Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System

Twenty-third Session

Apia, Samoa
16–18 February 2009

UNESCO

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IOC/ICG-PTWS-XXIII/3
Paris, March 2009
English only[1]

[1] Executive Summary available in English, French, Spanish and Russian at the beginning of this report.

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Executive Summary

The Twenty-third Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) was held in Apia, Samoa, 16–18 February 2009 under the Session Chairmanship of Mr Giorgio de La Torre, a.i. Chairman of the ICG/PTWS. It was attended by 61 participants from 21 ICG/PTWS Member States and representatives from three organizations, and observers.

The Session reviewed progress during the intersessional period from October 2007 to February 2009 as reported by the Regional Working Groups of the South East and South West Pacific and the Working Group on Sea Level Information and Data Exchange.

The ICG reviewed the report of the Warning and Advisories providers, discussed the results of the Pacific-wide exercise, Exercise Pacific Wave '08 and planned for the next Pacific Wide Exercise in 2010.

The ICG approved nine recommendations on (1) Enhancing Tsunami Warning Products, (2) PTWS Exercises, (3) Official Contacts and Sharing of Information, (4) Request for IOC Review of GLOSS Terms of Reference, (5) PTWS Medium Term Strategy 2009-2013, Working Group Structure and Implementation Plan 2009-2011, (6) Steering Committee of the ICG/PTWS, (7) Seismic Data Exchange in the South West Pacific, (8) Pacific Emergency Communications and (9) Appreciation to the Government of Samoa

The ICG re-structured its Working Groups into three Technical Working Groups on (1) Risk Assessment and Reduction, (2) Detection, Warning and Dissemination and (3) Preparedness and Readiness. To these technical groups the ICG added four Regional Working Groups (Central American on the Pacific, South East Pacific, South West Pacific and South China Sea).

The ICG approved a PTWS Medium Term Strategy 2009-2013 that describes the basic directions towards continuously improving the Pacific Tsunami Warning & Mitigation System to meet stakeholder requirements during the period 2009-2013. The three main pillars of the new strategy are:

- Risk Assessment and Reduction: hazard and risk identification and risk reduction
- Detection, Warning and Dissemination: rapid detection and warning dissemination down to the last mile
- Awareness and Response: public education, emergency planning and response.

The ICG elected new Officers for the inter-sessional period, welcoming Lt. Giorgio de La Torre of Ecuador as Chairman and Mrs Filomena Nelson from Samoa and Mr Yohei Hasegawa of Japan as Vice-Chairs.

The ICG decided to organize its Twenty-fourth Session between October 2010 and March 2011 and **noted** the expression of interest of the Russian Federation to host the 25th Session of the ICG/PTWS and highlighted the commemorative aspects of this Session.

Résumé exécutif

La vingt-troisième session du Groupe intergouvernemental de coordination du Système d'alerte aux tsunamis et de mitigation dans le Pacifique (GIC/PTWS) s'est tenue à Apia, Samoa, du 16 au 18 février 2009 sous la présidence de M. Giorgio de La Torre, président par intérim du GIC/PTWS, et en présence de 61 participants venus de 21 États membres du Groupe intergouvernemental, de représentants de trois organisations et d'observateurs.

Les participants ont examiné les progrès accomplis pendant la période intersession (d'octobre 2007 à février 2009), présentés par les groupes de travail régionaux du Pacifique du Sud-Est et du Sud-Ouest et le groupe de travail chargé de l'information et de l'échange de données sur le niveau de la mer.

Le GIC a examiné le rapport des fournisseurs de services consultatifs et d'alertes, a discuté des résultats de l'exercice réalisé à l'échelle du Pacifique, intitulé « Vagues du Pacifique 2008 », et a prévu pour 2010 le prochain exercice dans tout le Pacifique.

Le GIC a approuvé neuf recommandations concernant (1) l'amélioration des alertes au tsunami, (2) les exercices du PTWS, (3) les points de contacts officiels et le partage d'information, (4) la demande de réexamen par la COI du mandat du GLOSS, (5) la Stratégie à moyen terme du PTWS pour 2009-2013, le groupe de travail sur la structure et la mise en œuvre du Plan 2009-2011, (6) le Comité directeur du GIC/PTWS, (7) les échanges de données sismiques dans le Pacifique du Sud-Ouest, (8) la communication d'urgence dans le Pacifique et (9) les remerciements adressés au Gouvernement du Samoa.

