet Cevdet Yalciner; and Dr Stefano Tinti (posted in June 2004 on <http://ioc3.unesco.org/itic/contents.php?id=110>). It was then agreed that a first meeting would be organized with the Chair of the Review Team, Dr Synolakis during the December 2004 Officers Meeting. During the December 2004 Officers Meeting discussions were held with Dr Synolakis and the TORs were reviewed and agreed upon. It was agreed that the Review would start with a computer-based questionnaire early 2005.

149 The Indian Ocean tsunami of 26 December 2004 made the Officers decide that proceeding with the planned questionnaire was neither appropriate nor realistic.

150 **The Group recommended** that the IOC Executive Council reassess the need for an external review of the Pacific Tsunami Warning System, in the light of the extensive changes made in the structure and operations of PTWS following the Indian Ocean tsunami of 26 December 2004.

4.3 ITSU MASTER PLAN

151 The Chairman introduced this Agenda item. Dr Schindel  recalled that ITSU-XIX revised the conclusions of the *ITSU Master Plan* (Doc. IOC.ITSU-XIX/3 Annex VII) thereby including capacity building and mitigation. ITSU-XIX had also decided to include a further revision of the Master Plan in the Agenda of ITSU-XX. The December 2004 Officers Meeting had requested the Chair to send a message to Member States in January 2005 to inquire if any changes should be made in the Master Plan. The Chair had suggested a few modifications: seismic station map, water level map, list of national and regional tsunami warning centres, list of events, new criteria for tsunami warning, tsunami glossary, web site. The Officers had noted that the Master Plan evolved from a strategic document to a document that also includes information on the current status of ITSU and they felt that the Master Plan should focus only on long-term strategy. The Officers had agreed to review the Master Plan and discuss any required changes by e-mail. They requested additional input from the TROIKA Group. The Chair would then submit, on the basis of the comments by Officers, Member States and the TROIKA Group, a proposal for changes to ITSU-XX. Due to the heavy workload following the Indian Ocean tsunami, no action was taken.

152 **The Group decided** that the Master Plan had been reviewed at ITSU-XIX and that no further revisions were required at this time.

4.4 ITSU COMMUNICATION PLAN

153 Vice-Chairman, Dr Charles McCreery introduced this Agenda item. He recalled that the *ITSU Communications Plan* is a general reference for participants of the PTWS. The last Edition of the Plan (12th Edition) was published in 1997 with an update in 1999. He recalled further the 13th Edition of the Communications Plan was scheduled to be distributed before the end of the first quarter of 2004. It was to include information about the new procedures and criteria, modified product identifiers, bulletin formats, updated sea-level and seismic networks, and

updated contact information. However, due to other PTW Centre operational priorities, difficulties encountered in re-organizing and updating the large database of contacts, and the impact on PTWC of the Indian Ocean tsunami of 26 December 2004, the 13th Edition was not completed during the intersessional period.

154 Two revisions were prepared during the intersessional period. These documents were prepared for the First and Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System in the Indian Ocean within a Global Framework (3–7 March 2005, Paris; 14–16 April 2005, Mauritius). These documents were available for this session.

155 A draft of the new Plan was made available to the Group. It contains general information about the tsunami phenomenon and hazard, an overview of the structure of the PTWS, information about how bulletins are disseminated from PTWC, a description of the seismic and sea-level data and analyses methods, an explanation of PTWC's procedures and types of bulletins, including examples, a brief description of the North West Pacific Tsunami Advisory Centre (NWPTAC) operated by Japan, and a comprehensive listing of the designated national contact points and their contact information.

156 A number of issues regarding the Plan were outlined by the PTWC Director. He explained that the Plan would be made available on the PTWC web site for easier access and more updated information. Contact information will be password protected to prevent general access to sensitive items such as unlisted operational telephone numbers. He noted there are still some countries in the Pacific without designated contact points and that other countries have listings that may not be their designated contact points. Further, while certain contact information such as telephone numbers has been updated regularly, other information needs a comprehensive review. A request for this review and update will be sent by PTWC to the Member States, and responses compiled, before publishing the new Plan.

157 Lastly, a proposed set of forecast points for the NWPTAC was provided to the Group for their review and approval. They are the same as the PTWC forecast points listed in the Plan that cover the Western Pacific from Papua New Guinea to Russia. In addition, there are three new points on the Korean peninsula, three new points in the Philippines, and one new point in Papua New Guinea. This set of forecast points for the NWPTAC was approved based on there being no objections from the Group.

158 Japan confirmed that JMA will send a sample bulletin of NWPTAC to the Director of PTWC.

159 China stated that the contact points in Hong Kong would be maintained.

160 **The Group commended** the Director of PTWC for the work done to review and make available the new *ITSU Communication Plan*.

161 **The Group requested** the ITSU national contacts to review the list of contact points by December 2005 and to remove contacts that were not strictly essential. **The Group instructed** the PTWC to disseminate the 'Communications Plan for the Tsunami Warning System in the Pacific' and for ITIC to publish the Communications Plan on the IOC/ITIC web site, not later than February 2006.

4.5 ORGANIZATION OF PACIFIC WIDE TSUNAMI DRILL

162 The Chairman introduced this Agenda item. He stressed the need to organize national, as well as Pacific wide exercises, to assess and improve tsunami preparedness at the national and regional level. It was noted that simulating scenarios and learning lessons from such exercises would be an effective way to improve preparedness. **The Group established** a sessional Working Group (see Agenda item 2.5).

163 **The Group adopted** [Recommendation ITSU-XX.3](#).

5. OBSERVATION SYSTEMS AND RELATED MATTERS

5.1 SEA-LEVEL OBSERVATIONS

164 Mr Bernard Kilonsky (Sea Level Centre, Dept. of Oceanography, University of Hawaii) introduced this Agenda item. He recalled the multi-purpose use of the GLOSS stations: (i) satellite altimeters need to be calibrated using *in situ* sea-level gauges; (ii) the GLOSS network is needed for global ocean dynamics studies and monitoring variability (ENSO, EL NINO); (iii) long mean sea-level (MSL) records are needed for climate change studies (e.g., for IPCC); (iv) many coastal applications, tides, engineering require sea-level data; (v) longer records of higher frequency climate change are used to calculate changes in storm surge statistics; and (vi) higher frequency sampling is important for storm and tsunami monitoring and warning.

165 Mr Kilonsky then introduced proposed standards for tsunami enabled tide gauges. This included the utilization of international channels on the global meteorological Geostationary Satellite System (GTS), and WMO's GTS to transmit high frequency sea-level data to warning centres in near real-time. The current array of GLOSS station reporting data in to PTWC and JMA was described, and plans to upgrade these sites presented. The use of DART buoys (bottom pressure sensors) in several scenarios and procedures were examined for their use in forecasting and monitoring tsunami events.

166 Chile stressed the need for a tool that would assist in identifying optimal geographic locations for sea-level stations and DART buoys. In this regard, Dr A. Rabinovich (Russian Federation) demonstrated a prototype software programme for calculating tsunami warning times and for optimising the placement of tsunami warning stations in offshore and coastal areas. This software has been developed by Dr Isaac Fine and is a joint Russia–Canada undertaking. For an arbitrary tsunami source location, it is possible to estimate a safe warning time, as the time delay between the wave arrival at a specified coastal site and the wave arrival at coastal warning stations or offshore DART buoys. Dr Rabinovich demonstrated the interactive nature of this software using examples for the Indian Ocean and the coast of Chile.

167 Several Member States called for the development and distribution of a sea-level data display software tool. The Group was informed that many different formats were used by sea-level data operators to transmit their data. Although PTWC was using a software tool to display the data, substantial efforts had to be made to regularly update the conversion routines, to accommodate frequent changes in station hardware or software by the station operators. In addition, such changes were often not reported to the PTWC.

168 **The Group called** for improved standardization of sea-level data transmission formats to facilitate use and display of the data by tsunami warning centres. In this regard the Group noted that the ICG/IOTWS Inter-sessional Working Group on 'Sea-level Data Collection and Exchange, including Deep-sea Tsunami Detection Instruments' had as one of its objectives to

"Liaise with CBS/WMO and relevant Expert Teams to develop a more effective data representation and code form for Real Time exchange of Sea-Level data and to conduct test of latency (timeliness) of GTS transmissions". Reference is made to Agenda item 4.1.

- 169 Mr Kilonsly informed the Group that the University of Hawaii's plans for further upgrading of sea-level stations in the Pacific Ocean only include upgrading during normal maintenance cycles and that no financial resources are available for additional stations.
- 170 The United States of America informed the Group that, as part of their Tsunami Enhancement Programme, the US will be deploying a total of 32 DART buoys throughout the Pacific. The exact positions of the DARTs are still to be determined, it is expected that to achieve optimum placement of the buoys, some locations may be within territorial waters or Exclusive Economic Zones of Member States. The US requests all possible support from the members to assist in obtaining clearances and permission for the deployment of these buoys when necessary.
- 171 Australia informed the Group that the planned Australian sea-level network in the Pacific includes two DART-type buoys to cover the critical areas off the south Queensland coast and the NSW coast. The first is likely to be placed between the Puysegur Trench (south of New Zealand) and the Australian coast (at the 90 minute warning isochron) and the other off the northeast coast to provide early warnings for tsunamis triggered at the Kermadec Trench, which runs through Fiji. As a matter of priority, all existing sea-level stations operated by the Bureau's National Tidal Centre (NTC) will be upgraded to real-time data transmission capability.
- 172 An additional seven new sea-level gauges, with real-time telemetry equipment, will be installed along the east coast of Australia. These will provide monitoring and warning capability of a tsunami threat originating from the New Zealand zone or from the tectonic plate areas stretching from Vanuatu to Papua New Guinea. To ensure an effective monitoring and warning system is established, upgrades (to tsunami capability) to four existing and aging AusAID-funded South West Pacific sea-level gauges will include real-time telemetry. The tidal gauge at Macquarie Island (part of the Antarctic sea-level gauge network) will also be replaced and real-time telemetry added, to ensure monitoring of the southeast coast. The remaining eight existing NTC tidal gauges around the Australian coast will be installed with telemetry equipment to ensure real-time observations and monitoring is possible. Where there may be an unreliable power source available and to ensure the tidal gauge sensors and telemetry equipment will operate 24/7, a solar power pack and back-up battery will be installed.
- 173 It is anticipated up to an additional 13 new sea-level gauges with real-time telemetry equipment will be installed amongst the Pacific Island countries (subject to approval being granted) in locations that have the most prominent tectonic plate activity to provide monitoring and warning capability from a potential tsunami threat. Upgrades (to tsunami capability) to the eight remaining and aging AusAID-funded South West Pacific gauges will enhance them with real-time satellite link functionality, and another two existing research gauges will be replaced in the SW Pacific.
- 174 All sea-level data from the Australian sea-level network will be freely available to users in the region. In particular, data from the expanded network will be made directly available to the PTWC to facilitate tsunami warnings in the South West Pacific. Australia is working with GLOSS and the WMO to standardise GTS sea-level data formats.
- 175 **The Group expressed** its appreciation for the planned efforts of Australia along the Australian coast, as well as amongst Pacific Island countries.

- 176 **The Group called on** Member States to cooperate closely with GLOSS to maintain and upgrade their sea-level stations.

5.2 SEISMIC OBSERVATIONS

- 177 The PTWC Director introduced this Agenda item. Dr McCreery reviewed the tsunami data and analysis methods currently used by the PTWC for earthquakes in the Pacific region.

- 178 Then Dr Rhett Butler (Global Seismographic Network Programme Manager) recalled that the Incorporated Research Institutions for Seismology (IRIS) is a University consortium involving 102 member institutions of the USA and 46 foreign affiliates. The Global Seismographic Network (GSN) is composed of 138 global stations and arrays. It is the cornerstone of the International Federation of Seismic Networks (FDSN). The GSN is a facility that has been built over a period of 20 years with a budget of US\$ 100 million. It is a partnership of the US NSF and USGS and managed through the IRIS consortium with USGS. The facility runs two network operators (USGS Albuquerque Seismological Laboratory and the University of California, San Diego) and affiliates. The GSN focuses on national and international scientific research, focusing on earthquake and tsunami hazards and nuclear monitoring. However, through the success of the network, GSN is now also active in monitoring (e.g., the National Earthquake Information Centre). In addition, in 2004, the GSN became an observing system within GEOSS. Performance goals of the GSN include (i) free and open access to data via the Internet; (ii) real-time data availability without delay or restriction; (iii) operation of a continuous and complete archive; (iv) quality control; and (v) high data return. During the past few years, data availability has risen from around 75% to nearly 90%. The design goals of the GSN include (i) broadband; (ii) 3-component; (iii) low-noise and (iv) full fidelity. Over 80% of the GSN stations transmit data in real-time through VSAT or the Internet. Dr Butler stated that the 26 December 2004 earthquake in the Sumatra-Andaman region clearly demonstrated the need for a global seismic network: a large, complex fault, it was not characterized by its epicentre and no circum-Indian Ocean nation could “sample” the full earthquake source radiation. Data sharing was therefore essential. Dr Butler further noted that most stations are land-based which provides incomplete coverage of earth. It would therefore be appropriate to deploy more ocean-based stations such as DART or the TAO/TRITON buoys.

- 179 Dr Tim Ahern, Programme Manager of the IRIS Data Management System, Secretary of the FDSN and Manager of the FDSN Archive for Continuous Data, explained that more than 5,000 seismic stations have data available through the FDSN archive. The archive manages a wide range of data including seismological, meteorological, geophysical, and hydrological data. The Archive currently holds over 75 terabytes of data and is growing at a pace of 20 terabytes per year. Telemetry has improved data reception and distribution in real-time considerably and has increased quality at reduced costs. The 1,131 stations are telemetered in real-time from 36 different networks. Dr Ahern explained that the Archive has solved the format problem by identifying a simple ‘Buffer of Uniform Data’ (BUD) format to which other formats are converted through other levels of the network. Dr. Ahern also mentioned that the Archive had developed an automated data quality control system.

- 180 Dr Ahern concluded his presentation by mentioning a few areas for possible cooperation. These included: (i) offering data management services for the tsunami community; (ii) protocol conversion; (iii) archiving of existing data; (iv) servicing non-real time data needs; and (v) training programmes.

- 181 **The Group thanked** Dr Butler and Dr Ahern for their excellent and most interesting presentations.

182 **The Group instructed** the Officers and ITIC to further investigate possible areas of cooperation, and for the inter-sessional working groups on the Medium-Term Strategy and on seismic measurements and data exchange to take this into consideration. **The Group invited** FDSN to collaborate with the relevant inter-sessional working groups established by ITSU-XX.

183 **The Group called on** Member States to cooperate with FDSN to establish new seismic stations and to contribute to the FDSN network. Reference is made also to Agenda item 9.9 in this regard.

5.3 DATA COMMUNICATION ISSUES

184 The Chairman introduced this Agenda item. Dr Schindel  noted that this issue had been discussed already under Agenda items 5.1 and 5.2, except for the issue of transmission of the bulletins. This is explained in the Communications Plan: messages can be sent by e-mail, GTS, fax and other methods.

185 The Group was reminded that there exist bandwidth limitations on the GOES East satellite, as well as on other satellites. Accordingly, any upgrading of sea-level stations might run into these limitations. In this regard, it was noted that GLOSS is trying to organize the use of ‘international channels’ on all geostationary satellites for transmission of sea-level data. In this regard, Mr Kilonsky informed the Group that a meeting of the GOES user group would take place on 9 November 2005. This would be an occasion for ITSU to express its interest in using the international channels. A similar request could be addressed to JMA for the GMS satellite.

186 **The Group adopted** [Recommendation ITSU-XX.2.](#)

5.4 OTHER

187 The Chairman introduced this Agenda item. Dr Schindel  invited the ITIC Director to make a presentation on the Sea-level Data Station inventory project.

188 Dr Laura Kong provided information on the Project ‘Water Level Station Systems Database Integration via an XML Web Service’. She described a collaborative project between the ITIC, GLOSS, University of Hawaii Sea-Level Centre, PTWC, and the NOAA Pacific Services Centre to develop a XML web service tool for sea-level stations.

189 The objective of the project is to integrate databases held by multiple agencies, institutions and organizations and used to describe water level station (tide gauge) specifications including station, system, and data path, format, and product parameters. Currently, information used to describe water level station specifications is distributed among databases held by multiple agencies, institutions and organizations. Integration of the information contained in these various databases would greatly enhance the ability to access and use water level data. For example, an integrated database of water level station specifications could be used to support the establishment and expansion of regional tsunami detection and warning networks. It could also be used to establish Pacific Integrated Ocean Observing System (IOOS) water level station, data, and product requirements, as well as facilitate the distribution of water level-related data products.

190 The term Web Services describes a standardized way of integrating Web-based applications using open standards and descriptions over an Internet protocol backbone. Web services allow organizations to communicate data without intimate knowledge of each other's IT systems behind the firewall. Unlike traditional client/server models, such as a Web server/Web

page system, Web services do not provide the user with a GUI. Web services, instead share business logic, data and processes through a programmatic interface across a network. The applications interface, not the users. Developers can then add the Web service to a GUI (such as a Web page or an executable programme) to offer specific functionality to users. Web services allow different applications from different sources to communicate with each other without time-consuming custom coding, and because all communication is in XML, Web services are not tied to any one operating system or programming language.

191 Thus, the basic concept involves establishing XML schemas, pushing this data out to and/or pulling this data in from multiple provider databases, transforming it, and pushing it out in multiple report formats through a central client server.

192 Initial efforts will focus on the integration of the US NOS Centre for operational oceanographic products and services (CO-OPS), the National Water Level Observation Network (NWLON), UHSLC, and PTWC-WC/ATWC databases as a means to demonstrate the viability of this approach. To further narrow the scope, this effort will focus on the integration and dissemination of information that could be used by tsunami warning centre managers to support the establishment and expansion of regional tsunami detection and warning networks. Specifically, the collection and sharing of information needed to determine, if a given station is able to support tsunami detection and warning, is the target of this initial effort.

193 It should be noted that this ‘web service’ approach is consistent with the Integrated Ocean Observing System (IOOS) Data Management and Communications (DMAC) efforts underway to support interoperable data access, recovery, and archiving. It will serve as an example of a data system that could be adopted into the data transport component of IOOS.

194 Correspondingly, it is also consistent with the Intergovernmental Oceanographic Commission (IOC) Committee on International Oceanographic Data and Information Exchange (IODE) XML Steering Group’s efforts to promote the use of XML as a mechanism for the efficient exchange of oceanographic data. It supports the development of a data communications and management subsystem (DMS) for the seamless discovery and delivery of data within the Global Ocean Observing System (GOOS) and for interoperability with other relevant observing systems and research programmers, identified as a high priority by the IODE and the IOC/World Meteorological Organization’s (WMO) Joint Technical Committee for Oceanography and Marine Metrology (JCOMM). Further, the focus of this effort is closely aligned with IODE efforts to create an Ocean Data and Information Network (ODIN) with a special emphasis on tsunami forecasting.

195 ICG/ITSU Member States indicated strong support for this activity, funded from extra-budgetary sources, as this would facilitate the deployment of instrumentation and provide a database for not only tsunami warning centres utilizing sea-level data, but also other centres or research organizations using sea-level observations.

196 **The Group welcomed** the project and strongly urged Member States to provide metadata on sea-level stations (station information such as contact person, web page with real-time data, geographic coordinates, ...) to ITIC.

197 **The Group requested** ITIC to contact JCOMMOPS taking into account their role in preparing inventories of observation platforms, to inform them of the project and to seek their cooperation by referring in the JCOMMOPS web site to this new product.

198 France then provided information on a project that developed an open source application for computing M_m, M_o and M_w. He informed the Group that M_w, the energy magnitude (Kanamori) has become quite popular and used, rather than M_s, as the latter has saturation problems with large seismic events. A simple way is proposed to calculate M_w through the mantle magnitude M_m that also provides the seismic moment with a simple relation. This has proved to be simple but robust and works at variable periods between 50 s and 400 s. France explained that the objective of the software application is to obtain the M_m in the case of large earthquakes. Signals in SAC format are entered into the software (these can be local data and/or IRIS data). The output generated is a text file that includes the average M_m and standard deviation, as well as M_w and M_o. He further informed the Group that the software is a component in the Seismic Tool Kit (STK), also an open source application. In addition to the computation of M_m, the application contains various other signal processing tools with a GUI. Mr Reymond noted that the software is available for UNIX, Linux and Mac OS X operating systems. Information on the software can be obtained from <http://ORFEUS-eu.org/links/software> (go to STK).

6. TRAINING AND EDUCATION

6.1 ITSU TRAINING PROGRAMME: REPORT ON INTERSESSIONAL ACTIVITIES

199 The ITIC Director introduced this Agenda item.

200 Dr Laura Kong reported on the ITSU Training Programme that was conducted in Hawaii and internationally in 2004, and regretted that due to the Indian Ocean tsunami of 26 December 2004, it would not be able to conduct the ITP-Hawaii Programme in 2005 but would cooperate in organizing two other training activities in November 2005. Dr Kong referred to the ITIC Directors Report for more information.