Le GIC/PTWS a restructuré ses groupes de travail pour créer trois groupes de travail techniques sur (1) l'évaluation et la réduction des risques, (2) la détection, l'alerte et la diffusion et (3) la préparation et la disponibilité opérationnelle, auxquels il a ajouté les groupes de travail régionaux (pour la partie Pacifique de l'Amérique centrale, le Pacifique du Sud-Est, le Pacifique du Sud-Ouest et la mer de Chine méridionale).

Le GIC/PTWS a approuvé une Stratégie à moyen terme du PTWS pour 2009-2013 qui décrit les principales orientations à suivre pour continuer d'améliorer le Système d'alerte aux tsunamis et de mitigation dans le Pacifique afin de répondre aux besoins des parties prenantes pendant la période 2009-2013. Les trois principaux piliers de cette nouvelle stratégie sont :

- l'évaluation et la réduction des risques : l'identification des aléas et risques et la réduction des risques ;
- la détection, l'alerte et la diffusion : la détection rapide et la diffusion des alertes jusqu'aux endroits les plus reculés ;
- la sensibilisation et la riposte : l'éducation du public, la planification et les interventions en cas d'urgence.

Le GIC a élu un nouveau Bureau pour la période intersession, souhaitant la bienvenue à M. Giorgio de La Torre (Équateur) en sa qualité de Président et à Mme Filomena Nelson (Samoa) ainsi qu'à M. Yohei Hasegawa (Japon), en tant que vice-présidents.

Le GIC a décidé d'organiser sa vingt-quatrième session entre octobre 2010 et mars 2011, **a pris acte** que la Fédération de Russie s'était déclarée prête à accueillir la vingt-cinquième session du GIC/PTWS et a souligné le caractère commémoratif qu'aurait cette session.

Resumen dispositivo

El Grupo Intergubernamental de Coordinación del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico (ICG/PTWS) celebró su 23ª reunión en Apia (Samoa), del 16 al 18 de febrero de 2009, bajo la Presidencia del Sr. Giorgio de La Torre, Presidente interino del ICG/PTWS. Asistieron a la reunión 61 participantes de 21 Estados Miembros del ICG/PTWS y representantes de tres organizaciones, así como observadores.

En la reunión se examinaron los avances realizados durante el periodo entre reuniones, de octubre de 2007 a febrero de 2009, sobre la base de los informes de los grupos de trabajo regionales del Pacífico sudoriental y el Pacífico sudoccidental, así como del Grupo de Trabajo sobre mediciones del nivel del mar, acopio e intercambio de datos.

El ICG examinó el informe de los proveedores de asesoramiento y alerta, discutió los resultados del ejercicio Pacific Wave '08 y planificó el próximo ejercicio para todo el Pacífico en 2010.

El ICG aprobó nueve recomendaciones relativas a: 1) Aumento de los productos de alerta contra los tsunamis; 2) Ejercicios del PTWS; 3) Contactos oficiales e intercambio de información; 4) Solicitud de revisión del mandato del GLOSS; 5) Estrategia a Plazo Medio del PTWS para 2009-2013, Estructura del Grupo de Trabajo y Plan de ejecución para 2009-2011; 6) Comité de dirección del ICG/PTWS; 7) Intercambio de datos sismológicos en el Pacífico sudoccidental; 8) Comunicaciones de emergencia en el Pacífico; y 9) Agradecimiento al Gobierno de Samoa.

El ICG reestructuró sus Grupos de trabajo en tres Grupos de trabajo técnicos sobre: 1) Evaluación y reducción de riesgos; 2) Detección, alerta y difusión; y 3) Preparación. A estos grupos técnicos el ICG añadió cuatro Grupos de trabajo regionales (América Central en el Pacífico, Pacífico sudoriental, Pacífico sudoccidental y Mar de China meridional).

El ICG aprobó una Estrategia a Plazo Medio del PTWS para 2009-2013 en la que se explicitan las orientaciones básicas para un mejoramiento constante del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico de modo que responda a las necesidades de los interesados en el periodo 2009-2013. Los tres pilares principales de la nueva Estrategia son:

- Evaluación y reducción de riesgos: localización de peligros y riesgos y reducción de los riesgos.