201 The Director recalled that the Training Programme had been carried out since the 1970s to bring in international visitors to learn about tsunamis, and tsunami warning and mitigation systems. Over the years, the training programme length has varied from one week to nearly two months, and has varied in its content from general hazard risk assessment, tsunami warning, and preparedness/mitigation, to very specific training in instrumentation installation or maintenance. The ITIC Director noted however, that the Programme has always been funded at a low level, so that only a few visitors could be accommodated each year.

202 In 2004, the ITP-Hawaii hosted five participants, of which ITSU funded three. The ITIC noted that many of the candidates were well-qualified and regretted that only a few could be selected because of the funding limitations. In order to build sustained capacity in countries for tsunami mitigation, the ITIC Director stated that it was important for the training programmes to be widely available and asked Member States to consider contributions that would provide for more scientists to participate in the ITP-Hawaii.

203 Further, the Director noted the high benefit expressed by Indian Ocean countries, including ITSU Member States Australia, Indonesia, Malaysia, Singapore, and Thailand, to the ISDR/IOC-sponsored Hawaii Tsunami Warning and Mitigation System Study Tour, and suggested that a similar training may be of interest to ITSU Member States. Such Study Tours could be carried out in countries operating mature tsunami warning and mitigation systems, such as Chile or France (Tahiti) who may better serve the Spanish- and French-speaking Member States.

204 In November 2005, the ITIC is part of the organizing team for sponsoring tsunami numerical modelling training, 7–19 November 2005, in cooperation with the Philippine Institute of Volcanology and Seismology (PHIVOLCS), IASPEI, and IAVCEI in Manila, and for sponsoring the North Pacific Tsunami Awareness Workshop in cooperation with SOPAC, 20–22 November 2005, in Palau. These will be carried out as part of the ITP-International programmes.

205 **The Group thanked** Dr Kong for her report and **expressed** appreciation for the considerable work achieved during the inter-sessional period.

6.2 FUTURE ITSU TRAINING PROGRAMME

206 The ITIC Director introduced this Agenda item.

207 Dr Kong explained that during the Hawaii Study Tour for Indian Ocean Member States, participants suggested that such a Tour might be useful for many nations and that it be conducted in the Pacific. During ITSU-XX, there was a suggestion made that the ITP-International be carried out to focus on specific technical capacity needs such as seismological practices, tsunami numerical modelling, or community-based disaster preparedness. Towards those ends, it was suggested that SOPAC be engaged to help sponsor tsunami modelling training in cooperation with ITSU for Pacific Island Countries (PIC), especially in light of the significant interest from PICs in the 7–19 November 2005 training in Manila. Further, several Member States indicated a need to build capacities in seismological systems as a better understanding of the different systems and their advantages and disadvantages would assist those nations presently building or seeking to build seismic monitoring systems.

208 In this regard, the ITIC Director reported that the IOC has initiated the development of a training resource toolkit to assist in the conduct of training of various user groups by the different stakeholder groups. Over the next year, the IOC and its ITIC will develop TsunamiTeacher (handout provided). This is discussed under Agenda item 7.2.

209 Canada informed the Group that training could be provided in Canada (travel and accommodation to be funded from other sources) on the operation of sea-level stations and tsunami response procedures.

210 The Philippines expressed its concern about the many seismic monitoring systems being used in the region and recommended to organize a training course in this field with the view of harmonizing the systems in the region.

211 Australia announced that the Government is considering support for training related to tsunami warning and mitigation aimed at the South West Pacific small island countries.

212 The Representative of SOPAC recommended organizing training activities for Pacific island countries in the South West Pacific.

213 **The Group recommended** to Member States to inform IOC and ITIC of their future plans of training, to be posted on the web site.

214 Ecuador informed the Group of his country's plans to hold training courses in operational seismology and tsunami modelling in early 2006, and kindly requested ITIC to assist in the organization of the training. Ecuador reported on the Navy's plan to collaborate with the University San Francisco to build a Tsunami Warning Centre, indicating that the training and expert recommendations are essential to be able to design and find resources to build the system. The Delegate indicated that Peru, Colombia and other countries from the region would be invited

to attend so that they might build together a monitoring system for the northwest coast of South America.

- 215 The ITIC Director agreed to inquire with experts on their availability for this activity, which would involve Spanish-speaking experts working on PC-based analysis systems. It was agreed that this training be conducted in March 2006.

6.3 PUBLIC EDUCATION

- 216 The ITIC Director introduced this Agenda item. Dr Kong noted the critical importance of education to ensure disaster preparedness at all levels, and especially at the community level where school children can contribute to the building of preparedness in the homes, using the information gained from lessons learned in their school.

- 217 In regard to public education and other tsunami awareness materials, the ITIC Director noted the recent enhancements to the Spanish-language school curricula developed by Chile. These enhancements will also be incorporated into the English-language versions, and posted to the ITSU web site.

- 218 During the intersessional period, several other Member States submitted public education materials and other PowerPoint presentations to the ITIC. Additionally, during the current Session, the ITIC received a number of information materials from Member States, and these will be added to the archives that the ITIC maintains for all Member States to reference. The ITIC Director thanked Member States for their contributions, and encouraged further contributions in any format.

- 219 **The Group welcomed** the TsunamiTeacher initiative and invited Member States to contribute materials for the document collection module, as well as lecture material for the course module.

7. ITSU PUBLICATIONS AND AWARENESS TOOLS

7.1 TSUNAMI NEWSLETTER

- 220 The ITIC Director introduced this Agenda item.

- 221 Dr Kong reported that in 2004, the *Tsunami Newsletter* was published on schedule and that the ITSU-XIX National Reports published, as part of the *Tsunami Newsletter* in January 2005. In 2005, due to the increased workload of the ITIC resulting from the establishment of the Indian Ocean Tsunami Warning and Mitigation System, the ITIC will only publish two newsletters this year. Issue Number One will cover tsunami events from the end of 2004, and events and meetings through September 2005. Issue Number Two will then cover the remaining activities through the end of 2005. Later, the publication of the Newsletter will continue at a periodicity of three months.

- 222 The ITIC Director encouraged all Member States and organizations to contribute tsunami-related articles for inclusion in the Newsletter. Topics of interest to readers include tsunami awareness and preparedness activities, emergency response drills, instrument and communications installations and upgrades, new and improved methods of tsunamigenic evaluation, and summaries of tsunami observations and related numerical modelling.

7.2 TSUNAMI INFORMATION KIT

223 The ITIC Director introduced this Agenda item.

224 Dr Kong recalled that ITSU-XIX had instructed the ITIC Director and the IOC Secretariat to ensure that the product would be completed by the January 2005 Officers meeting (which was actually held in December 2004) and that at least 200 copies of the product would be printed and distributed. The Group was informed that no action had been taken on this matter until the December 2004 Officers meeting. At that occasion, the Chairman had proposed to create a “box” that would include the *Great Waves*, *Tsunami Glossary*, Infosheet ITSU, Infosheet TWSP, Infosheet ITIC, Infosheet National Contact and Warning Centre, stickers and the *Post-tsunami Survey Field Guide* (IOC Manuals and Guides 37). The Officers agreed with the proposal. They had decided to: (i) design the box: to be done by using existing “logo” and glossary front cover; (ii) prepare a template for national sheets, using the glossary front cover; (iii) make the template available to all ITSU Member States; (iv) for ITIC to design sheets on: ITIC, ITSU (in collaboration with the Chair) and TWSP (in collaboration with Dr C. McCreery). In addition, it was agreed that the international content of the box will include: *Great Waves* (available in E, F, S), *Tsunami Glossary* (available in E, F, S), *Post-tsunami Survey Field Guide* (available in E, F, S, R), ITIC sheet (to be available in E, F, S, R), ITSU sheet (to be available in E, F, S, R), and TWSP sheet (to be available in E, F, S, R). The National Content could be added as required (national sheet, specific brochures,...). The Officers had decided that the “box” should be ready by early June 2005 for distribution at the IOC Assembly (200 copies would be required). The draft design of the empty “box” would be submitted to the Officers for their approval by March 2005. The Officers would be requested to revise the drafts prepared by ITIC, PTWC and Secretariat, not later than March 2005 (English version only). Printing of the box and international inserts should be done in May 2005.

225 Dr Kong reported to the Group that due to the Indian Ocean tsunami of 26 December 2004 follow-up activities, no action had been taken on this matter. However, copies of the publications mentioned above were widely distributed during the many meetings in which the ITSU Officers, IOC Secretariat and tsunami experts participating in the framework of the IOTWS development.

226 The ITIC Director reported on the TsunamiTeacher project that the IOC will develop over the next year. The ITIC Director made a short presentation on the project and referred to both the ITIC Directors Report and to the handout distributed at the meeting.

227 The TsunamiTeacher will serve as a consolidated global resource toolkit containing reliable and authoritative resources, along with tsunami training modules, to assist national governments and community and local stakeholders to raise awareness and understanding of tsunamis, and plan to respond to and mitigate their impacts. The TsunamiTeacher, to be modelled after UNESCO-IOC’s OceanTeacher, will be a web-based, distance-learning product that is easily accessible by any user. The project will also be supported by DVD training packages. The five stakeholder target audiences are: Media, education systems, governments, community groups, and the private sector. The launch of the TsunamiTeacher is planned for the ICG/IOTWS-II meeting in Hyderabad, India, from 14 to 16 December 2005, with two modules completed, and the full website completed by September 2006. The TsunamiTeacher project will be based at the IOC-ITIC, and the website would maintained by the IOC/IODE Project in Oostend, Belgium. The language of the project would be English, and partnerships are being sought to translate the materials into French and Spanish.

228 The ITSU Member States indicated strong support for this concept, as this will build a resource of reliable and authoritative information that can serve multiple purposes and multiple audiences.

229 With regard to resources in other languages, the ITIC indicated that it could make materials in other languages available through the web site that is currently planned to be in English. The ITSU Technical Secretary reported that a proposal has been submitted to France for support in translating tsunami materials into French, and if supported, could be used to develop a French-language site.

230 Australia informed the Group that PI-GOOS had an educational programme called 'SEAREAD' and recommended that coordination be sought between this programme and TsunamiTeacher.

231 The Representative of SOPAC informed the Group that SOPAC had, in collaboration with the Pacific Disaster Centre, developed an 'Awareness kit'.

232 **The Group instructed** that the materials collected for the Tsunami Information Kit be included in TsunamiTeacher, taking into consideration the similar audiences of both products and decided to close the Tsunami Information Kit project.

7.3 ITSU WEBSITES

233 The ITIC Director introduced this Agenda item.

234 Dr Kong recalled that ITSU-XIX had thanked ITIC-USA and the IOC Secretariat for hosting the ITIC-USA and ITSU-IOC sites and instructed them to coordinate content development of the two sites, clearly keeping in mind the two target audiences. It had been agreed that the IOC site should focus on experts (providing technical information such as history, structure, membership, activities, formal documents), whereas the ITIC-USA site should concentrate on the general public (containing the *Master Plan*, photo gallery, newsletters, reading list, safety rules, *Post-tsunami Field Survey Guide*, *Great Waves*, fact sheets, and other content aimed at creating awareness). Between ITSU-XIX and February 2004, the Secretariat and ITIC had undertaken (i) revision of the table of contents of both sites; (ii) updating of the IOC/ITSU site by both Secretariat staff and ITIC staff; and (iii) updating of the ITIC site by ITIC staff.

235 The Secretariat and ITIC had subsequently met on 12 and 13 February 2004 in Honolulu to discuss practical arrangements for the ITIC and IOC/ITSU web sites. When comparing the tables of content it had been found that there was substantial overlap in focus audience between the two sites: the IOC sites included general audience content and the ITIC site covered quite a bit of expert information. Such overlap and duplication could only confuse our users and it takes more resources to maintain. It was therefore proposed to consolidate the content of the two existing sites into one site. It had also been proposed to sub-divide at the top header level into 'GENERAL INFO' and 'TECHNICAL INFO'. The general section would include material that was easy to understand and provided the general public (or school) audience with general information on tsunamis. In April 2004, a contractor had prepared draft designs for a remodelling of the IOC/ITSU web site but, due to lack of funds in the IOC/UNESCO regular programme budget, it had not been possible to proceed. In October 2004, (after consultation with the Officers), extra-budgetary funds (USA) had become available and the contractor was hired for the remodelling of the IOC/ITSU site (graphic and structural elements).

236 During December 2004, the IOC Officers reviewed the proposed structure and approved the top-level headers. With regard to “look and feel”, the Officers expressed their appreciation for the new IODE web site. The Officers considered that ITIC is the information service of ITSU and therefore decided to use the following text for the homepage banner: ‘International Tsunami Information Centre —The information services of the ITSU programme’. The Officers had made many additional recommendations regarding the implementation of the web site.

237 After the December 2004 Officers meeting, the contractor implemented all recommendations made by the Officers by the end of December 2004. Unfortunately, due to the Indian Ocean tsunami of 26 December 2004 follow-up responsibilities, the work on the new site then slowed down until March 2005. Ms Tammy Kaitoku of the ITIC visited UNESCO/IOC Headquarters between 15 and 25 March 2005 to work on the content transfer from the old IOC/ITSU and ITIC web sites to the new site. The new site was opened to the public on 20 May 2005. The following URLs can be used to access the site: <http://ioc.unesco.org/itsu>; <http://ioc3.unesco.org/itic> or <http://www.tsunamiwave.info>.

238 The Group was informed that in January 2005 (i.e., a month after the Indian Ocean tsunami of 26 December 2004) that the IOC/ITSU site received 124,000 unique visits. As from April 2005, the number visits averaged on 7,000 unique visits/month.

239 Australia requested, as there were now other regional tsunami warning systems, such as the Indian Ocean TWS, that an international web site, hosted by IOC, could be developed as a matter of urgency. Australia would be prepared to fund its development, subject to a proposal from the Secretariat.

240 **The Group expressed** its appreciation for the work carried out on the IOC/ITIC web site, noting the importance of having a single web site for the ITSU programme, and instructed ITIC to continue the further development, as well as promotion of the new web site.

241 **The Group**, recognizing that the new regional tsunami warning and mitigation system would probably develop their own web sites, **recommended** that an “overall” web site be developed that would provide a central point of entry to IOC’s tsunami programmes.

242 **The Group requested** Member States to inform ITIC of the URLs of national tsunami-related web sites in order to provide links to these within the IOC/ITIC web site.

7.4 OTHER

243 The ITIC Director introduced this Agenda item.

244 Dr Kong reported that the *Tsunami Glossary* (English version) had been reprinted by Chile. She noted that this publication had proven to be extremely useful during the IOTWS meetings and missions.

245 Dr Kong reported further that the *Great Waves* publication had been updated and reprinted (in English) and noted that this publication had proven to be extremely useful during the IOTWS meetings and missions.

246 Dr Kong recalled that ITSU-XIX (para. 176) had invited Member States to translate all ITSU documentation for public and expert use into their national and local languages. Dr Kong will invite Member States to report on the follow-up of this request.

- 247 The ITIC Director reported on a number of other products and services, including the Tsunami Bulletin Board, and the provision of customisable public information brochures. Dr Kong also noted the useful contributions made by the Japan Meteorological Agency and the USA Hawaii State Civil Defence, both of whom have widely distributed their tsunami awareness DVDs, entitled *Save Your Lives from Tsunami!* and *Tsunami: Waves of Destruction*, respectively.
- 248 The ITIC Tsunami Bulletin Board (TBB), which provides e-mail list serve information to more than 300 members, continued to be used often by tsunami professionals using Lyres List Manager V.7.0 software maintained by the USA NOAA National Weather Service. The system performed extremely well in the days and months following the Indian Ocean tsunami of 26 December 2004 with no problems in latency of posting or in access to the list serve.
- 249 The ITIC Director reported that there have been numerous requests from the media and other non-professionals to subscribe to the TBB which provides immediate access to a vast technical information base.
- 250 Dr Kong explained that the purpose of this list serve is to provide an open, objective scientific forum for the posting and discussion of news and information relating to tsunamis and tsunami research, and as such it is not open to the media or the general public. The ITIC is providing this list serve to tsunami researchers and other technical professionals for the purpose of facilitating the widespread dissemination of information on tsunami events, current research investigations, and announcements for upcoming meetings, publications, and other tsunami-related materials. All members of the TBB are welcome to contribute, and messages are immediately broadcast to all members without modification. The ITIC thus hopes that tsunami professionals will use this information service as a means of informing their colleagues. Further, the TBB expects that members will carry out scientific discussions in an objective and respectful manner.
- 251 The ITIC Director reported that the ITIC has revised and updated several English-language informational brochures, and will make these available in October 2005 in hard copy and electronic format. Reference was made to the ITIC Director's Report for more information. The electronic files are available for downloading from the ITIC web site (www.tsunamiwave.info) as both PDF-format and layered Microsoft Word files in which the text and graphics are separated into separate objects for manipulation and customisation.
- 252 **The Group recommended** that coordination and/or liaison should be organized between the regional IOC tsunami programmes with regard to newsletters and other information tools.
- 253 **The Group recommended** that public awareness activities should be organized within a multi-hazard framework.

8. REGIONAL AND OTHER TSUNAMI WARNING SYSTEMS

8.1 NORTHWEST PACIFIC TSUNAMI WARNING SYSTEM

- 254 The Delegate of Japan introduced this Agenda item. Japan established the North West Pacific Tsunami Advisory Centre (NWPTAC) in March 2005. The Delegate noted that the establishment of a regional tsunami warning centre has been discussed by the ITSU since 1978. Regarding the Northwest Pacific region, the Republic of Korea proposed at the Fourteenth Session of the ICG/ITSU that Japan should take the responsibility of operating a regional centre for the area. In response to this request, JMA started to provide tsunami information to relevant

countries in 2001, when a tsunami was expected due to the earthquake that occurred off the west coast of Hokkaido and Honshu, Japan. The JMA had made efforts for expansion of the area, so since March 2005, the NWPTAC started to provide tsunami information to countries around the Northwest Pacific Ocean Region. The NWPTAC collects seismic data from Japanese and global networks, determines hypocenter and magnitude, and exchanges information with PTWC. The NWPTAC estimates arrival times and expected tsunami heights from a pre-simulated tsunami database based on the location and magnitude of the earthquake and transmitted the advisory to the relevant countries around the Northwest Pacific region. When an earthquake greater than magnitude 6.5 occurs in this region, the NWPTAC provides tsunami information to relevant countries in 20 to 30 minutes by means of GTS, e-mail and facsimile. The advisory contains source parameters, evaluation of tsunamigenic potential and estimated tsunami arrival times and estimated tsunami heights for a set of forecast points. If a tsunami would actually be observed at tidal stations in this region, the NWPTAC would provide tsunami observations as subsequent information. The first information on 20 March 2005 is the information to the Republic of Korea and other relevant countries of the earthquake off the west of the Fukuoka prefecture.

255 Several Member States requested Japan to expand coverage of the NWPTAC to the South China Sea and the Sea of Okhotsk. Japan explained that the coverage area of the NWPTAC will be expanded on a step-by-step basis. The expansion to the South China Sea is in preparation and will be able to be included in the coverage area of the NWPTAC by March 2006. However, it was pointed out that there are currently insufficient sea-level gauges in that area to provide quality tsunami advisory information.

256 **The Group expressed** its high appreciation to Japan for the establishment of the North West Pacific Tsunami Advisory Centre as an important contribution to the Pacific Tsunami Warning System.

257 **The Group expressed** its concern about the insufficient network density of sea-level stations in the South China Sea, in the Sea of Okhotsk and off the Pacific coast of Russia and decided to study this matter in more detail for discussion at the next Session of the ICG/ITSU. In this regard, **the Group requested** the GE-GLOSS to provide information on the status of sea-level stations in this region.

258 The ITIC Director further recommended that the ITSU Chair and IOC Technical Secretary welcome, through a letter to the ASEAN Secretariat, the close cooperation between ITSU and the Southeast Asian countries represented in ASEAN. Dr Kong noted the valuable beneficial contributions made by Malaysia, Philippines, Singapore, and Thailand during ITSU and is looking forward to working with them and the other nations in the region to build an effective tsunami warning and mitigation system. Cooperation and collaboration with ASEAN will facilitate the improvements and enhancements.

259 **The Group requested** both the PTWC and the JMA to provide an interim tsunami advisory service for the South China Sea. **The Group further requested** the PTWC and the JMA to develop a communication plan for the South China Sea that describes messages, criteria, etc. for distribution to the concerned countries.

260 The United States of America informed the Group that the PTWC would make the interim tsunami information bulletins available to the countries in the South China Sea, beginning 1 December 2005, continuing through March 2006, and requested Member States, desiring to receive such interim support, to provide both the JMA and the PTWC national contact information by 1 November 2005.

261 The Russian Federation requested the PTWC and the JMA to consider providing an interim advisory service for the Sea of Okhotsk.

262 **The Group urged** all countries covered by the NWPTAC to urgently provide contact point information to the NWPTAC and the PTWC so messages can be delivered.

263 **The Group stressed** the need for countries that are currently benefiting from interim tsunami advisory services provided by the PTWC and the JMA, to ensure that such functions will be assumed by centres within their region within an agreed-upon period.

8.2 CENTRAL AMERICA PACIFIC COAST TSUNAMI WARNING SYSTEM

264 The ITIC Director introduced this Agenda item. Dr Kong recalled that, during ITSU-XIX, it had been reported that the six countries of the Central America and CEPREDENAC (Coordination Centre for the Prevention of Natural Disasters in Central America) had decided to start the process for a Regional Tsunami Warning System for the Central American Region. Nicaragua had received the assignment to formulate the proposal, and this proposal had been completed and presented to the Executive Secretary of CEPREDENAC on 24 September 2003. The proposal had been presented by CEPREDENAC to other Central American countries in order to obtain comments, suggestions and inputs; and then to formulate the final version of the Central American Regional Tsunami Warning System, at the end of 2003. The CEPREDENAC had invited the ICG/ITSU to comment on the proposal. In this regard, ITSU-XIX had decided to establish an intersessional working group and had adopted Recommendation ITSU-XIX.2.

265 The ITIC Director noted the strong need for coordination between the ICG/ITSU and the ICG/CARTWS because of the presence of countries which would need to participate in both the warning and mitigation systems. Dr Kong also noted that Colombia in South America must also be involved because their borders included both the Caribbean and the Pacific.

266 Dr Kong recalled the Americas Hemispheric Consultation in preparation for the Early Warning Conference-II held in Guatemala, in June 2003, wherein a meeting of Central America countries, Centro de Coordinación de la Prevención de Desastres Naturales en América Central (CEPREDENAC) with the ITIC Director and Associate Director and the Association for Caribbean States (AEC) was held to discuss the progress in the establishment of a sub-regional system in Central America on the Pacific Coast. This resulted in the joining of El Salvador to ITSU and the elaboration of a proposal for a tsunami warning system at the end of 2003. In January 2005, the ITSU Chair and ITIC Director met again at the World Conference for Disaster Reduction with National Disaster Managers from Member States, CEPREDENAC, and AEC, and discussed activities to further the project in 2005. These have included a number of activities starting immediately in February 2005.

267 Nicaragua made a presentation on the activities in Central America during the intersessional period.

268 Nicaragua then made another presentation on the Centre for Disaster Prevention in Central America (CEPREDENAC). CEPREDENAC is an intergovernmental organization with a membership that includes emergency commissions and scientific institutions in Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. One of CEPREDENAC's objectives is to organize measures for early warning in the region. Nicaragua recalled that between 1500 and 2005, 49 tsunamis had affected Central America. Since the 2004 tsunami, progress has accelerated: meetings of relevant institutions have been held in all Central American countries, tsunami hazard studies have been undertaken in Costa Rica and Nicaragua, as well as outreach

actions by the University of Costa Rica. In 2005, the following activities were undertaken: (i) meeting of the body of Directors of CEPREDENAC (Kobe, Japan); (ii) strategic meeting about the establishment of a tsunami warning system for Central America (San Salvador); (iii) regional tsunami warning system workshop (April 2005, Managua). This meeting was attended by 70 participants from governments, emergency commissions, scientific institutions, NGOs, educators, outreach professionals, funding agencies, etc.; and (iv) workshop on digital seismic networks (Managua, August 2005).

269 Nicaragua explained that the planned tsunami warning system for Central America is still in its early stage of development. The CEPREDENAC must coordinate the efforts and has to establish a technical steering committee. It was decided to establish national warning centres and warning systems. The centres will work closely together and exchange data in real-time. National warning centres may also send warning to other countries. A number of activities were planned for 2005: (i) formation of a technical steering committee, by CEPREDENAC (this has not taken place); (ii) formation of National Warning Centres, by countries (completed in Nicaragua, almost completed in El Salvador, not yet completed in other countries); (iii) all Central American countries to become members of the PTWS of (not completed for Panama, Honduras); (iv) elaboration of national communications plans (preliminary); (v) creation of a Regional Warning System (preliminary); and (vi) elaboration of a regional communications plan, (preliminary). It was also planned to exchange seismic data in real-time, as well as to elaborate medium and long-term plans.

270 Nicaragua informed the Group that about 100 short period and eight broad band seismic stations are available in the region. Data acquisition and processing software is standardized to a large extent in Central America (Seislog-SEISAN, Earthworm, SeisComp). Seismic data have been exchanged in real-time since 1993. Training activities have been started. Another workshop is planned for February 2006.

271 The number of sea-level stations in the region is currently insufficient. Two stations were provided by PTWC in El Salvador and Nicaragua. Data can be displayed on-line over the Internet. Additional stations exist in the region but are currently not adapted to tsunami requirements.

272 **The Group expressed** its appreciation for the progress made by CEPREDENAC and its Member States in the establishment of a Central America Tsunami Warning System.

273 **The Group urged** Honduras and Panama to join the ICG/ITSU and to identify national contact points. **The Group invited** Mexico to participate more actively in the activities of the ICG/ITSU. **The Group further requested** countries that have both a Gulf/Atlantic and Pacific coast to ensure close coordination between the Pacific and Caribbean efforts.

274 The Group was informed that there was currently no plan from GLOSS to install additional sea-level gauges in the Central America region and requested GLOSS to provide a complete list of GLOSS stations with the plan of upgrading.

275 **The Group recommended** the organization of joint activities such as workshops and training courses between the ICG/ITSU and CEPREDENAC.

276 **The Group decided** to maintain the Inter-sessional Working Group on the Central America Tsunami Warning System.

8.3 SOUTHWEST PACIFIC TSUNAMI WARNING SYSTEM

277 The ITIC Director introduced this Agenda item.

278 Dr Kong recalled that ITSU-XIX adopted Recommendation ITSU-XIX.4 (Working Group on the Southwest Pacific and Indian Ocean) with the following Terms of Reference: (i) to evaluate capabilities of countries in these regions for providing tsunami warning services; and (ii) to ascertain requirements from countries in the Southwest Pacific and Indian Ocean for the tsunami warning services. The Recommendation had further asked Australia and the ITIC to prepare a draft prior to the next SOPAC meeting for consideration by the Working Group. The Working Group was composed of representatives from Australia, Fiji, Indonesia, Japan, New Zealand, Observer from Papua New Guinea and the Directors of ITIC and PTWC (chaired by Indonesia).

279 The ITIC Director provided background information and referred to the ITIC Director's Report (Doc. IOC/ITSU-XX/9). The ITIC has initiated good cooperation with SOPAC and the Pacific Islands Countries (PIC) through the joint organization of workshops and participation in meetings. The ITIC also is assisting the PI-GOOS coordinator in SOPAC to increase tsunami awareness.

280 The ITIC Director reported that ITSU will continue to support SOPAC's effort to build capacity for tsunami early warning and mitigation within a multi-hazard context, noting the outcomes of the Early Warning for Pacific Island Countries regional planning held in early September 2005. Dr Kong noted the generous contribution that Australia has announced to enhance the monitoring networks and the willingness to help build technical capacity in the region through training. The Director also noted the generous contributions of the USA which will add sea-level monitoring instrumentation, including DART systems, to increase the network density for quickly detecting tsunamis both along coasts and most importantly within the deep ocean.

281 The ITIC Director recalled the Terms of Reference of the ITSU-XIX Working Group included both the Southwest Pacific and Indian Ocean, but that since the Indian Ocean tsunami of 26 December 2004, the Working Group has focused solely on the Southwest Pacific.

282 Dr Kong reported that the ITSU-XX Working Group officially met after the South Pacific Tsunami Awareness Workshop (SPTAW) to assess and endorse the outcomes of the Workshop, and to identify its next actions. Attending were Australia, Fiji, Indonesia, Japan, New Zealand, Russia, the PTWC and ITIC.

283 **The Group noted** that the Working Group would be better split into two separate groups for later activities. It further noted that the assessment of needs and capacities had been conducted through the SPTAW, and that the Japan Meteorological Agency will provide, starting in March 2005, tsunami warnings services to Papua New Guinea. Finally, the Group decided that the outcomes should be reported to the SOPAC STAR and Thirty-third session of the SOPAC Governing Council that will take place in August 2005.

284 The PTWC Director informed that a very productive meeting had been held in Fiji, 5–6 September 2005, organized by SOPAC. The region had recognized that, although the threat to them comes mainly from local tsunamis, it would be beyond the local capabilities to establish a local tsunami warning system. A better approach would therefore be for the region to initially enhance the seismic and sea-level capabilities. In this regard, it was recalled that Australia has pledged support for the installation and support of sea-level and seismic equipment in the region.

Using the currently available seismic stations, PTWC was able to provide bulletins within 15 minutes, i.e. for regional events. It was also recommended that SOPAC takes the role of an expertise centre so that emergency managers involved in tsunami mitigation can obtain good information about tsunamis, including the development of numeric modelling techniques (whereby the technical infrastructure and bathymetry would reside at SOPAC but would be accessible by all countries in the region).

285 Australia reiterated its intention to deploy and upgrade seismic and sea-level stations, as well as DART buoys. All data collected by these instruments will be provided to PTWC to enable PTWC to provide better tsunami warning services. The efforts of Australia should be seen as a reinforcement of the PTWS activities. The Delegate informed the Group that Australia was currently engaged in encouraging countries in the Southern Pacific, that were currently not Member States of IOC and ICG/ITSU, to join.

286 **The Group strongly urged** countries in the Southern Pacific that were currently not Member States of IOC and ICG/ITSU to join. In this regard, **the Group instructed** ITIC to compile lists indicating which countries in the region are/are not UNESCO, IOC and ICG/ITSU Member States. **The Group invited** ICG/ITSU Member States to use these lists to encourage non-Member States to join. In this regard, it was stated that for UNESCO Member States there is no cost associated with IOC membership or with receiving its products and services.

287 **The Group noted** that PTWC will continue providing on-going advisory information services for countries in the Southwest Pacific and to exchange with the region its observatory messages containing preliminary earthquake parameters for vents with magnitudes above about 5.7.

288 **The Group requested** SOPAC member countries to undertake further emergency management and public awareness activities.

289 **The Group dissolved** the Working Group on the Southwest Pacific and Indian Ocean.

8.4 INTERGOVERNMENTAL COORDINATION GROUP FOR THE INDIAN OCEAN TSUNAMI WARNING AND MITIGATION SYSTEM

290 The Chairman introduced this Agenda item. Dr Schindel  provided a technical presentation on the Indian Ocean tsunami of 26 December 2004 event.

291 **The Group extended** its deepest sympathies and condolences to the victims of the Indian Ocean tsunami of 26 December 2004, their families, the people and governments of the countries affected, and expressed its deepest concern over the negative economic, social, psychological, environmental and other consequences and impacts of the tsunami disaster.

292 The Chairman then invited the Technical Secretary, Mr Peter Pissierssens to provide an overview of the activities taken by IOC, following the 2004 tsunami. Mr Pissierssens explained that, taking into consideration the experience of the IOC in the Pacific region through its ICG/ITSU, the countries of the region had requested IOC to take the lead of the UN efforts in the establishment of the Indian Ocean Tsunami Warning and Mitigation System (IOTWS). The system would build national capacity to (i) assess national tsunami risk (hazard assessment); (ii) establish national/regional warning centres against local/regional/basin-wide tsunamis (warning guidance); and (iii) promote education/preparedness and risk reduction against tsunami hazard (mitigation and public awareness). From the start, IOC had collaborated closely with WMO and ISDR, combining the specific expertise of each agency. The IOC action elements included (i)

establishment of a governance system for the IOTWS; (ii) strengthening of a core observational network, based upon the GLOSS sea-level system; and (iii) capacity building.

293 With regard to the development of a Governance system, the Group was informed of the following activities: (i) the First and Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System in the Indian Ocean within a Global Framework (3–8 March 2005, Paris; 14–16 April 2005, Mauritius); (ii) adoption of Resolution XXIII-12 by the Twenty-third Session of the IOC Assembly, establishing the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS) (June 2005); and (iii) the organization of the First Session of the ICG/IOTWS in Perth, Australia between 3 and 5 August 2005. The First Session had elected the ICG/IOTWS Officers and had also established intersessional working groups dealing with a wide range of technical issues. In addition, the Government of Australia is hosting the Secretariat of the ICG/IOTWS in Perth. Furthermore, Germany, Japan and Norway are providing staff support for a ‘Tsunami Unit’ at IOC Headquarters, Paris. Additional support has been offered or is being provided to IOC by Belgium, Canada, Finland, France, Ireland, Israel, Italy, Norway and the United States of America.

294 The core system observational network had involved the provision, as from April 2005, of a ‘Tsunami Advisory Information Service’ by the PTWC and JMA, and the upgrading of existing, or installation of new sea-level gauges in the Indian Ocean. In this regard, substantial support had been received from Finland and from several others donors through the first UN/OCHA Flash Appeal. Considerable progress had also been made with the planning of capacity building activities: national assessment missions had been undertaken to 16 countries (Bangladesh, Comoros, Indonesia, Kenya, Madagascar, Malaysia, Mauritius, Mozambique, Myanmar, Oman, Pakistan, Seychelles, Somalia, Sri Lanka, Tanzania, Thailand). These missions aimed at (i) informing national stakeholders on the requirements (organizational, infrastructural and human resources) for the establishment and operation of a TWS; (ii) assessing the available resources; (iii) promoting the establishment of national coordination committees involving the widest possible group of stakeholders; and (iv) identifying capacity building needs. The missions had been undertaken in partnership or cooperation with IOC, WMO, ISDR, IFRC, ADRC, USGS and NOAA. The results of the missions would be used to identify common requirements at the sub-regional and regional level. These would be used to prepare a comprehensive capacity-building action plan during the Second Session of the ICG/IOTWS (Hyderabad, India, 14–16 December 2005).

295 Mr Pissierssens drew particular attention to the intersessional working groups that were established by the ICG/IOTWS-I:

- WG 1: Seismic measurements, data collection, and exchange;
- WG 2: Sea-level data collection and exchange, including deep-sea tsunami detection instruments;
- WG 3: Tsunami hazard identification and characterisation, including modelling, prediction and scenario development;
- WG 4: The establishment of a system of interoperable operational centres.

296 **The Group expressed** its appreciation for the considerable work achieved by the Secretariat, ICG/ITSU Officers and other tsunami experts who had been involved in the process of developing the IOTWS.

297 **The Group**, while appreciating the considerable efforts in the development of national tsunami warning systems and deployment of equipment in the region by Member States in the region and donors, **called for** attention to the issue of sustainability, and **called for** the integration of the national tsunami warning and mitigation systems in a multi-hazard framework.

298 **The Group noted** with appreciation the intention of the ICG/IOTWS to establish a ‘DART international Partnership’ and welcomed the decision that this partnership will not be restricted to the Indian Ocean region. **The Group called on** countries operating DART buoys in other regions, to join the Partnership as an effort to ensure global standardization.

299 Chile expressed its intention to joint the Partnership.

300 **The Group welcomed** the establishment, by the ICG/IOTWS-I of several technical intersessional working groups and recommended that similar working groups be established for the Pacific region. **The Group recommended** further that ITSU intersessional groups should liaise closely with the groups established by the ICG/IOTWS and other ICGs.

8.5 INTERGOVERNMENTAL COORDINATION GROUP FOR TSUNAMI AND OTHER COASTAL HAZARDS WARNING SYSTEM FOR THE CARIBBEAN AND ADJACENT REGIONS

301 The Chairman recalled that ITSU-XVII had reviewed a proposal for an IAS tsunami warning system. The Thirty-fifth Session of IOC Executive Council (June 2002) had reviewed the proposal and had recommended that *“the Workshop on the IAS Project on the development of the Tsunami Warning System in the Caribbean be arranged with the participation of experts from the Pacific and Caribbean region”* in order to review the original project proposal of the IOCARIBE Tsunami Steering Group of Experts and provide comments. This had led to the organization of the Workshop in Mayagüez, Puerto Rico from 19 to 21 December 2000. A draft version of the proposal had been prepared and subsequently discussed at ITSU-XVIII where a working group was established and tasked to address outstanding issues. The proposal was then submitted to IOCARIBE-VII (25–28 February 2002, Vera Cruz, Mexico). At that meeting the proposal was strongly endorsed but no funding was identified. Some additional work had been done to try implementing some parts of the proposal at the US national level. Thus, ITSU had been working on this issue during four sessions and several proposals had been prepared and submitted to IOCARIBE. Some work had been carried out by ITIC and PTWC.

302 The Chairman informed the Group that the IOC Assembly, during its Twenty-third Session had adopted Resolution XXIII-13 (Establishment of an Intergovernmental Coordination Group for Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions). The Chairman informed the Session that the First Session of the ‘Intergovernmental Coordination Group for Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions’ is planned to be held in Barbados from 10 to 12 January 2006.

303 The Vice-Chairman then explained that the Caribbean region countries had been well aware of the tsunami risk in their region but the Indian Ocean tsunami of 26 December 2004 brought this issue to the forefront. During the Barbados meeting in February 2005 this issue had been discussed. The seismic disaster management, coastal oceanography officials from 12 agencies reviewed the existing monitoring networks, examined data sharing among the networks and planned a programme of action. The 7th Biannual Conference of the Faculty of Pure and Applied Sciences of the University of the West Indies had met in Jamaica and had adopted a resolution to improve the tsunami preparedness using the governments, national, regional and international bodies, civil societies, the private sector, the academic research and educational

communities. At the IOCARIBE Session held in June 2005, a draft resolution had been prepared that was subsequently adopted by the IOC Assembly at its Twenty-third Session as Resolution XXXII-13, as mentioned above. At the IOCARIBE Session, PTWC also agreed to provide an interim advisory service, as was already the case for the Indian Ocean.

304 The ITIC Director noted the presence of two warning centres for the Caribbean and Adjacent Regions, and called for the close coordination between the PTWC and West Coast/Alaska Tsunami Warning Centres in the issuance of tsunami information. Dr Kong recalled the concern on confusing and conflicting tsunami information resulting from the 14 June 2005 earthquake and tsunami warning off northern California, and strongly recommended to ensure that this would not result for the Caribbean.

305 The Chairman then introduced Dr Christa von Hillebrandt-Andrade of the Puerto Rico Seismic Network, Department of Geology, UPRM and invited her to give a presentation on progress with the development of a Caribbean Tsunami Warning System.

Monitoring

306 Seismic Monitoring: At present, there are approximately 20 broadband stations with real-time telemetry and open access to monitoring institutions. These stations are located in Costa Rica (1), Mexico (1), Montserrat Island (1), Nicaragua (1), Puerto Rico (13), Venezuela (1), and Virgin Islands (2). These stations, in addition to other stations in the Atlantic, Pacific, Southern US and Northern South America are also available from the Global Seismic Network (GSN) for regional monitoring purposes. Over the next year, the United States Geological Survey has plans to install GSN quality stations in Antigua, Barbados, Dominican Republic, Honduras, Jamaica, Panama, Trinidad, and Turks and Caicos Islands. Data will be transmitted over satellite and made accessible to monitoring institutions. Satellite communications will be provided by the USGS to the Anegada (British Virgin Islands) and Mona Island (Puerto Rico). Other real-time open broadband stations are to be installed in the region by the Netherlands in Ecuador (3), Grand Cayman Islands (3), St. Martin, Saba and St. Eustatius. The Puerto Rico Seismic Network is aware of other broadband stations which are operating and are being planned for Colombia, Mexico, Venezuela and Central America.

307 DART Buoys: Based on tsunamigenic fault sources, NOAA will be installing seven DART buoys. These stations will be installed offshore of northwestern Puerto Rico, in the Atlantic Ocean, offshore Colombia/Venezuela and in the Gulf of Mexico. The USGS is developing regional assessments of tsunami hazard potential in the Caribbean. Also, the Pacific Marine Environment Laboratory of NOAA is developing tsunami inundation models with the DART buoys.

308 Sea-level stations: Dr von Hillebrandt-Andrade explained that at present there are four tsunami sea-level stations in Puerto Rico which are operated by NOAA. There are plans for NOAA to install or upgrade an additional four stations in the north-eastern Caribbean. Around 40 additional sea-level stations are in existence in the Caribbean that were installed as part of the GOOS sea-level observing network. The status and plans for these stations are uncertain.

Warning and Protocol

309 The Pacific Tsunami Warning Centre has accepted responsibility for providing interim tsunami warning guidance for the region. The various seismic networks, although they are considered authoritative sources for earthquake and potential tsunamis, their response is limited by not having 24x7 hour operations. Due to this and other situations, 24-hour response warning

points are being identified by the different countries. These agencies include, but are not limited to meteorological offices, emergency response agencies, fire stations and police stations. Protocols have and need to be established to coordinate the different actions. In Puerto Rico, three focal points have been identified for the production, reception and/or dissemination of the tsunamis products: Puerto Rico Seismic Network, Puerto State Emergency Management Agency and the US National Weather Service San Juan Field Office. The Puerto Rico Seismic Network has been seeking funding at the state and federal level to serve as a 24x7 Tsunami Warning Centre.

310 Dr von Hillebrandt-Andrade informed the Group that on 2 September 2005, a test was carried out between the PTWC and the established contact points in the Puerto Rico and Virgin Islands region to test the communication system. Of the five contact points established in Puerto Rico (3), Virgin Islands and British Virgin Islands, only one received and responded in a timely fashion.

Research

311 For the Caribbean region, the maximum tsunami inundation maps have been prepared and distributed for Puerto Rico. A Centre for Coastal Hazards has been established in Puerto Rico by Prof. Aurelio Mercado at the University of Puerto Rico at Mayagüez to research all coastal hazards.

Education and Emergency Preparedness

312 Education and emergency preparedness has been identified as a critical part of the Caribbean Tsunami Warning System. In the Caribbean, each nation has the responsibility of designing and carrying out their programme. The Puerto Rico Tsunami Warning and Mitigation Programme, established in 2000 in the University of Puerto Rico at Mayagüez, has carried out the following activities:

- Production and distribution of the documentary ‘Tsunami in Puerto Rico: The Forgotten Danger’. As of 2005, this video is available in VHS and DVD format, in both English and Spanish with subtitles and sign language.
- 250 tsunami warning signs were prepared and installed throughout much of Puerto Rico’s coasts.
- The website <http://poseidon.uprm.edu> is continuously updated.
- Workshops have been held for emergency response personnel on tsunami issues.
- Four tsunami evacuation exercises have been held in schools located in tsunami inundation zones. Personnel from other schools and emergency management agencies have participated so that they can carry out other drills.
- Preparation and distribution of a tsunami fact sheet.

313 The objectives of the education outreach programme of the programme have been for the state, regional and local emergency management officials, and the general population:

1. Review the tsunami inundation maps that have been prepared for Puerto Rico and to become familiar with the extent of the potential flooding.
2. Learn to recognize the natural signs of an impending tsunami emergency.
 - a. An earthquake of intensity VII or greater;
 - b. Water along the coast sea recedes or advances in an uncharacteristic fashion.

Under either of these circumstance people should immediately move inland, towards higher ground or up a building or object.

3. Evacuate or prepare to evacuate if a tsunami warning or watch is issued.

314 **The Group thanked** Dr von Hillebrandt-Andrade for her excellent presentation. **The Group commended** Dr von Hillebrandt-Andrade for her outstanding efforts in the Caribbean region, especially in hazard assessment and mitigation.

315 **The Group invited** Dr von Hillebrandt-Andrade and other Caribbean colleagues to participate in the intersessional working groups that were being established during the current Session of the ICG/ITSU in order to improve coordination.

316 The Group was informed that the Puerto Rico Centre for Coastal Hazards was established within the University of Puerto Rico the previous week, led by Prof. Aurelio Mercado. This centre will recognize the need to address several coastal hazards together, including tsunami, i.e., in a multi-hazard framework.

8.6 INTERGOVERNMENTAL COORDINATION GROUP FOR THE TSUNAMI EARLY WARNING AND MITIGATION SYSTEM IN THE NORTH-EASTERN ATLANTIC, THE MEDITERRANEAN AND CONNECTED SEAS

317 The Chairman introduced this Agenda item. Dr Schindel  recalled that the European Union had funded the ‘Genesis and Impact of Tsunamis on the European Coasts’ (GITEC and GITEC-2) projects between 1993 and 1998. Improvements to tsunami modelling, tsunami catalogues and tsunami-warning systems had been the most important outcomes of these projects. The data collected within the framework of these projects were now included in the HTDB. No real warning system was put in place, except for some prototypes in, France, Greece, Italy and Portugal. Since 1998, no other tsunami projects had been funded by the European Commission. Since the Indian Ocean tsunami of 26 December 2004, several meetings have been held in Europe, several of which were attended by the ICG/ITSU Chairman.

318 The Chairman informed the ICG/ITSU that the IOC Assembly, during its Twenty-third Session adopted Resolution XXIII-14 (Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas). The Chairman informed that the First Session of this Group is planned to take place in Rome, Italy on 21 and 22 November 2005.

319 **The Group noted** the information provided by the Chairman with interest.

320 **The Group recommended** ensuring close coordination and cooperation between the ICG/ITSU and the other Intergovernmental Coordination Groups. In this regard, **the Group recommended** that its Chairperson or Vice-Chairperson should participate in meetings of these other groups and vice-versa.

8.7 FRAMEWORK FOR THE GLOBAL TSUNAMI AND OTHER OCEAN-RELATED HAZARDS EARLY WARNING SYSTEM

321 The Chairman introduced this Agenda item. Dr Schindel  informed the Group that the IOC Assembly, during its Twenty-third Session adopted Resolution XXIII-15 (Establishment of a Framework for the Global Tsunami and other Ocean-related Hazards Early Warning System) which established an ad hoc Working Group.

322 He noted that the Resolution specifically:

“Instructs the IOC Executive Secretary to:

- (i) invite Member States and Chairpersons of relevant IOC subsidiary bodies to participate in this ad hoc Working Group;*
- (ii) invite the WMO, ISDR, GEO and relevant intergovernmental and other organizations to participate in the work of the ad hoc Working Group;*
- (iii) submit the report of the ad hoc Working Group to the Thirty-ninth Session of the Executive Council.”*

323 The Group was further informed that the ad hoc Working Group would focus on what additional value a global layer could add to the various regional tsunami warning systems that were being set up. It was expected in this regard that the experience gained in one region would be of interest and benefit to others. The Group might also look into the benefits of cooperation in global tsunami research. It was further noted that invitations for the meeting of this Group would be extended to Member States and Chairpersons of relevant IOC subsidiary bodies, as well as the WMO, ISDR, GEO and relevant intergovernmental and other organizations. In this regard, reference was made to SOPAC.

324 **The Group recommended** the establishment of a global tsunami web site that would serve as a central portal to all regional and national tsunami web sites and would address all user audiences. In this regard, reference is made to Agenda item 7.3 (ITSU web sites) and 7.2 (TsunamiTeacher).

325 Australia informed the Group that it would be willing to consider providing support for the development of this global tsunami web site portal.

326 **The Group instructed** the IOC Secretariat and ITIC to prepare a proposal by the end of 2005, invited Member States to assist in the drafting, and requested the IOC Secretariat to submit the proposal to Australia for consideration.

9. EXISTING PARTNERSHIPS AND OPPORTUNITIES FOR NEW ONES

9.1 COOPERATION WITH THE IUGG TSUNAMI COMMISSION

327 Prof. Kenji Satake, Chairman of the IUGG Tsunami Commission, introduced this Agenda item. He recalled that the International Union of Geodesy and Geophysics (IUGG)’s Tsunami Commission (TC) was co-sponsored by IASPEI (International Association of Seismology and the Earth’s Interior), IAPSO (International Association of Physical Science of the Ocean) and IAVCEI (International Association of Volcanology and Chemistry of the Earth’s Interior). The establishment of the IUGG TC had taken place following the 1960 Chilean earthquake and had also led to close collaboration with the IOC’s Pacific Tsunami Warning System programme, ITSU. He described a number of scientific achievements since the 1960s, such as the plate tectonics theory, mathematic modelling of earthquake source, worldwide standardized seismograph network, kinematic fault model, seafloor displacement due to faulting, moment magnitude scale, seismic moment tensor, the establishment of the Global Digital Seismic Network, the routine dissemination of Harvard CMT, heterogeneous slip distribution, numerical computation of tsunamis, real-time acquisition and analysis of seismic data, real-time exchange of research results, geological and historical studies of historical tsunamis, etc. He identified some future challenges for tsunami warning systems such as the assessment of unusual tsunamis, probabilistic tsunami hazard estimates based on recent, historical and prehistoric data,

instrumentation, numerical simulation methods for generation, propagation and inundation, and education and awareness.

328 He then reported on the activities of IUGG-TC during the past two years. They include the publication of the Proceedings of the Tsunami Session held during the July 2003 IUGG General Assembly, and the Joint Workshop with ICG/ITSU just before the ITSU-XIX meeting in Wellington, New Zealand. The IUGG contributed to its Tsunami Commission some funds to purchase the proceeding volumes of that Workshop and distributed them to Tsunami Warning Centres in the world. The books were also distributed by Prof. Satake during the ITSU-XX Session.

329 At the Twenty-Second International Tsunami Symposium held in June 2005 in Chania, Greece, three working groups were formed for collecting data; tsunami measurement data, tsunami instrumental data and tsunami satellite data. It is expected that the working groups will first discuss the data format and will then request data from the community. The collected data will be compiled and made available on CD or other forms, and will be provided to the community, as well as to the National Geophysical Data Centre.

330 Prof. Satake further informed the Group that the Joint IUGG/ITSU Workshop, held in Santiago, Chile on 29 and 30 September 2005 had been attended by 50 participants from 14 countries. Twenty-six presentations were made by experts from 11 countries. The Workshop had made the following recommendations and needs (see also [Annex IV](#)):

1. Lessons from the 2004 tsunami show the need for:
 - (a) improvement and standardization of sea-level network;
 - (b) free and open real-time data exchange on tsunami;
 - (c) forty year experience of Pacific for Indian Ocean and Atlantic Ocean;
 - (d) better documentation of coastal effect of recent large tsunamis.
2. Tsunami Hazard Maps, from global to local levels.
3. Global Tsunami Data Base.
4. Paleotsunami studies.
5. Multi-purpose real-time sea-level monitoring network.
6. New forecasting methods for tsunami warning.
7. Sharing operational experience of emergency management.
8. Tsunami education and awareness.

331 **The Group thanked** Prof. Satake for his excellent presentation. **The Group stressed** that close cooperation between ITSU and the science community is extremely important for the future of tsunami warning and mitigation, and that the tsunami science community develops the tools that are needed by the operational tsunami warning centres. **The Group welcomed** continued close collaboration between the ICG/ITSU and the IUGG TC and recommended continuing to organize a workshop in conjunction with the next ITSU session.

9.2 COOPERATION WITH ISDR AND WMO

332 The Chairman introduced this item and referred to Agenda item 8.4 which clearly illustrated the close collaboration between IOC and ISDR and WMO within the framework of the development of the Indian Ocean Tsunami Warning and Mitigation System. The cooperation

between IOC, ISDR and WMO was based on complementary competences of the partners, resulting in an end-to-end approach of tsunami warning and mitigation.

- 333 Dr Schindelé introduced the proposal to expand this cooperation to the Pacific region. In this regard, ISDR has expressed interest and willingness to collaborate with IOC in this regard. The Chairman will call that the Sessional Working Group on the Development of an ITSU Medium-term Strategy (Agenda item 4.2) and was requested to take into consideration the cooperation with WMO and ISDR.
- 334 The ITIC Director reported on the intersessional cooperation between ITSU and the ISDR, referring to the activities in 2005 carried out in collaboration for the implementation of the Indian Ocean Tsunami Warning and Mitigation System.
- 335 Dr Kong recalled the cooperation starting with the ISDR-led OCHA Flash Appeal proposal which obtained US\$ 11 million for the Evaluation and Strengthening of Early Warning Systems (TSU-REG-05/CSS06-REGION), noting the large number of tsunami-related sessions that took place during the ISDR World Conference on Disaster Reduction (18–22 January 2005, Kobe, Japan).
- 336 Dr Kong further elaborated on the close cooperation with ISDR and Japan for the conduct of the ISDR-IOC Japan and Hawaii Tsunami Warning System Study Tours for high level administrators responsible for tsunami warning activities (July 2005), and the ITIC involvement in the ISDR Planning Workshop on Public Awareness and Education Component of Early Warning Strengthening Project (7–8 September 2005, Bangkok, Thailand).
- 337 The ITIC Director reported that a number of activities are planned with the ISDR Platform for the Promotion of Early Warning and ISDR Communications liaison. These include Media awareness building with the Asian Broadcasting Union and the Japan NHK with focus on ITSU Members Indonesia, Sri Lanka and Thailand, and an animated computer game on disaster reduction involving the building of communities and the consequences of design and policy decisions when natural disasters, such as tsunamis, earthquakes, and volcanic eruptions, hit. The target audience will be both government officials and the public, and the use of realistic scenarios to provide informative consequences in a fun and educational manner.
- 338 **The Group welcomed** the close collaboration between IOC, WMO and ISDR in the development of the Indian Ocean Tsunami Warning and Mitigation System and **recommended** that such cooperation be established with the ICG/ITSU.

9.3 COOPERATION WITH IHO

- 339 Past Chairman, Mr Hugo Gorziglia introduced this Agenda item.
- 340 Mr Gorziglia informed the Group that the International Hydrographic Organization (IHO) had been established to facilitate the provision of adequate and timely hydrographic information for world-wide marine navigation and other purposes, through the co-ordination of the endeavours of national hydrographic offices. The specific objectives were: (i) the co-ordination of the activities of national hydrographic offices; (ii) the greatest possible uniformity in nautical charts and documents; (iii) the adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys; and (iv) the development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography. The IHO currently has 76 Member States. It has a regional sub-structure, the so-called ‘Regional Hydrographic Commissions’.

341 Mr Gorziglia recalled that there exists a Memorandum of Understanding between IOC and IHO. This describes collaboration related to (i) IOC-IHO General Bathymetric Chart of the Oceans (GEBCO), and in the development of International Bathymetric Charts (IBC); (ii) measures to strengthen and broaden their reciprocal co-operation, particularly with respect to the provisions of the UNCLOS; (iii) to develop a concept for making available data; (iv) the formulation of proposals for, and the execution of, technical cooperation projects; (v) promotion of training, education and capacity building in all spheres of mutual interests; (vi) inviting each other's representatives to attend and actively participate, in meetings of their respective governing and subsidiary bodies; (vii) considering the possibility of temporary exchange of personnel; and (viii) holding periodic coordination meetings IOC-IHO. Mr Gorziglia then provided details on some of the cooperation activities between IOC and IHO.

342 With regard to tsunami warning he suggested cooperation in the following areas:

- to provide NAVAREA Coordinators and mariners with basic information on tsunamis level of risk to the mariner. (Preparedness);
- to instruct on the meaning of different types of messages and actions to be taken (Preparedness);
- to provide the mariner with timely and relevant information on tsunami warning through a standardize procedure (Warning).

343 Noting that several countries in Africa, Asia and Central America had not joined IHO, and taking into consideration that these countries were prone to tsunamis, the Group urged these countries to consider becoming IHO Member States so as to fully benefit from the IHO programmes related to bathymetry and cartography that would assist them in addressing the necessary tsunami risk assessment, specifically inundation mapping.

344 **The Group welcomed** the support provided by Italy 'Building Coastal Resilience to Ocean-based Extreme Events through Improved Coastal Mapping Capacity in the Indian Ocean' that would assist Bangladesh, Indonesia, Kenya, Madagascar, Mozambique, Myanmar, Sri Lanka, Tanzania, and Thailand to address the need for countries to acquire and fully exploit Coastal Bathymetry data for the development of various products required for preparedness and mitigation of ocean-based extreme events. **The Group recommended** that IHO consider that a similar project should be considered for countries in the Pacific.

9.4 COOPERATION WITH CTBTO

345 The Chairman introduced this Agenda item. Dr Schindelé recalled that the Comprehensive Nuclear Test Ban Treaty Organization had invited the ITSU Chairman, PTWC Director and Director of NWPTAC to the plenary session of its Working Group B (21 February 2005, Vienna, Austria). The ITSU Chair presented a keynote lecture and provided information on the ITSU Group, the characteristics of the tsunami phenomena and the strategy of the Pacific Tsunami Warning System. As a result, the CTBTO offered to IOC to send to PTWC and NWPTAC data of seismological and hydroacoustic stations to improve the rapidity to detect major earthquakes in the Pacific and in the Indian Ocean.

346 Dr Sergio Barrientos, Chief, Seismic Section, International Monitoring System of the CTBTO, addressed the Group. He explained that the CTBTO system components of interest here are the primary seismic and auxiliary seismic stations. The primary stations send data in continuous mode to Vienna, whereas the auxiliary stations are interrogated when an event has been detected by the network. There are 50 primary stations and 120 auxiliary stations. All data

are transmitted through a global telecommunication system (satellite) and broadcast to Vienna. It is expected that by 2007 the primary network will be fully completed. The network also includes 11 hydroacoustic stations (six hydrophone —pressure gauges and five T-phase seismic stations located on islands).

347 Dr Barrientos recalled that the Preparatory Commission, on 5 March 2005, had endorsed a recommendation whereby the Working Group B recommends that the Preparatory Commission tasks the PTS to *“Explore and initially assess with national authorities and international tsunami warning organizations recognized by UNESCO, upon their request, which data and products might be useful and can be provided by the PTS for tsunami warning. [...] The technical tests could include primary seismic and hydroacoustic data, and, upon request, auxiliary seismic data, from selected stations, and results of automatic analysis of such data. [...]”*. A test had subsequently been carried out with JMA, as well as with PTWC. The results of the tests will be presented at the next meeting of the Working Group B in February 2006 and possibly a recommendation for further action will be adopted. He noted that the data of the system is normally only shared with data centres in each country and is not available freely.

348 Japan informed the Group that JMA uses seismic data of the Global Seismic Network (GSN) from the LISS and IRIS server for the Northwest Pacific Tsunami Advisory and also for interim provision of the Indian Ocean tsunami advisory information. The JMA is also seeking the use of seismic data of the CTBTO seismic network. Under the cooperation with CTBTO, JMA started technical experiments, and now receives seismic data from 14 seismic stations on a real-time basis. The JMA reported in early September 2005, the result of the experiments to the CTBTO Working Group B, and showed the importance of the CTBTO data for tsunami warning.

349 The United States of America reported that the ITSU Chairman, Vice-Chairman and JMA representatives provided technical briefings to the CTBTO Working Group B in February 2005, in an effort to obtain support for the release of CTBTO seismic and hydro-acoustic data to support tsunami warnings. The Working Group B approved release of the CTBTO data to JMA, PTWC, and USGS for evaluation. In September 2005, the US Delegate, along with representatives from JMA and the USGS, presented preliminary results to Working Group B, indicating that the CTBTO data provided benefits to the tsunami-warning programme. The Working Group B responded by authorizing continuation of testing. A follow-on report will be delivered in February or March 2006.

350 **The Group expressed** its great appreciation for the offer by CTBTO to provide data of their seismic and hydroacoustic stations in real-time for tsunami warning purposes and to improve the rapidity and efficiency of detection of large earthquakes in the Pacific. **The Group welcomed** closer and continued cooperation between ITSU and CTBTO and **requested** PTWC and JMA to report on the results of the test to the Officers and to ICG/PTWS-XXI.

9.5 WORLD DATA CENTRE-A, SOLID EARTH GEOPHYSICS DEVELOPMENTS RELATED TO TSUNAMIS

351 This Agenda item was discussed under Agenda item 3.6. It had been decided there to request Dr Gusiakov and Dr Dunbar to prepare a work plan for future action. The Chairman invited Dr Dunbar to introduce the work plan.

352 Ms Dunbar explained that there are currently two separate global historical tsunami databases, maintained by Dr Gusiakov of NTL/ICMMG and Ms Dunbar of NOAA/NGDC-WDC. Since the ICG/ITSU expressed the desire to have one unified database to reduce the

confusion caused by having two databases, the database managers developed, during the ITSU-XX Session, a work plan to meet this goal.

353 They noted that there are more than 2,400 events that will require comparison. After some discussion between Dr Gusiakov, Dr Dunbar, and Dr Kong, it was determined that a more realistic approach would be to begin with the largest events that contribute the most to the tsunami risk. There are approximately 300 events with maximum run-up >5 m and/or >10 deaths. Basic source data for these 300 events could be verified within a relatively short time (~1 year), thus improving the quality of the most frequently accessed portion of the databases. This work will begin using e-mail exchange and Internet access to the databases. If Dr Gusiakov is able to come to the USA during 2006, he will visit the ITIC and the NGDC for additional work in resolving the differences in the databases. At the end of the first year, the source data for the largest events will be the same in the two databases. During the second year, the data managers will continue the comparison with the goal of ultimately having one unified database.

9.6 COOPERATION WITH SOPAC

354 Mr Lasarusa Vuetibau (Fiji) and Mr Malaefatu Leavasa (Samoa) introduced this Agenda item.

355 They explained that, because of their geographical location, Southwest Pacific countries are vulnerable to Earthquakes and Tsunamis. Recognition of the Pacific Island Countries' (PICs) vulnerability is not a new issue: it has been highlighted in the Barbados Plan of Actions, Hyogo framework for Actions, Madang meeting, etc. The severe lack of resources, technical and human capacity constraints has prompted PICs to adopt a perspective for an integral approach to Early Warning Systems, i.e., the Tsunami Early Warning system is part of a bigger all hazards approach. Most PICs do not have seismic networks; Fiji, Papua New Guinea and Tonga are known to operate their own National Seismograph Networks which are not geared for Early Warning Systems (EWS) but largely to monitor seismicity. It has been realized that the existing communication networks between countries, within countries i.e., between urban centres and the remote parts of the islands need to be improved. Most seismic monitoring systems in the Southwest Pacific are obsolete and also there is a lack of broadband seismic stations to monitor tsunamigenic events. Some PICs have also raised concerns on the need for real-time access to tide gauge data.

356 They stated that the most effective tools for community preparedness, particularly in the 'Big Ocean, Small Islands' context of the Southwest Pacific are well functioning early warning systems that deliver accurate and understandable information to our communities in a timely manner. EWS will be very effective when communities are very well aware of the nature of the hazards and risks that threaten their livelihoods and how to respond to the alert/warning messages delivered to them through the EWS. It is imperative that the rigorous Tsunami Awareness outreach be regularly carried out to our PICs coastal communities.

357 They also identified the following issues that needed to be addressed:

- The current status of existing seismic monitoring systems in the Southwest Pacific region.
- Identifying the existing gaps within the system and prioritising the actions required to address them.
- Gaining commitment of funding support to achieve the objectives of the Regional Framework for Action in relation to Early Warning Systems.

358 **The Group thanked** Mr Lasarusa Vuetibau and Mr Malaefatu Leavasa for their interesting presentation.

359 Referring to the statement by Australia regarding support for the South West Pacific (Agenda Item 8.3), **the Group looked forward** to further active participation of the SOPAC Member States in the PTWS and **invited** the SOPAC Secretariat to participate in the future work of the ICG/ITSU.

360 The ITIC Director reported on the inter-sessional cooperation between ITSU and SOPAC. Dr Kong reported on the collaboration in 2004 and 2005 for the conduct of two tsunami awareness workshops for the South Pacific Tsunami Awareness Workshop (SPTAW), 1–3 July 2004, and the North Pacific Tsunami Awareness Workshop, 20–22 November 2005. Additionally, the ITIC and PTWC are collaborating with the Pacific Disaster Centre and SOPAC on the development of a Southwest Pacific Tsunami Awareness Kit which will produce a Sample Kit for Fiji by the end of 2005.

361 The PTWC Director reported on the tsunami early warning and mitigation discussions carried out at SOPAC's A Regional Planning Workshop Enhancing Early Warning for Pacific Island Countries, 5–6 September 2005, Suva, Fiji, in which he and the ITIC attended.

362 The ITIC Director suggested that SOPAC identify an actual person that will be dedicated to advocate and facilitate tsunami mitigation efforts with SOPAC Member States. Dr Kong indicated that a Virtual Centre will not be adequate for sustaining the active, on-going effort that is needed. The person should be able to work on both the technical aspects concerned with sea-level and seismic monitoring, and evaluation and hazard risk assessment and numerical modelling, and the non-technical aspects of national tsunami response plans, emergency management, preparedness, education, and outreach.

363 The ITIC Director recommended that, as appropriate, this person or persons spend at least some of the time at the ITIC and PTWC to understand the processes, protocols, and activities which build an effective system.

364 Possible means of resource mobilization include ITSU Member State secondment, ITSU Member State funding support to the IOC Trust Fund for such a position, and/or SOPAC-generated support through the Pacific Island Forum. In this regards, attention is called to the Commonwealth Secretariat Report for the Inter-regional Expert Consultation on Disaster Warning and Response Systems in Small Island Developing States Regions, (8–9 August 2005, Christ Church, Barbados) calling for high-level advocacy and support for the Pacific in regards to tsunami hazard mitigation and preparedness.

365 The ITIC Director expressed also her appreciation to other Member States, including Australia, France, Indonesia, Japan, New Zealand, and the USA for their continued support and involvement in SOPAC activities in the Pacific Island Countries.

9.7 COOPERATION WITH GLOSS

366 This Agenda item was discussed under Agenda item 5.1.

367 **The Group welcomed** closer collaboration between the ICG/ITSU and the GLOSS programme, and **recommended** that the ICG/ITSU Chair or Vice-Chairman participate in Sessions of the GLOSS Group of Experts.

9.8 COOPERATION WITH JCOMM

- 368 The Technical Secretary introduced this Agenda item and recalled that ITSU-XIX (para. 261) had *“agreed to investigate a potential closer relationship with JCOMM, through a recommendation to the IOC and WMO Executive Councils, and to agree to investigate the benefits and how best they might be realized. The recommendation should envisage a report that would be prepared for consideration by JCOMM-II, which will be held in Halifax, Canada, in the fall of 2005.”*
- 369 The Technical Secretary informed the Group that this matter had been discussed at the JCOMM Management Committee, Third Session (17–20 March 2004, Geneva, Switzerland) through Mr P. Parker and the IOC/ITSU Secretariat.
- 370 The ITSU-XIX (para. 262) had further *“recommended to study the Terms of Reference of the JCOMM Programme Areas in general, and its Expert Teams in particular, and identify areas where JCOMM and ICG/ITSU could collaborate. This could involve the Services, Observations, Capacity Building or Data Management Programme Areas.”* The ITSU-XIX had also adopted ResolutionITSU-XIX.1 (Cooperation with JCOMM).
- 371 This resolution stated *“Decides to study the benefits of establishing cooperative links with JCOMM, and how they might be realized, with the view to presenting a report to WMO and IOC Executive Councils and the JCOMM Management Committee in preparation for consideration by JCOMM-II. (...) Requests the Chair to discuss the co-operation with JCOMM at the appropriate level”.*
- 372 During the December 2004 Officers Meeting, the Chair had reported on his discussion with Dr Johannes Guddal, JCOMM Co-President. Dr Guddal had suggested two ways to start cooperation: (i) to contact the Services Programme Area Chair (Mr P. Parker); (ii) to contact the Chair of the Expert Team on waves and storm surges (Dr Val Swail). The Chair had also informed the Officers that the report of the 2003 Session of the JCOMM Expert Team on wind waves and storm surges made no mention about tsunamis. The Officers had furthermore expressed their concern about the possible transfer of ITSU into JCOMM, as there was currently no reference to tsunamis in any of the relevant Programme Areas (Services and Observations). The Officers had requested the Chair to contact Dr V. Swail on this matter.
- 373 The Chairman participated in the JCOMM Management Committee (9–12 February 2005, Paris) presenting the status report of the ICG/ITSU activities and described the strategy of a tsunami warning system. He focused on the role of GLOSS as a global sea-level network for a tsunami monitoring and warning system. One of the conclusions of this meeting, in addition to the cooperation between WMO and IOC, is that future tsunami warning systems must be developed as part of a more comprehensive natural marine hazards warning system, encompassing storm surges, tropical cyclones, extreme waves, etc.
- 374 The Technical Secretary then referred to the JCOMM-II Summary Report (Agenda item 11.5) which summarized the discussions on Natural Disaster Reduction in general including Tsunami warning and a more comprehensive natural marine hazards warning system, as well as to Recommendation 11/1 of JCOMM-II.
- 375 **The Group welcomed** closer collaboration with JCOMM and requested the Chair and Vice-Chair to liaise with the Coordinators of the JCOMM OPA and SPA to discuss cooperation.

9.9 OTHER

376 The ITIC Director recommended that the ITSU Chair and IOC Technical Secretary welcome, through letter, the close cooperation between ITSU and the Federation of Digital Seismic Networks (FDSN) and its cooperating institutions, notably the Incorporated Research Institutions for Seismology (IRIS) and the International Deployment of Accelerographs (Project IDA).

377 The PTWC Director noted with great appreciation the important contributions of the Global Seismic Network in providing the real-time continuous seismic waveforms that are critical for the earthquake monitoring duties that the PTWC and JMA are engaged in for tsunami warning. He welcomed the continued strong cooperation with IRIS.

378 **The Group welcomed** close collaboration between ICG/ITSU and the FDSN, and **requested** the PTWC and ITIC to liaise with the FDSN and its cooperating institutions on behalf of the ICG/ITSU.

379 The ITIC Director further recommended that the ITSU Chair and IOC Technical Secretary welcome, through letter, the close cooperation between ITSU and the International Federation of Red Cross and Red Crescent Societies. Dr Kong noted the strong role they play in disaster preparedness in the Pacific, and the complementary role they will play by taking the international and national activities which ITSU focuses on and delivering the warning, preparedness, and response information down to the household level through its extensive network of volunteers working at the community level.

380 **The Group welcomed** the close collaboration between ICG/ITSU and the International Federation of Red Cross and Red Crescent Societies (IFRC), and **requested** ITIC to liaise with the IFRC on behalf of the ICG/ITSU.

381 The United States of America recalled that the IOC is a participant in the Group on Earth Observations (GEO) and recommended IOC ensure that tsunami issues be included in the IOC Agenda in its continuing participation in GEO.

10. PROPOSALS FOR FUTURE PROJECTS

382 No proposals were made for future projects.

11. OTHER BUSINESS

11.1 IOC SECRETARIAT ISSUES

383 The Technical Secretary introduced this Agenda item.

384 Mr Pissierssens referred to Agenda item 4.1 where it is stated that *“In terms of the ITSU programme’s position within the IOC Structure, the Chairman informed the ICG/ITSU that, as from the 2006–2007 biennium, the tsunami activities will be placed within MLA-2 (Main Line of Action 2: Developing operational capabilities for the management and sustainable development of the open and coastal ocean). This new structure was agreed upon by the IOC Assembly during its Twenty-third Session (through Resolution XXIII-16: IOC PROGRAMME AND BUDGET FOR 2006–2007). This MLA is managed by Mr Keith Alverson”*.

385 In addition, the Technical Secretary informed the ICG/ITSU that a new 'Tsunami Unit' will be established within the MLA-2. This Unit will include three professional positions, funded from extra-budgetary resources. These will include (i) Office Head (reports to IOC Executive Secretary, manages local staff and budget, serves as Technical Secretary for ICG/ITSU and ICG/IOTWS); (ii) Senior Advisor, Tsunami expert, (reports to Office Head, oversees development of operational seismographic and tsunami warning systems, oversees tsunami-modelling capabilities and related training courses); and (iii) Deputy Head, (reports to Office Head, organizes assessments and expert advice, convenes scientific meetings and training courses). The Senior Advisor has been identified and will be Mr Masahiro Yamamoto. It is noted that the positions will be established for a period of three years.

386 The Group was informed that, in view of the establishment of the new Unit the current Technical Secretary for ICG/ITSU might have to transfer his responsibilities to the new Unit and leave his management duties for ICG/ITSU and ICG/IOTWS as soon as the new Unit is operational.

387 **The Group expressed** its appreciation for the support provided by the Technical Secretary during the intersessional period and, in particular, during the past 10 months, after the Indian Ocean tsunami of 26 December 2004.

388 **The Group requested** the IOC Executive Secretary to continue supporting ICG/ITSU during the transition period to the new Tsunami Unit and to maintain Mr Peter Pissierssens as the Technical Secretary for ICG/ITSU at least during the first semester of 2006.

389 **The Group expressed** its appreciation to Germany, Japan and Norway for providing staff to the IOC Secretariat to assist with the implementation of the tsunami programme activities.

390 **The Group welcomed** the provision of staff supported through extra-budgetary funding but **expressed** its concern about the long-term sustainability of such an arrangement. **The Group also requested** the IOC Executive Secretary to clarify to the Chair what would be the responsibilities of the Tsunami Unit in relation to the Secretariats of the newly established ICGs.

12. PROGRAMME AND BUDGET

391 The Technical Secretary informed the ICG/ITSU about the UNESCO Regular Programme funding that will be made available for ICG/ITSU in the 2006–2007 biennium. He noted that this budget had been submitted for approval to the UNESCO General Conference (33rd Session), being held in October 2005. The proposed budget is as follows (MLA-2) (as detailed in Resolution XXIII-16):

MLA 2 Developing operational capabilities for the management and sustainable development of the open and coastal ocean	In US\$
GOOS	606,423
<i>Rio GOOS Staff</i>	<i>66,000</i>
<i>Perth Office Staff</i>	<i>160,000</i>
<i>GOOS-Africa Staff</i>	<i>50,000</i>
ITSU	72,123
JCOMM	139,831
<i>JCOMM Staff</i>	<i>50,000</i>
IODE Activities	143,510
<i>Ostend Office Staff</i>	<i>120,000</i>
Ocean Mapping	60,348
Sub-total MLA 2	1,468,235

392 He explained that the table showed that ITSU would be allocated a budget of US\$ 72,123 (this would be reduced by another 13.4% to cover running costs bringing the expected available budget to approximately US\$ 63,600/biennium or approximately US\$ 31,800/year).

393 It was further noted that the above-mentioned Resolution XXIII-16 “*Appeals to the Thirty-third General Conference of UNESCO to approve the supplementary amount of US\$ 1,000,000 to be allocated to IOC for helping Member States to develop Tsunami Early Warning Systems*”.

394 The sessional working group on “Programme and Budget 2006–2007”, established under Agenda item 2.5, prepared a detailed work plan for the next intersessional period, taking into consideration the discussions under all agenda items as well as the available UNESCO regular programme funds. The Chairman also invited Member States to provide information on expected extra-budgetary support as well as in-kind contributions and requested the sessional working group to incorporate this information in the Programme and Budget.

395 **The Group adopted** [Recommendation ITSU-XX.4](#).

13. DATE AND PLACE FOR ITSU-XXI (to be renamed ICG/PTWS-XXI)

396 The Technical Secretary introduced this Agenda item and noted that the Session had decided to hold its Twenty-first Session prior to the Thirty-ninth Session of the IOC Executive Council (21–28 June 2006, UNESCO Headquarters, Paris). The Technical Secretary referred also to the offer made by Ecuador, during ITSU-XIX, to host the Twenty-first Session in Ecuador (para. 299 of the ITSU-XIX report) in 2007.

397 **The Group decided** to organize its Twenty-first Session in 2006, possibly during the last week of April 2006.

398 Australia informed the Group that it was offering to host the Twenty-first Session of the ICG/ITSU. The Group gratefully accepted the offer of Australia.

399 Ecuador offered to host the Twenty-second Session in 2007. **The Group gratefully accepted** the offer of Ecuador.

14. ELECTION OF CHAIR AND VICE-CHAIR

400 The Technical Secretary introduced this Agenda item. Mr Pissierssens referred in this regard to the practical arrangements for the election of the Officers of the main subsidiary bodies as they are presented in the IOC Manual (INF-785, Section 5, ‘Officers’), which states:

“Unless nominated by the parent body, the Chairman and a Vice-Chairman shall be elected by the subsidiary body itself. Both shall normally serve for one intersessional period and the next session, if any, of the subsidiary body; if there is no such session (e.g., in the case of a Task Team working by correspondence), the intersessional period shall be that of the parent body. The Chairman and the Vice-Chairman shall be eligible for re-election for only one more inter-sessional period and subsequent session as just defined; however, on an exceptional basis and in the interest of the Commission, both may be eligible for one further term”.

401 He recalled that Dr François Schindelé and Dr Charles McCreery had been elected Chairman and Vice-Chairman respectively, during the Seventeenth Session of the ICG/ITSU in 1999. The election of Chair and Vice-Chair was not included in the Agenda of the Eighteenth Session in 2001. They were re-elected a second time during the Nineteenth Session in 2003 bringing their total number of Terms of Office to three (which is in accordance to the rules).

402 The Technical Secretary further informed the Group that Circular Letter No. 2341 (dated 17 December 2004) had invited Member States to nominate candidates for the position of the ICG/ITSU Chair and Vice-Chair. To this Circular Letter, two responses were received. For the position of Vice-Chair the nomination of Mr Fred Stephenson (Canada) was received on 14 June 2005. For the position of the ICG/ITSU Chair, the Secretariat received the nomination of Capt. Roberto Garnham but this nomination was withdrawn on 31 August 2005. The nomination of Capt. Rodrigo Nuñez for the position of the ICG/ITSU Chair was received on 3 October 2005.

403 **The Group unanimously elected** Capt. Rodrigo Nuñez as Chairman and Mr Fred Stephenson as Vice-Chairman.

404 **The Group recommended** electing, as from the next occasion, two Vice-Chairpersons, following the example of the ICG/IOTWS. In this regard, it was stated that the Second Vice-Chairperson should be selected from a small country that has not yet established a national tsunami warning system.

15. ADOPTION OF THE SUMMARY REPORT, RESOLUTIONS AND RECOMMENDATIONS

405 **The Group reviewed** the draft resolutions and recommendations and the draft Summary Report and **adopted** them as herein presented. **The Group requested** the ICG/ITSU Chairman and the IOC Technical Secretary to prepare an Action Sheet on the ITSU-XX decisions by the end of October 2005, and to make it available to all Member States and ITSU-XX participants through the IOC/ITIC web site.

406 **The Group requested** its Chair to report on the proceedings of the ITSU-XX Session to the Thirty-ninth Session of the IOC Executive Council, 21–28 June 2006, UNESCO Headquarters, Paris.

407 **The Group considered** the work practises of the Group and ways to improve them. In this regard, **the Group recalled** that the IOC, in 2001, had revised its Rules of Procedure (Doc.

IOC/INF-1166) and under Rule 48 item 3, had outlined the reporting expectations of its subsidiary bodies. It was noted that the IOC Governing Bodies (IOC Assembly and IOC Executive Council) were the only bodies that were required to adopt a Summary Report in session. Subsidiary bodies are required to submit to the next Assembly or the Executive Council *“a short and concise report on its work [...] containing the following elements: election of Officers, resolutions, financial implications, a list of draft recommendations, major achievements and problems occurred during the intersessional period, list of participants and annexes as needed.”*

408 **The Group decided**, for future sessions, to only adopt the action items, resolutions and recommendations in session. For the parts of the Summary Report that include introductions of agenda items, reports on progress and other text with an informative nature, authors will be requested to submit contributions prior to the Session. These parts will be prepared by the Secretariat after the Session as the summary report and will henceforth not be formally adopted during the Session. **The Group further requested** the Secretariat to continue preparing a detailed Annotated Agenda for future Sessions, as had been done for the current Session.

16. CLOSURE

409 The Chairman declared the Session closed at 13h30 on Friday, 7 October 2005.

ANNEX I

AGENDA

- 1. OPENING**
- 2. ORGANIZATION OF THE SESSION**
 - 2.1 ADOPTION OF THE AGENDA
 - 2.2 DESIGNATION OF RAPPORTEUR
 - 2.3 SESSION TIMETABLE AND DOCUMENTATION
 - 2.4 LOCAL ARRANGEMENTS
 - 2.5 ESTABLISHMENT OF SESSIONAL WORKING GROUPS
- 3. PROGRESS IN THE PROGRAMME IMPLEMENTATION**
 - 3.1 REPORT OF THE CHAIRMAN ON INTERSESSIONAL ACTIVITIES
 - 3.2 NATIONAL REPORTS
 - 3.3 ITIC DIRECTOR'S REPORT
 - 3.4 PTWC DIRECTOR'S REPORT
 - 3.5 REPORT OF THE WORKING GROUP ON A COMPREHENSIVE TSUNAMI HAZARD REDUCTION PROGRAM
 - 3.6 REPORT ON THE GLOBAL HISTORICAL TSUNAMI DATABASE PROJECT
 - 3.7 REPORT ON THE INTERNATIONAL TSUNAMI SIGNS AND SYMBOLS
- 4. ITSU STRATEGIC PLAN**
 - 4.1 DEVELOPMENT OF AN ITSU MEDIUM-TERM STRATEGY
 - 4.2 ITSU REVIEW
 - 4.3 ITSU MASTER PLAN
 - 4.4 ITSU COMMUNICATION PLAN
 - 4.5 ORGANIZATION OF PACIFIC WIDE TSUNAMI DRILL
- 5. OBSERVATION SYSTEM AND RELATED MATTERS**
 - 5.1 SEA-LEVEL OBSERVATIONS
 - 5.2 SEISMIC OBSERVATIONS
 - 5.3 DATA COMMUNICATION ISSUES
 - 5.4 OTHER
- 6. TRAINING AND EDUCATION**
 - 6.1 ITSU TRAINING PROGRAMME: REPORT ON INTER-SESSIONAL ACTIVITIES
 - 6.2 FUTURE ITSU TRAINING PROGRAMME
 - 6.3 PUBLIC EDUCATION
- 7. ITSU PUBLICATIONS AND AWARENESS TOOLS**
 - 7.1 TSUNAMI NEWSLETTER
 - 7.2 TSUNAMI INFORMATION KIT
 - 7.3 ITSU WEBSITES

7.4 OTHER

8. REGIONAL AND OTHER TSUNAMI WARNING SYSTEMS

- 8.1 NORTHWEST PACIFIC TSUNAMI WARNING SYSTEM
- 8.2 CENTRAL AMERICA PACIFIC COAST TSUNAMI WARNING SYSTEM
- 8.3 SOUTHWEST PACIFIC TSUNAMI WARNING SYSTEM
- 8.4 INTERGOVERNMENTAL COORDINATION GROUP FOR THE INDIAN OCEAN TSUNAMI WARNING AND MITIGATION SYSTEM
- 8.5 INTERGOVERNMENTAL COORDINATION GROUP FOR TSUNAMI AND OTHER COASTAL HAZARDS WARNING SYSTEM FOR THE CARIBBEAN AND ADJACENT REGIONS
- 8.6 INTERGOVERNMENTAL COORDINATION GROUP FOR THE TSUNAMI EARLY WARNING AND MITIGATION SYSTEM IN THE NORTH-EASTERN ATLANTIC, THE MEDITERRANEAN AND CONNECTED SEAS
- 8.7 FRAMEWORK FOR THE GLOBAL TSUNAMI AND OTHER OCEAN-RELATED HAZARDS EARLY WARNING SYSTEM
- 8.8 OTHER REGIONS

9 EXISTING PARTNERSHIPS AND OPPORTUNITIES FOR NEW ONES

- 9.1 COOPERATION WITH THE IUGG TSUNAMI COMMISSION
- 9.2 COOPERATION WITH ISDR AND WMO
- 9.3 COOPERATION WITH IHO
- 9.4 COOPERATION WITH CTBTO
- 9.5 WORLD DATA CENTRE-A, SOLID EARTH GEOPHYSICS DEVELOPMENTS RELATED TO TSUNAMIS
- 9.6 COOPERATION WITH SOPAC
- 9.7 COOPERATION WITH GLOSS
- 9.8 COOPERATION WITH JCOMM
- 9.9 OTHER

10. PROPOSALS FOR FUTURE PROJECTS

11. OTHER BUSINESS

- 11.1 IOC SECRETARIAT ISSUES
- 11.2 REVISION OF THE NAME OF THE ICG/ITSU AND ITS TERMS OF REFERENCE

12. PROGRAMME AND BUDGET FOR 2006–2007

13. DATES AND PLACE FOR ITSU-XXI

14. ELECTION OF CHAIR AND VICE-CHAIR

15. ADOPTION OF THE SUMMARY REPORT AND RECOMMENDATIONS

16. CLOSURE

ANNEX II

RESOLUTIONS AND RECOMMENDATIONS

Resolution ITSU-XX.1

INTERGOVERNMENTAL COORDINATION GROUP FOR THE PACIFIC TSUNAMI WARNING AND MITIGATION SYSTEM (ICG/PTWS)

The International Coordination Group for the Tsunami Warning System in the Pacific,

Noting that the IOC Assembly, during its Twenty-third Session, adopted three resolutions (Resolution XXIII-12, Resolution XXIII-13 and Resolution XXIII-14) establishing the “Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS)”, the “Intergovernmental Coordination Group for Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions” and the “Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connecting Seas”;

Recalling that the Tsunami Warning System in the Pacific (ITSU) covers the Pacific Ocean, the Southern Ocean regions of the Pacific and all attached seas, including the Philippine Sea, East China Sea, Yellow Sea, Sea of Okhotsk, Bering Sea, South China Sea, Java Sea, Arafura Sea, Sulawesi Sea, Mindanao Sea, Sulu Sea, Celebes Sea, Bismark Sea, Solomon Sea, Coral Sea, and Tasman Sea,

Reaffirming that the ITSU is a coordinated network of regional, sub-regional and national systems and capacities,

Reaffirming further that Member States should have the responsibility to have control over the issuance of warnings within their respective territories,

Recognising that the timely access to seismic, sea-level and other related data is the key to an effective tsunami warning system,

Recognising that:

- (i) the impact of tsunamis can be substantially reduced through institutional and legislative frameworks, as well as community participation, and that this requires tsunami warnings must reach local communities by various means and be understood at all levels, so that people are well informed and motivated towards safety measures and actions,
- (ii) Member States build public awareness through education and capacity building to ensure effective community awareness of the risks posed by tsunamis, so that their population is prepared for, and knows how to act in the event of a tsunami warning,
- (iii) a role for the ITSU is to promote amongst its members good practice examples of capacity and resilience building, and emergency management to improve the management of tsunami risk through mitigation, preparedness, response and recovery activities,

Stressing that all IOC Member States should make every endeavour to:

- (i) exchange seismic, sea-level and other data relevant to tsunamigenic events at or near real-time with interested Member States,
- (ii) exchange national assessments and warnings of tsunamigenic events and tsunamis with interested Member States in a timely manner,

Expressing appreciation to the Secretariat of the UN International Strategy for Disaster Reduction (ISDR) for its guidance and support, and to the World Meteorological Organization (WMO) for contributing its infrastructure and technical support,

Noting that the International Tsunami Information Centre (ITIC) was established by the IOC through Resolution IV-6 (1965) and hosted by the United States of America in Honolulu, Hawaii,

Recognising:

- (i) the long experience of the ITIC as the primary provider of information and expertise for technology transfer, training and capacity building for the Tsunami Warning System in the Pacific in conjunction with the IOC Secretariat,
- (ii) the long experience of the Richard H. Hagemeyer Pacific Tsunami Warning Centre (PTWC) in Hawaii as the primary operational centre for the Tsunami Warning System in the Pacific,

Welcoming the continuing strong support of the United States of America for the operation of the PTWC and ITIC,

Decides:

- (i) to rename the “International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU)” to the “Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)” to align its name with the other tsunami warning and mitigation systems and their governing bodies established under the auspices of the IOC;
- (ii) to revise the Terms of Reference for the ICG/ITSU to align them with the approaches adopted for other tsunami warning and mitigation systems, and to accommodate the unique role of the ITIC, as established in Resolution IV-6 (1965), and elaborated in Resolution X-23 (1977) and Resolution EC-XXI.4 (1988), and as detailed in Annex to this Resolution;
- (iii) that the IOC shall provide the Secretariat of the ICG/PTWS;
- (iv) that the IOC’s ITIC shall assume the role of Secretariat for the ICG/PTWS, with the Terms of Reference as detailed in Annex to this Resolution;
- (v) that the Director and Associate Director of ITIC also officially hold the titles of the Director and Associate Director of the IOC Secretariat for the ICG/PTWS, and serve as *ex-officio* office holders of the ICG/PTWS;
- (vi) that ITIC continue to act as the primary provider of information and expertise for technology transfer, training and capacity building;

Agrees that ITIC shall provide advice and support on request to the members of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and

Mitigation System”, the “Intergovernmental Coordination Group for Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions” and the “Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connecting Seas” and other countries and regional organisations desiring assistance;

Agrees that:

- (i) the “Richard H. Hagemeyer Pacific Tsunami Warning Centre (PTWC)” in Hawaii continue to act as the primary operational centre for the PTWS, noting that there are a number of other tsunami warning and mitigation capabilities in the Pacific;
- (ii) the Director of the PTWC continue to serve as an *ex-officio* office holder of the ICG/PTWS;

Agrees further that, to facilitate durability, the Pacific Tsunami Warning and Mitigation System should utilize or build on, where possible, existing organizations and institutions and complement existing warning frameworks, and within a multi-hazard approach where appropriate;

Requests to the *ad hoc* IOC “Working Group to prepare a framework for a global tsunami and other ocean-related hazards early warning system” that it considers how the word “ITSU” might be applied as a brand name for global tsunami warning and mitigation related activities;

Decides that the ITIC will report on its activities, including on those in its role as the IOC Secretariat for the ICG/PTWS, at each session of the ICG/PTWS;

Invites IOC Member States, including Member States of the PTWS, to encourage countries in the Pacific that are not already participating in the PTWS, to join the IOC and PTWS, and that in doing so, members should clarify to them the benefits that accrue from membership of the PTWS, which does not require any set annual financial contribution;

Requests that the IOC Secretariat in Paris promote interoperability amongst all tsunami warning and mitigation systems;

Requests that tsunami warning and mitigation activities undertaken by the IOC, WMO, ISDR and others be appropriately consistent.

Financial implications: none

Annex to Resolution ITSU-XX.1

Terms of Reference of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)

The ICG will be a subsidiary body of the IOC and will report to, and seek guidance from, the IOC Assembly.

Objectives:

1. To coordinate the activities of the PTWS;

2. To organize and facilitate as appropriate the exchange of seismic, sea-level and other data at or near real-time and information required for the interoperability of the PTWS;
3. To promote the sharing of experience and expertise related to tsunami warning and mitigation for the Pacific basin;
4. To promote tsunami research;
5. To promote the establishment and further development of national tsunami warning and mitigation capacities in accordance with standard protocols and methods;
6. To develop, adopt and monitor implementation of work plans of the PTWS, and to identify required resources;
7. To promote implementation of relevant capacity-building, resilience building and emergency management, including high levels of public awareness;
8. To liaise and coordinate with other tsunami warning systems;
9. To liaise with other relevant organizations, programmes and projects;
10. To promote the implementation of the PTWS within a multi-hazard framework;
11. To develop and promote best practices in tsunami warning;
12. To keep under constant scrutiny the status of the system and how it satisfies the needs.

The IOC Secretariat for the ICG/PTWS shall:

1. Support the IOC in the coordination of work of the ICG;
2. Facilitate the liaison among the various contact points and tsunami warning centres;
3. Maintain a current list of operational contact points and facilities for the PTWS and make it available on request to all Member States;
4. Maintain a list of those countries that are members of ITSU and a list of those countries that are not members, and make this available on the ITSU website.
5. Organize the liaison between ICG/PTWS and the ICG for other Oceans and Seas to facilitate best practices in tsunami warning;
6. Initiate and support training activities to enhance and enrich tsunami warning in the Pacific.

Membership of the ICG/PTWS:

- Member States of the IOC within and bordering the Pacific Ocean;
- Observers from other IOC Member States.

Invited observers from other organizations (including NGOs), programmes and projects, in accordance with the IOC rules and procedures.

Officers of the ICG/PTWS

- A Chair and two Vice-Chairs, who will be elected in accordance with the Statutes and Rules of Procedure of the IOC,
- Past Chair,
- Director of the PTWC,
- Director and Associate Director of the IOC Secretariat for the ICG/PTWS.

Resolution ITSU-XX.2

**INTER-SESSIONAL WORKING GROUP ON THE MEDIUM TERM STRATEGY
FOR THE PACIFIC TSUNAMI WARNING AND MITIGATION SYSTEM**

The International Coordination Group for the Tsunami Warning System in the Pacific,

Recalling the devastating impact of the Indian Ocean tsunami of 26 December 2004,

Stressing the need for the UN agencies and other partners to work together, reinforcing each other's core areas of expertise,

Noting with appreciation the excellent collaboration between IOC, WMO and ISDR in the establishment of the Indian Ocean tsunami warning and mitigation system,

Recognizing the new context of an end-to-end framework and taking into consideration the need to further develop and maintain national systems in a multi-hazard context,

Decides to establish an inter-sessional working group for the development of a medium-term strategy for the Pacific tsunami warning and mitigation system;

Decides that the Group will be composed of Australia, Canada, Japan and New Zealand and will be chaired by Australia. Other members may be added at the discretion of the Group's Chair;

Decides further that the Group will work by e-mail correspondence;

Requests the Group to take into consideration:

- (i) the work of the inter-sessional working groups on seismic measurements, data collection and exchange; sea-level measurements, data collection and exchange; tsunami hazard identification and characterization; resilience building and emergency management; and interoperability of regional, sub-regional and national tsunami warning systems in the Pacific, established by the ICG/PTWS and other ICGs, as well as any cross-cutting matters between the ICGs;
- (ii) the *ITSU Master Plan*;
- (iii) capacity building requirements of new and existing Member States of the Pacific Tsunami Warning and Mitigation System, as revealed by relevant assessments or as indicated by the Member States;

Instructs the Group to submit to the Twenty-first Session of the ICG/PTWS, a draft of the medium-term strategy for the Pacific Tsunami Warning and Mitigation System.

Financial implications: none

Recommendation ITSU-XX.1

ESTABLISHMENT OF ICG/PTWS INTER-SESSIONAL WORKING GROUPS

The International Coordination Group for the Tsunami Warning System in the Pacific,

Noting the devastating impact of the Indian Ocean tsunami of 26 December 2004 that highlighted the benefits of effective and durable tsunami warning systems,

Recognizing the desirability of continuously reviewing the effective and durable operation of the PTWS,

Decides to establish the following inter-sessional working groups with terms of reference as defined in Annex to this Resolution:

1. Working Group One on Seismic Measurements, Data Collection and Exchange;
2. Working Group Two on Sea-level Measurements, Data Collection and Exchange;
3. Working Group Three on Tsunami Hazard Identification and Characterization, including Modelling, Prediction and Scenario Development;
4. Working Group Four on Resilience Building and Emergency Management;
5. Working Group Five on Interoperability of Regional, Sub-regional and National Tsunami Warning Systems in the Pacific;

Decides further that membership of the working groups shall be open to all IOC Member States and invited organizations, and shall be convened by chairs nominated by the ICG/PTWS;

Instructs the inter-sessional working groups to liaise, as appropriate, with similar inter-sessional working groups established by the ICG/IOTWS and other regional tsunami warning and mitigation systems;

Instructs the inter-sessional working groups to report and provide recommendations for further action to the next Session of the ICG/PTWS.

Annex to Recommendation ITSU-XX.1

**TERMS OF REFERENCE
FOR THE ICG/PTWS INTER-SESSIONAL WORKING GROUPS**

Working Group One on Seismic Measurements, Data Collection and Exchange

Objectives:

1. To review and report on existing arrangements with regard to seismic measurements, data collection and exchange;

2. To advise on how best to ensure that all earthquakes of magnitude 6 or greater can be reliably located and sized in a timely manner;
3. To review and make recommendations regarding upgrading and enhancements to the PTWS network, communications, processing and analysis to further reduce the time required for earthquake source characterization to meet desired warning responses.

Chair: to be identified.

Working Group Two on Sea-level Measurements, Data Collection and Exchange

Objectives:

1. To review and report on existing arrangements with regard to sea-level data collection and exchange;
2. To liaise with CBS/WMO/JCOMM and relevant Expert Teams to develop a more effective data representation and code form for exchange of sea-level data and to conduct test of latency (timeliness) of GTS transmissions;
3. To consider desirable additional sites enhancement;
4. To coordinate plans for sea-level observing sensitivity tests to understand the optimal, effective PTWS sea-level network;
5. To review and report on various means of transmitting sea-level data to warning centres.

Chair: Australia

Working Group Three on Tsunami Hazard Identification and Characterization

Objectives:

1. To review and report on existing arrangements with regard to tsunami hazard identification and characterization;
2. To advise on credible seismic scenarios that need to be captured for numerical tsunami modelling e.g., location, magnitude, rupture, orientation, dip, and probability of occurrence;
3. To review details on models that are currently used or in development;
4. To review desirable documentation (inputs, outputs etc.);
5. To explore cooperation regarding coastal inundation models;
6. To review as appropriate requirements for bathymetry;
7. To develop guidance on mandatory metadata including detail of bathymetry, hydrography and topography;
8. To consider the issue of assessing hazard, vulnerability and risk, including the facilitation of access to models.

Chair: France

Working Group Four on Resilience Building and Emergency Management

Objectives:

To promote good practice examples of capacity and resilience building and emergency management to improve the management of tsunami risk through mitigation, preparedness, response and recovery activities. Such measures include the following:

- Mitigation: land use planning, building standards, engineering and non-structural counter-measures.
- Preparedness: capacity assessments, public education, training, response and evacuation planning and exercising.
- Response: effective forecasting and early warning systems coupled with sound communications systems.
- Recovery: infrastructure and socio-economic recovery plans supported by adequate financial and logistical resources.
- Public awareness.

Chair: Canada

Working Group Five on Interoperability of Regional, Sub-regional and National Tsunami Warning Systems in the Pacific

Objectives:

To coordinate the development and operational implementation of warning systems in the Pacific, through:

- advice on the modalities of operation, methods and standards for the development and issuance of warnings, and requirements in terms of coordination and operating within a multi-hazard approach,
- advice on arrangements for redundancy and back-up arrangements,
- support the update of the PTWS Communications Plan.

Chair: USA

Recommendation ITSU-XX.2

COOPERATION WITH GLOSS, GTS, AND SATELLITE OPERATORS

The International Coordination Group for the Tsunami Warning System in the Pacific,

Recognizing the strong common links between the ICG/ITSU and other operational programmes of the IOC and WMO, including the Global Sea Level Observing System (GLOSS), the Global Telecommunication System (GTS), and the global Geostationary

Meteorology Satellite System, operated by European Space Agency, the Japan Meteorological Agency, and the US National Oceanic and Atmospheric Administration,

Noting the essential importance of timely sea-level information for confirming the existence or non-existence of a tsunami and for upgrading or downgrading tsunami warnings,

Considering the strong likelihood of benefits flowing to the ICG/ITSU and the providers, and users of tsunami services at the international, regional, and national levels,

Recommends that GLOSS:

- (i) explore the possibilities of using the international channels of the global Geostationary Meteorology Satellite system; and
- (ii) requests WMO to allow the use of the GTS, to transmit sea-level data from GLOSS multiple purpose sea-level station to any regional, sub-regional and national tsunami warning centres;

Recommends further that the sea-level data with a sampling rate of one minute be transmitted through the geostationary satellites at a minimum transmission frequency of 15 minutes or better and immediately retransmitted to the warning centres;

Requests the Officers or their designated delegate to coordinate this cooperation with the Global Geostationary Meteorology Satellite Data Collection system, relevant GTS managers and committees at the appropriate level to realize this recommendation.

Recommendation ITSU-XX.3

PACIFIC-WIDE TSUNAMI EXERCISE

The International Coordination Group for the Tsunami Warning System in the Pacific,

Noting that the Indian Ocean tsunami of 26 December 2004 has brought to the attention of the world the urgent need to be more prepared for such events,

Understanding that simulating scenarios and learning lessons from such exercises is an effective way to improve preparedness,

Recognizing that the PTWS requires regular review and testing,

Recommends that an end-to-end tsunami exercise be carried out for the Pacific Ocean during the second week of May 2006, with a final report of results written before the next IOC Executive Council meeting in late June 2006.

Further recommends that a Task Team be formed to design and carry out the exercise and bearing in mind the following elements:

- (i) Membership of the Task Team for organizing the exercise should include representatives from PTWC, WC/ATWC, NWPTAC, Australia, Chile, France, Fiji, New Zealand, Nicaragua, Russian Federation, Samoa and United States of America;
- (ii) The exercise should simulate each country being put into a warning situation requiring decision-making and be taken to the step just prior to public-notification;
- (iii) The exercise will take place in two stages:
 - a. In the first stage, the scenario of a destructive tsunami crossing the Pacific will be simulated with notification by PTWC and other warning centres such as WC/ATWC and the NWPTAC to the designated contact points and national emergency authorities of the Member States responsible for tsunamis; this scenario may be compressed in time;
 - b. In the second stage, it should be conducted the same day or sometime within the following days, decision-making and notification down to the last stage before public notification is simulated. In this stage, notification to the emergency management authorities of a single coastal community is sufficient for simulating the end-to-end process of the entire Member State;
- (iv) Member States be strongly encouraged to participate;
- (v) Due care be taken so as not to inadvertently alarm the public; a most conservative approach may be best, considering this will be the first such Pacific-wide exercise;
- (vi) Member States should share information about past National or Sub-National tsunami exercises prior to this exercise;
- (vii) Participating Member States be required to share information regarding the procedures applied and lessons learned during the exercise;
- (viii) The details of the exercise, as well as its set of outcomes and performance measures be defined in advance, taking into consideration when possible, the results of the Member State assessments; outcomes and performance measures should be collected using a standard instrument and at a minimum include:
 - a. How each Member State received the warning (e.g., GTS, fax, e-mail)?
 - b. Elapsed time between when the bulletin is issued and when it is received and recognized;
 - c. What assessment tools are applied for decision-making about evacuations?
 - d. How the public would be notified and instructed?
 - e. Elapsed time until the public would be notified and instructed;
 - f. Summary of each Member State's National Emergency Plan for tsunamis, including any chapters on exercises;
 - g. Feedback from stakeholders regarding their performance and the performance of the information providers;
 - h. Media response;

- (ix) ITSU National Contacts will be responsible for collecting results of their Member State and providing them to the Task Team by 1 June 2006;
- (x) A formal letter announcing the exercise and providing its details should be composed by the Task Team and sent by the IOC as soon as possible to the highest possible contact within the emergency management structure of each Member State to help facilitate its participation.

The exercise should not be considered as a one-time event but as the first exercise in a pattern of recurring exercises;

Requests that resources be made available from the IOC and Member States to facilitate organizational and follow-up meetings, and a contractor to help facilitate the debriefing process and quickly assemble the report.

Financial implications: US\$ 5,000 in 2006

Recommendation ITSU-XX.4

PROGRAMME OF WORK AND BUDGET FOR 2006–2007

The International Co-ordination Group for the Tsunami Warning System in the Pacific,

Recalling that ICG/ITSU has been identified by the IOC Governing Bodies as a high priority and flagship programme of the Commission, being until recently the only programme within the IOC fully dedicated to the co-ordination of an operational natural hazard warning system with the goal of reducing the tsunami danger and its impact on coastal communities;

Appreciating highly the support of the Republic of Korea and the USA provided to the IOC Tsunami Programme in 2004-2005 through Trust Fund and in-kind contributions;

Also appreciating the continuing support of the USA in hosting and funding the operation of PTWC and ITIC, and the support of Japan for the NWPTAC,

Appreciating further the intention of Australia, Canada, Chile, Ecuador and France to provide extra-budgetary support during the 2006-2007 biennium,

Taking into account discussions, which took place during the Twentieth Session of the ICG/ITSU regarding the programme activities and agreed upon priorities for 2006-2007;

Being informed of the IOC Programme and Budget for 2006-2007 adopted by the Twenty-third Session of the IOC Assembly held in Paris in June 2005;

Recognizing further that the IOC PTWS programme cannot successfully meet its obligations without an adequate provision of resources and that since Indian Ocean tsunami of 26 December 2004 those obligations and commitments have increased significantly;

Invites all Member States to support the PTWS programme by following the example of a few Member States contributing directly to the IOC Trust Fund, or in-kind by covering operational costs of maintaining the Tsunami Warning System;

Requests PTWS National Contacts to be pro-active in making national authorities aware of the programme and of the benefits of disaster reduction, through risk determination and resource allocation to diminish its impact;

Requests the Executive Secretary IOC to take all necessary measures for providing support to the Pacific Tsunami Warning System programme, by allocating the necessary funds and staff, within existing IOC resources,

Expresses a strong hope that in light of the importance and priority of the programme, and the need to provide guidance and expertise in support of recently established warning systems (e.g., the IOTWS), all activities mentioned in the Work Programme for 2006-2007 above, will receive the necessary funding.

Adopts the ICG/ITSU Programme and the required resources for 2006-2007 identified in Annex A.

Annex to Recommendation ITSU-XX.4

1. Participation of ITSU Officers/Experts/Secretariat in meetings of other Intergovernmental Coordination Groups for regional Tsunami Warning and Mitigation Systems, and other organizations dealing with issues relevant to the Tsunami Programme.
2. Assistance to the International Tsunami Information Centre (ITIC) for its continuing activities in fulfilling its obligations to the ICG/PTWS during 2006–2007 and including the ITIC Director's travel.
3. Planning, conduct and assessment of a Pacific-wide Tsunami Warning exercise in early 2006.
4. Organization of ICG/PTWS-XXI in April 2006 (Melbourne, Australia).
5. ITSU Officers Meeting in January 2007 (Honolulu, USA).
6. Organization of ICG/PTWS-XXII in October 2007 (Ecuador).
7. Support for ICG/PTWS participation in the ICG/IOTWS inter-sessional Working Groups established at ICG/IOTWS-I.
8. Support to the ITIC Associate Director, including one trip each year to ITIC for briefing and reporting on the accomplishments.
9. Completion and assessment of the Assessment Questionnaire for ICG/PTWS Member States.
10. Completion of the Integrated Tsunami Data Base (ITDB).
11. Support for development of the TsunamiTeacher —translations into French and Spanish

12. Support for the Working Group on the Central American Pacific Coast Tsunami Warning System.

Budget Summary (in US\$)								
Priority	2006				2007			
	Funded UNESCO/ RP	Unfunded	EB support anticipated	EB funding source	Funded UNESCO/ RP	Unfunded	EB support anticipated	EB funding source
1	15,000				15,000			
2	10,000	18,000	600,000	USA	10,000	18,000	600,000	USA
3	5,000							
4	9,000	7,000	40,000	Australia				
5						16,000		
6						19,000	30,000	Ecuador
7		12,000				12,000		
8			3,000	Chile			3,000	Chile
9		5,000						
10		3,000						
11			7,000	France			7,000	Chile
12		3,000				3,000		
TOTAL	39,000	48,000	650,000		25,000	68,000	640,000	

TOTALS: Funded \$64,000
 Unfunded \$116,000
 EB Support \$1,290,000

Note: Canada has committed \$20,000 to the Trust Fund. These funds are not yet committed in the above budget

The budget has been prepared for a normal inter-sessional period of two years, but will be reviewed and revised as required at ITSU-XXI in April 2006.

ANNEX III

SPEECHES

A. Welcome Speech by Mrs Virginia Reginnato, Mayor of Viña del Mar

Mr Robert Garnham, Captain and Director of Navy Hydrographic and Oceanographic Service;

Mr François Schindelé, Chairman of the International Coordination Group for the International Pacific Tsunami Warning System;

Mrs Laura Kong, Director of International Tsunami Information Centre;

Mr Peter Pissierssens, Representative of the Intergovernmental Oceanographic Commission of UNESCO;

Representatives of the International Coordination Group for the International Pacific Tsunami Warning System;

Members of Parliament, civil and navy authorities, special guests and friends,

It is an honour for Viña del Mar to be the host of a such an important International Meeting like this which has put together different countries that share similar coastal characteristics as a significant feature, and I say significant, not only because of its real importance but also because of the recent and unfortunate natural phenomena that destroyed the Asian Pacific Coast.

In spite of the big loss and sad images that were seen around the world caused by this tsunami, a lesson to the world has been branded. Nature showed its most cruel and rough side and we cannot be indifferent. The lesson I am referring to is prevention and preparation of our community in order to act efficiently in an emergency situation. We cannot avoid natural phenomena but we can mitigate its effects. To do this, education, information and simulation exercises are fundamental, as well as training for professionals.

I am proud to say that in Viña del Mar we have approached this matter properly and without being alarmists. Viña is the only city in Chile that has internationally approved signs for tsunami events. On the other hand, our city hall has a prevention plan for tsunami alerts. We also work with students and the community providing information. This is possible thanks to our consciousness as a coastal city but unfortunately, this evidence was not seen in South East Asia.

I want to thank the Naval Hydrographic and Oceanographic Service, SHOA, and the National Emergency Office, for their permanent support. We have worked together to create a new consciousness about these matters in our community.

I am very positive that these days will be very profitable, with exchange of ideas, experiences and work methodologies that enrich us and make us more conscious and aware that this world is just one. All of us are part of it and we are not free from suffering from national disasters. We do have the responsibility of creating consciousness in our community and teaching the response capacity needed to act in these situations.

Thank you very much.

**B. Welcome Speech
by Capt. Roberto Garnham, Director SHOA**

Mrs Virginia Reginnato, Mayor of the City of Viña del Mar,
Mr François Schindelé, Chairman of the International Coordination Group for the Tsunami Warning System in the Pacific,
Mr Peter Pissierssens, Head, Ocean Services of Intergovernmental Oceanographic Commission of UNESCO,
Mr Hugo Gorziglia, Past Chairman of ITSU,
Delegates, Ladies and Gentlemen,
Welcome to Viña del Mar,

We are very happy to welcome the delegates to the Twentieth Session of the International Coordination Group for the Tsunami Warning System in the Pacific (ITSU) and the observers from other oceans.

Chile is aware that the ITSU Programme run by UNESCO under the auspices of the Intergovernmental Oceanographic Commission (IOC) is a well-organized group dealing with the tsunami risk within the region. We are delighted to be able to assist with the organization of this meeting.

It has been traditional that the biennial meetings of ITSU are preceded by an international workshop. We are pleased to report that the National Emergency Office of the Ministry of Interior accepted an invitation from ITSU to host this activity preceding this ITSU Session. The Workshop was titled 'Tsunami Hazard Mitigation and Risk Assessment'.

Chile is one of the most active seismic areas in the Pacific. The tsunami risk is something well known to everybody living in our country. More than 40 local tsunamis have affected some part of our long coast within the last 500 years, including the huge 1960 earthquake and tsunami. However, we should keep the new generations well aware of the problem and our organizations well prepared to deal with this kind of disaster. We are aware that there is still a lot of work to be done in order to increase our level of understanding of the tsunami problem. Activities such as these sessions are vital for sharing that knowledge.

Regarding the far field tsunami activity we count on the services provided by the Pacific Tsunami Warning Centre (PTWC) for early warning and information on the nature and size of any potential tsunami out of our coasts. The information provided by PTWC is an integral part and a complement of Chilean National Tsunami Warning System.

So again welcome to Chile and we wish you a very successful Session.

**C. Welcome Speech
by Dr François Schindelé, Chairman ICG/ITSU**

Excellencies,
Capt. Roberto Garnham, Director of SHOA,
Mr Peter Pissierssens, Representative of IOC/UNESCO,
Distinguished Delegates of Member States,
Ladies and Gentlemen,
Senoras and Senors,

It is an honour and great pleasure to open the Twentieth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, as Chairman of this Group.

On behalf of the Group, I express my deep thanks to the Government of Chile to have hosted this Session in your very nice country and for your welcome address. From the 28 Member States of ITSU, 20 are attending this Session. Australia, Canada, Chile, China, Colombia, Republic of Korea, Ecuador, Fiji, France, Malaysia, Japan, New Zealand, Nicaragua, Peru, Philippines, Russian Federation, Samoa, USA, Singapore and Thailand. Two other organizations are also attending this Session. This is the first time that so many countries are attending ITSU and I thank all the distinguished delegates for coming and in their effort to participate.

This Session is particular for different reasons. Firstly, this corresponds to the 40 years of the existence of the Group and of the implementation of PTWS. Secondly, the most catastrophic tsunami occurred last year in the Indian Ocean, destroying suddenly the lives of more than 200,000 people in the Indian Ocean region.

The entire world realized what a tsunami is and that this phenomenon could occur at any time and impact anywhere along numerous coastlines.

The Indian Ocean tsunami of 26 December 2004 event was a lesson for the world and for ICG/ITSU. Major earthquakes are definitively unpredictable, the location, the size and the date. The conclusion is that major earthquakes can occur in every sea and ocean. Currently, and probably during the next decade, there is no way to predict them. This is the first conclusion that everybody must accept and report.

The second lesson was given by a small girl who informed her parents about the risk of the tsunami when she saw the sea receding and argued that large waves would come —she saved hundreds of people. This shows that mitigation works, based on education and preparedness. Since the Indian Ocean tsunami of 26 December 2004, the people in the entire world who have access to the media know the meaning of the word tsunami, what a tsunami is and how dangerous its waves can be. This knowledge should not be forgotten; to the contrary it should be included in natural hazard mitigation programmes. This is a challenge for ITSU and for every IOC Member State.

The third lesson is that, before the Indian Ocean tsunami of 26 December 2004, the only ocean protected by a tsunami warning system was the Pacific. Consequently, ICG/ITSU was the only structure with substantial expertise on tsunami warning systems. The IOC's Member States of the Pacific Ocean have accumulated substantial knowledge and expertise in natural disaster management and on prevention measures to deal with the risk of tsunamis. In particular, invaluable experience and knowledge has been acquired on how to assess the tsunami risk at the national and local level, how to promote awareness and preparedness, and how to build national and regional tsunami warning systems.

The direct consequences

The critical issue of our Group is the continuous improvement of the Tsunami Warning System in the Pacific, taking into account:

- the recent and continuous progress in science and technology to assess the tsunami risk and the tsunami training and forecasting,

- the mitigation and preparedness becomes more and more critical due to the increase of populations living close to the coast or coming on holiday to these regions,
- the development of the Tsunami Warning System in other regions that will provide new methodology and experience to ITSU.

During this week, we will review the work accomplished during the last two years, especially since the Indian Ocean tsunami of 26 December 2004 when all the ITSU Officers and several Member States were contacted to participate in the World Conference on Disaster Reduction and all meetings for the implementation of a Tsunami Warning and Mitigation System in the Indian Ocean and other regions.

When I walked around in Viña del Mar these past days, I discovered tsunami signalizations in the streets that were not in place a few years ago. This is a very important initiative taken by the Municipality and must be highlighted and deeply considered. Since the Indian Ocean tsunami of 26 December 2004, coastal inhabitants and visitors are looking for information how to protect themselves in case of tsunami warnings.

I am confident that all delegates will participate very actively in the discussions during the Session for the improvement of the efficiency of the TWSP and at a global level.

Finally, I want to thank the local organizing committee, especially Capt. Roberto Garnham and Mr Emilio Lorca for the hard and excellent work done during this year to organize this Session.

I wish everybody an excellent and productive Session.

Thank you very much for your attention.

ANNEX IV

RECOMMENDATIONS OF THE INTERNATIONAL WORKSHOP "TSUNAMI HAZARD MITIGATION AND RISK ASSESSMENT" SANTIAGO, CHILE, 29–30 SEPTEMBER 2005

The Workshop, Tsunami Hazard Mitigation and Risk Assessment, jointly convened by the IUGG Tsunami Commission and the International Coordination Group of the Tsunami Warning System for the Pacific (ICG/ITSU), and ONEMI, was held in Santiago, Chile on 29 and 30 September 2005. Twenty papers were presented, ranging from overviews of local and regional vulnerability to tsunami to the case studies of several largest tsunamis in the Pacific and the Indian oceans.

Thirty registrants from 11 countries (Chile, Peru, Nicaragua, USA, Canada, Russia, Japan, Fiji, Samoa, New Zealand, France) attended the Workshop, many of the international delegates also attending the ICG/ITSU-XX Session to be held in Valparaiso, Chile from 3 to 7 October 2005.

The workshop concluded with the following **recommendations**:

1. Lessons learned from the 2004 Sumatra tsunami show that the following actions should be undertaken: (a) improvement and standardization of sea level network, (b) free and open real time data exchange on tsunami, (c) IO and AO TWSs should be built based on experience gained in 40-year operation of the Pacific TWS, (d) better documenting of coastal effect of recent large tsunamis,
2. Tsunami Hazard Maps, from global to local levels, should be developed and used as the main tool for evaluation of tsunami risk in different parts of the World Ocean coastline.
3. The existing Global Tsunami Database should be maintained and improved by means of further search of historical data in local and national archives to improve the database quality and completeness.
4. Paleotsunami studies are of primary importance for evaluation of the recurrence interval for largest tsunami (Krakatau 1883, Chile 1960, Sumatra 2004) and they should be encouraged in all parts of world coast.
5. Multi-purpose (hurricanes, storm surges, global warming) real-time sea-level monitoring network for tsunami warning and further monitoring should be expanded. For scientific and sustainability reasons the locating of tsunami enabled coastal sea level gauges in protected harbour is recommended.
6. New forecasting methods for tsunami warning, based on real time sea level monitoring and numerical techniques, should be developed and implemented into the TWS operations.
7. Sharing operational experience of emergency management should be encouraged. Such presentations and participation of TWS operational personnel should be encouraged in the future joint IUGG/TC – ICG/ITSU workshops.
8. Tsunami education and awareness are the key elements of public safety and any efforts should be supported in all tsunami-prone coast of the world.

ANNEX V

LIST OF DOCUMENTS

Working Documents	Title
IOC/ITSU-XX/1 prov. rev.	Provisional Agenda (revised)
IOC/ITSU-XX/1 add. rev.	Provisional Timetable (revised)
IOC/ITSU-XX/2 prov.	Annotated Provisional Agenda (revised)
IOC/ITSU-XX/3	Summary Report (this document)
IOC/ITSU-XX/4 prov.	Provisional List of Documents
IOC/ITSU-XX/5 prov.	Provisional List of Participants
IOC/ITSU-XX/6	Report of the Chairman of ICG/ITSU on Intersessional Activities
IOC/ITSU-XX/7	National Reports on Tsunami-related Activities: 7.1 Australia 7.2 Canada 7.3 Chile 7.4 China 7.5 Colombia 7.6 Costa Rica 7.7 Ecuador 7.8 Fiji 7.9 France 7.10 Japan 7.11 Korea, Republic of 7.12 Malaysia 7.13 New Zealand 7.14 Nicaragua 7.15 Peru 7.16 Russian Federation 7.17 Samoa 7.18 Singapore 7.19 Thailand 7.20 USA 7.21 Viet Nam
IOC/ITSU-XX/8	Report of the ITIC Director
IOC/ITSU-XX/9	Report of the PTWC Director
IOC/ITSU-XX/10	Summary Report on the Global Tsunami Data Base Project Implementation
IOC/ITSU-XX/11	Signs Comparison

Working Documents	Title
IOC/ITSU-XX/12	IOC TsunamiTeacher Information Document
IOC/ITSU-XX/13	ITIC-UHSLC-NOAA Water Level Station Systems Database Integration via an XML Web Service
IOC/ITSU-XX/14	Tsunami Reconnaissance Digital Data Repository

ANNEX VI

LIST OF PARTICIPANTS

I. MEMBER STATES

AUSTRALIA

Dr Ray P. CANTERFORD
Assistant Director, Weather & Ocean Services
Bureau of Meteorology
G.P.O. Box 1289 K
Melbourne, Victoria 3001
Tel: 61 3 9669 4087
Fax: 61 3 9669 4695
E-mail: r.canterford@bom.gov.au,
ads@bom.gov.au

Mr Robert OWEN-JONES
Director, Environment
Dept. of Foreign Affairs & Trade
R.G. Casey Building, John McEwen Crescent
Barton ACT 0221
Tel: 61 2 6261 3516
Fax: 61 2 6112 1262
E-mail: Robert.owen-jones@dfat.gov.au

Mr Rick BAILEY
National Manager, Oceanographic Services
Australian Bureau of Meteorology
700, Collins St.
Melbourne VIC 3000
Tel: 61 3 9669 4103
Fax: 61 3 9669 4103
E-mail: R.Bailey@bom.gov.au

Mr Gordon CHEYNE
Project Manager
Australian Tsunami Warning System
Geoscience Australia
G.P.O. Box 378
Canberra, ACT 2905
Tel: 61 20 6249 9494
Fax: 61 20 6249 9977
E-mail: gordon.cheyne@ga.gov.au

Mr Mark SULLIVAN
Emergency Management Australia
Innovation Centre, Bruce, ACT 2900
Tel: 61 2 6256 4693
Fax: 61 2 6256
E-mail: mark.sullivan@ag.gov.au

Dr Mark LEONARD
Senior Seismologist
P.O. Box 378 Geoscience Australia, Civil,
Canberra, ACT, 2601
Geoscience Australia
Tel: 61 2 6249 9351
Fax: 61 2 6249 9969
E-mail: mark.leonard@ga.gov.au

CANADA

Mr Fred STEPHENSON
Manager, Geomatics Engineering
Canadian Hydrographic Service
Institute of Ocean Services
P.O. Box 6000
9860 W. Saanich Rd.
Sidney, B.C. V8L 4B2
Tel: 1 250 363 6350
Fax: 1 250 363 6323
E-mail: stephensonF@pac.dfo-mpo.gc.ca

CHILE

Capt. Roberto GARNHAM
Director, Servicio Hidrográfico y
Oceanográfico de la Armada (SHOA) de Chile
Errázuriz 232, Playa Ancha
Valparaíso
Tel: 56 32 266 500
Fax: 56 32 266 542
E-mail: rgarnham@shoa.cl

Dr Rodrigo NUÑEZ
Director, Servicio Hidrográfico y
Oceanográfico de la Armada (SHOA) de Chile
Errázuriz 232, Playa Ancha
Valparaíso
Tel: 56 32 266 101
Fax: 56 32 266 542
E-mail: rnunez@shoa.cl

Mr John FLEMING BAEZA
Head, Dept. of Oceanography
Servicio Hidrográfico y Oceanográfico de la
Armada (SHOA) de Chile
Errázuriz 254, Playa Ancha
Valparaíso
Tel: 56 32 266 670

Fax: 56 32 266 542

E-mail: jfleming@shoa.cl

Mr Emilio LORCA MELLA
Geologo, Jefe Seccion Geofisica Marina
Departamento de Oceanografia (SHOA)
Errazuriz 254, Playa Ancha
Valparaiso
Tel: 56 32 26 66 98
Fax 56 32 26 65 42
E-mail: elorca@shoa.cl
(Also representing ITIC)

Mr Eduardo MARTINEZ BERGER
Ingeniero Industrial
Director Protection Civil
I. Municipalidad de Vina del Mar
Uno Oriente 235
Vina del Mar
Tel: 56 32 269 702
Fax: 56 32 739 277
E-mail: eduardo.martinez@munivina.cl

CHINA

Dr Xue Jia SONG
Professor, Director
National Marine Environment Forecasting
Centre
8, Dahuisi Rd, Haidian District
Beijing 100081
Tel: 86 10 6217 3623
Fax: 86 10 6217 3620
E-mail: sxj@nmetc.gov.cn

Dr Wei WU
Assistant Professor
National Marine Environment Forecasting
Centre
8, Dahuisi Rd, Haidian District
Beijing 100081
Tel: 86 10 6217 3615
Fax: 86 10 6217 3620
E-mail: wuwei@nmefc.gov.cn

Dr Wing Tak WONG
Senior Scientific Officer
Hong Kong Observatory
134A, Nathan Rd.
Hong Kong
Tel: 852 2926 8430
Fax: 852 2311 9448
E-mail: wtwong@hko.gov.hk

COLOMBIA

Dr Hans Jurgen MEYER
Universidad del Valle
Observatorio Sismológico del Suroccidente
(OSSO)
Cali
Tel: 57 2 339 7222/330 1661
Fax: 57 2 331 3418
E-mail: hjm@osso.org.co
E-mail : hjm_osso@yahoo.com

COOK ISLANDS

Not represented

COSTA RICA

Not represented

ECUADOR

Lt. Edwin PINTO USCOCOVICH
Jefe del Departamento de Ciencias del Mar
Oceanographic Institute of the Navy (INOCAR)
Base Naval Sur, Ave. 25 de Julio
Via Puerto Marítimo
Guayaquil
Tel: 593 4 2481300, Ext: 2121/2101
Tel: 593 4 2481300, Ext: 1200/3302
Fax: 593 4 2485166
E-mail: inocar@inocar.mil.ec
E-mail: tsunamis@inocar.mil.ec
E-mail: ambiente@inocar.mil.ec

EL SALVADOR

Not represented

FIJI

Mr Lasarusa VUETIBAU
Seismologist, Seismology Unit
Mineral Resources Dept.
Mead Rd.
Suva
Tel: 679 338 1611
Fax: 679 337 0039
E-mail: lasarusa@mrd.gov.fj

FRANCE

Dr François SCHINDELE (*Chairman*)
Assistant Director
Departement Analyse et Surveillance de
l'Environnement
Laboratoire de Geophysique
B.P. 12

91680 Bruyères-le-Châtel
Tel: 33 1 69 26 50 63
Fax: 33 1 69 26 70 23
E-mail: schindel@ldg.bruyeres.cea.fr

Dr Dominique REYMOND
Seismologist, CEA/DASE/LDG
B.P. 640
Papeete
98713 Polynesie Française
Tel: 689 82 80 25
Fax: 689 83 50 37
E-mail: reymond.d@labogeo.pf

GUATEMALA
Not represented

INDONESIA
Not represented

JAPAN

Mr Noritake NISHIDE
Director, Administration Division
Seismological & Volcanological Dept.
Japan Meteorological Agency
1-3-4 Ohtemachi, Chiyoda-ku
Tokyo 100-8122
Tel: 81 3 3211 8684
Fax: 81 3 3212 2857
E-mail: noritake.nishide@met.kishou.go.jp

Mr Yuji NISHIMAE
Section Chief
Japan Meteorological Agency
1-3-4 Ohtemachi, Chiyoda-ku
Tokyo 100-8122
Tel: 81 3 3212 8341
Fax: 81 3 3215 2963
E-mail: nishimae@met.kishou.go.jp

**KOREA, DEMOCRATIC PEOPLE'S
REPUBLIC**
Not represented

KOREA, REPUBLIC OF

Mr Kwang-Joon PARK
Director-General
Observation Bureau
Korea Meteorological Administration (KMA)
460-18, Shindaebang-dong, Tongjak-gu
Seoul 156-720
Tel: 82 2 841 5105
Fax: 82 2 836 6753
E-mail: kjpark@kma.go.kr

Dr Jun Hee LEE
Senior Researcher
Korea Meteorological Administration (KMA)
460-18, Shindaebang-dong, Tongjak-gu
Seoul 156-720
Tel: 82 2 841 7663
Fax: 82 2 841 7664
E-mail: ljh@kma.go.kr

MALAYSIA

Mr Kong Chiew LOW
Director, Seismological Division
Malaysian Meteorological Service
Jalan Sultan, 46667 Petaling Jaya
Tel: 603 7967 8062
Fax: 603 7955 0964
E-mail: kclow@kjc.gov.my

MEXICO
Not represented

NEW ZEALAND

Mr Hans BROUNTS
Emergency Management Planner
P.O. Box 5010
Wellington
Tel: 64 4 473 7363
Fax: 64 4 473 7369
E-mail: hans.brounts@dia.govt.nz

Mr David COETZEE
Emergency Management Planner
Ministry of Civil Defence & Emergency
Management
P.O. Box 5010
Wellington
Tel: 64 4 473 7363
Fax: 64 4 473 7369
E-mail: david.coetzee@dia.govt.nz

Dr Kenneth GLEDHILL
GeoNet Manager
Institute of Geological & Nuclear Sciences
41A, Bell Rd. South
Lower Hutt 6315
Tel: 64 4 570 4848
Fax: 64 4 570 4676
E-mail: k.gledhill@gns.cri.nz

NICARAGUA

Dr Wilfried STRAUCH
Director for Geophysics

INETER, Geofísica
Managua
Tel: 505 249 2761
Fax: 505 249 1082
E-mail: wilfried.strauch@gf.ineter.gob.ni

PERU

Mr Yerko JARA SCHENONE
Direccion de Hidrografia y Navegacion
Av. Gamarra 500 Chucuito Callao
Tel: 51 1 429 6304
Fax: 511 420 2122
E-mail: jyara@dhm.mil.pe

PHILIPPINES

Dr Bartolome C. BAUTISTA
Deputy-Director
Philippine Institute of Volcanology &
Seismology
PHIVOLCS Building
C.P. Garcia Av, U.P. Campus, Diliman,
Quezon City
Tel: 63 2 929 92 54
Fax: 63 2 929 89 61
E-mail: bart@phivolcs.dost.gov.ph

RUSSIAN FEDERATION

Dr Igor KUZMINYKH
Central Design Office of Hydrometeorological
Instrument Production
Korolev 6, Obninsk
Tel: 7 0843 962 303
Fax: 7 0843 964 453
E-mail: kuz@ckb.obninsk.org

Dr Alexander RABINOVICH
P.P. Shirshov Institute of Oceanology
36, Nakhimovsky Prosp.
Moscow 117997
Tel: 7 095 124 8713
Fax: 7 095 124 8713
E-mail: abr@iki.rssi.ru
rabinovicha@pac.dfo-mpo.gc.ca

Dr Viacheslav GUSIAKOV
Head, Tsunami Laboratory
Institute of Computational Mathematics &
Mathological Geophysics
Lavrentieva, 6
Novosibirsk 630090
Tel: 7 383 330 7070
Fax: 7 383 330 8783
E-mail: gvk@sscc.ru

Dr Tatiana N. IVELSKAYA
Chief, Sakhalin Tsunami Centre
Sakhalin Administration for
Hydrometeorology
78, Zapadnaya St.
Yuzhno-Sakhalinsk, 693000
Tel: 7 4242 423691
Fax: 7 4242 721307
E-mail: twc@sakhalin.ru
ivelskaya@mail.ru

SAMOA

Mr Faatali Malaefatu LEAVASA
Scientific Officer (Geophysics)
Meteorological Division
Ministry of Environment
Natural Resources & Meteorology
P.O. Box 3020
Apia
Tel: 685 20855/20856
Fax: 685 20857
E-mail: mleavasa@meteorology.gov.ws

SINGAPORE

Mr Choon Siong SIM
Senior Meteorological Officer
Meteorological Services Division
National Environment Agency
P.O. Box 8, Changi Airport
Singapore 918141
Tel: 65 6542 9075
Fax: 65 6545 7192
E-mail: Sim_Choon_Siong@nea.gov.sg

THAILAND

Mrs Sumalee PRACHUAB
Director Seismological Bureau
Meteorological Dept.
4353, Sukhumvit
Bangkok 10260
Tel: 662 399 4547
Fax: 662 399 0968
E-mail: sumalee_tmd@yahoo.com

Mr Kriengkrai KHOVADHANA
Deputy Director-General
Thailand Meteorological Dept.
4353 Sukhumvit Rd.
Bangkok 10260
Tel: 662 398 9888
Fax: 662 399 4016
E-mail: kriengkrai@metnct.tmd.go.th

USA

Mr Ralph (Jeff) LADOUCE
Director, National Weather Service Pacific
Region, NOAA
737, Bishop St, Suite 2200
Honolulu, Hawaii 96813-3213
Tel: 1 808 532 6416
Fax: 1 808 532 5569
E-mail : Jeff.Ladouce@noaa.gov

Ms Paula DUNBAR
Physical Scientist
NOAA/NGDC/WPC
325, Broadway, Boulder
Colorado 80305
Tel : 1 303 497 6084
Fax : 1 303 469 6513
E-mail : paula.dunbar@noaa.gov

Dr Samuel JOHNSON
Chief Scientist
US Geological Survey
400 Natural Bridges Drive
Santa Cruz, CA 95060
Tel: 1 831 427 4746
Fax: 1 831 427 4709
E-mail: sjohnson@usgs.gov

Dr Charles MCCREERY
Director, Pacific Warning Centre (PTWC)
91-270 Fort Weaver Rd.
Ewa Beach, Hawaii 96706-2928
Tel: 1 808 689 8207x301
Fax: 1 808 689 4543
E-mail: mccreery@ptwc.noaa.gov
(Also representing the PTWC)

Mr Brian YANAGI
Deputy Director
International Tsunami Information Centre
(ITIC)
737 Bishop St., Suite 2200
Honolulu, Hawaii 96813-3213
Tel: 1 808 532 6422
Fax: 1 808 532 5576
E-mail: brian.yanagi@noaa.gov
(Also representing IOC-ITIC)

VIET NAM

Not represented

II. ORGANIZATIONS

International Hydrographic Bureau (IHB)

Capt Hugo GORZIGLIA (*Past Chairman*)
Director, IHB
4, Quai Antione 1^{er}
P.O. Box 445
98011 Monaco Cedex
PRINCIPAUTE DE MONACO
Tel: 377 93 10 81 00
Fax: 377 93 10 81 40
E-mail: hgorziglia@ihb.mc

IOC Global Sea-Level Observing System (GLOSS)

Mr Bernie KILONSKY
Sea Level Centre, Dept. of Oceanography
University of Hawaii
1000 Pope Rd, MSB 317
Honolulu, HI 96822
USA
Tel: 1 808 956 6572
Fax: 1 808 956 2352
Email: kilonsky@hawaii.edu

Intergovernmental Oceanographic Commission-International Tsunami Information Centre (IOC-ITIC)

Dr Laura KONG
Director, International Tsunami Information
Centre (ITIC)
737 Bishop St., Suite 2200
Honolulu, Hawaii 96813-3213
USA
Tel: 1 808 532 6423
Fax: 1 808 532 5576
E-mail: l.kong@unesco.org

Mr Emilio LORCA MELLA
Geologo, Jefe Seccion Geofisica Marina
Departamento de Oceanografia
SHOA
Errazuriz 254, Playa Ancha
Valparaiso
CHILE
Tel: 56 32 26 66 98
Fax 56 32 26 65 42
E-mail: elorca@shoa.cl
(Also representing Chile)

Mr Brian YANAGI
International Tsunami Information Centre
(ITIC)
737 Bishop St., Suite 2200
Honolulu, Hawaii 96813-3213
USA
Tel: 1 808 532 6424
Fax: 1 808 532 5576
E-mail: brian.yanagi@noaa.gov
(Also representing the USA)

**Incorporated Research Institutions for
Seismology (IRIS)**

Dr Rhett BUTLER
Program Manager
Global Seismic Network
1200 New York Ave. NW
Washington, DC 20005
USA
Tel: 1 202 682 2220
Fax: 1 202 682 2444
E-mail: rhett@iris.edu

Dr Timothy AHERN
Program Manager
IRIS DMS, IIS/FDSN
1408 NE 45th St., Seattle, WA
USA
Tel: 1 206 547 0393
Fax: 1 206 547 1093
E-mail: tim@iris.edu

**International Union of Geodesy &
Geophysics (IUGG)**

Dr Kenji SATAKE
Geological Survey of Japan
Nigashi
Tsukuba, Ibaraki
JAPAN
Tel : 81 29 861 3640
Fax : 81 29 852 3461
E-mail : kenji.satake@aist.go.jp

Pacific Tsunami Warning Centre (PTWC)

Dr Charles McCREERY (*Vice-Chairman*)
Director, Pacific Warning Centre (PTWC)
91-270 Fort Weaver Rd.
Ewa Beach, Hawaii 96706-2928
USA
Tel: 1 808 689 8207x301
Fax: 1 808 689 4543
E-mail: mccreery@ptwc.noaa.gov
(Also representing the USA)

III. OBSERVERS

AUSTRIA

Dr Wolfgang LENHARDT
Central Institute for Meteorology &
Geodynamics (ZAMG)
Home Warte 38
A-MPO Vienna
Tel: 43 1 36026 2507
Fax: 43 1 37 70 25
E-mail: wolfgang.lenhardt@zamp.ac.at

Dr Sergio BARRIENTOS
Chief IMS/SM, CTBTO/IMS
P.O. Box 1200
Vienna A1400
Tel: 43 1 260 306 1009
Fax: 43 1 260 305 922
E-mail: Sergio.barrientos@ctbto.org

USA

Dr Peter DAVIS
Executive Director IDA
University of California, San Diego
9500 Gilman Dr.
La Jolla, CA 92093
Tel: 1 858 534 2839
Fax: 1 858 534 6354
E-mail: pdavis@ucsd.edu

PANAMA

Not Represented

IV. IOC SECRETARIAT

Mr Peter PISSIERSSENS
Head, Ocean Services Unit
1, rue Miollis
75015 Paris
FRANCE
Tel: 33 1 45 68 40 46
Fax: 33 1 45 68 58 12
E-mail: p.pissierssens@unesco.org

Mr Masahiro YAMAMOTO
Senior Advisor
Tsunami Unit IOC
1, rue Miollis
75015 Paris
FRANCE
Tel : 33 1 45 68
Fax : 33 1 45 68 58 12
E-mail : m.yamamoto@unesco.org

Mr Adrien VANNIER
Administrative Coordinator
Ocean Services Unit
1, rue Miollis
75015 Paris
FRANCE
Tel: 33 1 45 68 39 63
Fax: 33 1 45 68 58 12
E-mail: a.vannier@unesco.org

Ms Patricia GORZIGLIA
Public Relations
Hydrographic & Oceanographic Service of the
Chilean Navy
Errazuriz 254, Playa Ancha
Valparaíso
CHILE
Tel: 56 32 266737
Fax: 56 32 266542
E-mail: rp@shoa.cl

V. SHOA SECRETARIAT

Ms Cecilia ZELAYA
Tsunami Programme
Hydrographic & Oceanographic Service of the
Chilean Navy
Errazuriz 254, Playa Ancha
Valparaíso
CHILE
Tel: 56 32 266697
Fax: 56 32 266542
E-mail: tsunamis@shoa.cl

Mr Patricio GARCIA
Tsunami Programme
Hydrographic & Oceanographic Service of the
Chilean Navy
Errazuriz 254, Playa Ancha
Valparaíso
CHILE
Tel: 56 32 266690
Fax: 56 32 266542
E-mail: tsunamis@shoa.cl

Mr Jorge RODRIGUEZ
Technician
Hydrographic & Oceanographic Service of the
Chilean Navy
Errazuriz 254, Playa Ancha
Valparaíso
CHILE
Tel: 56 32 266767
Fax: 56 32 266542

Mr Pedro CORTES
Technician
Hydrographic & Oceanographic Service of the
Chilean Navy
Errazuriz 254, Playa Ancha
Valparaíso
CHILE
Tel: 56 32 266547
Fax: 56 32 266542

Mr César SANCHEZ
Technician
Hydrographic & Oceanographic Service of the
Chilean Navy
Errazuriz 254, Playa Ancha
Valparaíso
CHILE
Tel: 56 32 266574
Fax: 56 32 266542

ANNEX VII

LIST OF ACRONYMS

ADRC	Asian Disaster Reduction Centre
AEC	Association for Caribbean States
AFNOR	Association française de normalisation
ASEAN	Association of South East Asian Nations
BUD	Buffer of Uniform Data
CBS	Commission for Basic Systems
CEPREDENAC	Centro de Coordinación de la Prevención de Desastres Naturales en América Central (Coordination Centre for the Prevention of Natural Disasters in Central America)
CO-OPS	Centre for Operational Oceanographic Products & Services (USA)
CPPT	Centre Polynésien de Prévention des Tsunamis (France)
CTBTO	Comprehensive Nuclear Test Ban Treaty Organization
DART	Deep-ocean Assessment & Reporting of Tsunamis (USA)
DHN	Dirección de Hidrografía y Navegación (Peru)
DMAC	Data Management & Communications
DMS	Data Communications and Management Subsystem
ENSO	El Niño and the Southern Oscillation (An Ocean/Atmosphere Interaction Study)
ETS	Episodic Tremor & Slip
EWS	Early Warning System
FDSN	Federation of Digital Broadband Seismic Networks
GEBCO	General Bathymetric Chart of the Oceans
GEOSS	Global Earth Observation System of Systems
GITEC	Genesis and Impact of Tsunamis on the European Coasts
GLOSS	Global Sea Level Observing System (IOC)
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GSN	Global Seismographic Network
GTDB	Global Tsunami Data Base
GTS	Global Telecommunications System (WMO)
HTDB	Historical Tsunami Data Base
IAEA	International Atomic Energy Agency

IAPSO	International Association of Physical Science of the Ocean
IASPEI	International Association of Seismology & the Earth's Interior
IAVCEI	International Association of Volcanology & Chemistry of the Earth's Interior
IBC	International Bathymetric Charts
ICG/CARTWS	Intergovernmental Coordination Group for the Caribbean and Adjacent Regions Tsunami Warning and Mitigation System
ICG/IOTWS	Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific
IDA	International Deployment of Accelerographs
IFRC	International Federation of Red Cross & Red Crescent Societies
IGOS	Integrated Global Observing Strategy
IHO	International Hydrographic Organization
INMARSAT	French Mobile Satellite Communications Network
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOCARIBE	IOC Sub-Commission for the Caribbean & Adjacent Regions
IODE	International Oceanographic Data & Information Exchange
IOOS	Integrated Ocean Observing System
IOTWS	Indian Ocean Tsunami Warning and Mitigation System
IPCC	Intergovernmental Panel on Climate Change
IRIS	Incorporated Research Institutions for Seismology (USA)
ISDR	International Strategy for Disaster Reduction
ISO	International Standards Organization
ITDB	Integrated Tsunami Data Base
ITIC	International Tsunami Information Centre (IOC)
ITRIS	Integrated Tsunami Research & Information System
IUGG	International Union of Geodesy & Geophysics
JCOMM	Joint Technical Committee for Oceanography & Marine Metrology
JCOMM ___ OPA & SPA	Joint Technical Committee for Oceanography & Marine Metrology Observing Programme Area & Service Programme Area
JCOMM OPS	Joint Technical Committee for Oceanography & Marine Metrology <i>in situ</i> Observing Platform Support Centre
JICA	Japan International Cooperation Agency
JMA	Japan Meteorological Agency
KMA	Korea Meteorological Administration

LISS	Live Internet Seismic Server
MLA	Main Line of Action
MSL	Mean Sea Level
NAVAREA	A World-Wide Navigational Warning Service
NGDC	National Geophysical Data Center (USA)
NHK	Nippon Hosou Kyoukai (Japan Broadcasting Corporation)
NOAA	National Oceanic & Atmospheric Administration (USA)
NOS	National Ocean Service (USA)
NPP	Nuclear Power Plants
NTC	National Tidal Centre (Australia)
NTHMP	National Tsunami Hazard Mitigation Programme (USA)
NTL/ICMMG	Novosibirsk Tsunami Laboratory of the Institute of Computational Mathematics & Mathematical Geophysics (Russian Federation)
NWLON	National Water Level Observation Network (USA)
NWPTA	Northwest Pacific Tsunami Advisory
NWPTAC	Northwest Pacific Tsunami Advisory Center (Japan)
ODIN	Ocean Data & Information Network
PDM	Parametric Data Manager
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PIC	Pacific Island Countries
PMEL	Pacific Marine Environmental Laboratory (USA)
PTWS	Pacific Tsunami Warning System
RDBMS	Relational Data Base Management System
ROSHYDROMET	Russian Federal Service for Hydrometeorology & Environmental Monitoring
SEAREAD	Australian Educational Programme
SHOA	Servicio Hidrografico y Oceanografico de la Armada de Chile (Naval Hydrographic & Oceanographic Service of the Armada of Chile)
SMD	Samoa Meteorology Division
SMS	Short Message Service
SOPAC	South Pacific Applied Geoscience Commission
SPTAW	South Pacific Tsunami Awareness Workshop
STK	Seismic Tool Kit
TAO/TRITON	Tropical Atmosphere Ocean Project TRITON Data Display
TBB	Tsunami Bulletin Board

TC	Tsunami Commission
TOR	Terms of Reference
TROIKA	Tsunami: Reduction Of Impacts through three Key Actions
TTT	Tsunami Travel Time
TWS	Tsunami Warning System
TWSP	Tsunami Warning System in the Pacific
UHSLC	University of Hawaii Sea Level Center (USA)
UN	United Nations
UN/OCHA	United Nations/Office for the Coordination of Humanitarian Affairs
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific & Cultural Organization
UPRM	University of Puerto Rico, Mayagüez
USGS	US Geological Survey
VSAT	Very Small Aperture Terminal (an earthbound station used in satellite communications of data)
WC/ATWC	West Coast/Alaska Tsunami Warning Center (USA)
WDC-SEG	World Data Centre for Solid Earth Geophysics
WESTPAC	IOC Sub-Commission for the Western Pacific
WMO	World Meteorological Organization
WWTD	World Wide Tsunami Database

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32. Thirteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, New York, 1990	E only
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36. Twenty-fourth Session of the Executive Council, Paris, 1991	E, F, S, R
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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
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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
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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*
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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*
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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 International 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*