- Detección, Alerta y Difusión: detección y difusión rápidas de alerta hasta la última milla.

- Sensibilización y respuesta: educación del público, planificación y respuesta de emergencia.

El ICG eligió una nueva Mesa para el periodo entre reuniones, y saludó con satisfacción la designación como Presidente del Teniente Giorgio de La Torre, de Ecuador, y de la Sra. Filomena Nelson, de Samoa, y el Sr. Yohei Hasegawa, de Japón, como Vicepresidentes.

El ICG decidió organizar su 24ª reunión entre octubre de 2010 y marzo de 2011, y **tomó nota** del interés de la Federación de Rusia de acoger la 25ª reunión del ICG/PTWS y destacó los aspectos conmemorativos de esa reunión.

Рабочее резюме

Двадцать третья сессия Межправительственной координационной группы по Системе предупреждения о цунами и смягчению их последствий в Тихом океане (МКГ/СПЦТО) была проведена в Апиа (Самоа) 16-18 февраля 2009 г. под председательством г-на Хиорхио де ла Торре, исполняющего обязанности председателя МКГ/СПЦТО. На ней присутствовал 61 участник из 21 государства – члена МКГ/СПЦТО, а также представители от трех организаций и наблюдатели.

Участники сессии рассмотрели прогресс, достигнутый в межсессионный период с октября 2007 г. по февраль 2009 г. и отмеченный в докладах региональных рабочих групп по юго-восточной и юго-западной частям Тихого океана, а также Рабочей группы по информации и обмену данными об уровне моря.

МКГ рассмотрела сообщение провайдеров оповещений, обсудила результаты учений, проводившихся в масштабах всего Тихого океана, учений «Тихоокеанская волна 08» и планы проведения следующего учения в Тихом океане в 2010 г.

МКГ одобрила девять рекомендаций, касающихся (1) улучшения продуктов системы предупреждения о цунами, (2) учений в рамках СПЦТО, (3) официальных контактов и обмена информацией, (4) просьбы о пересмотре МОК круга ведения ГЛОСС, (5) Среднесрочной стратегии СПЦТО на 2009-2013 гг., структуры рабочей группы и Плана осуществления на 2009-2013 гг., (6) Руководящего комитета МКГ/СПЦТО, (7) обмена сейсмическими данными в юго-западной части Тихого океана, (8) сообщений о чрезвычайных ситуациях в Тихом океане и (9) выражения признательности правительству Самоа.

МКГ реструктурировала свои рабочие группы, создав три технические рабочие группы по следующим вопросам: (1) оценка и уменьшение рисков, (2) обнаружение, предупреждение и распространение оповещений и (3) обеспечение подготовленности и готовность. Эти технические группы МКГ дополнила четырьмя региональными рабочими группами (по тихоокеанскому побережью Центральной Америки, по юго-восточной части Тихого океана, по юго-западной части Тихого океана и по Южно-Китайскому морю).

МКГ утвердила Среднесрочную стратегию СПЦТО на 2009-2013 гг., в которой изложены основные направления деятельности по постоянному совершенствованию Системы предупреждения о цунами и смягчения их последствий в Тихом океане в целях удовлетворения потребностей заинтересованных сторон в период 2009-2013 гг. Тремя основными компонентами новой стратегии являются:

- Оценка и уменьшение рисков: определение опасностей и рисков и уменьшение рисков.
- Обнаружение, предупреждение и распространение оповещений: быстрое обнаружение и распространение оповещений вплоть до последней мили.
- Повышение осведомленности и реагирование: обучение населения, планирование и реагирование в чрезвычайных ситуациях.

МКГ избрала новых должностных лиц на межсессионный период: лейтенанта Хиорхио де ла Торре (Эквадор) в качестве председателя, г-жу Филомену Нельсон (Самоа) и г-на Йохеи Хасегаву (Япония) в качестве заместителей председателя.

МКГ постановила организовать свою 24-ю сессию где-то в период с октября 2010 г. по март 2011 г. и **приняла к сведению** проявленную Российской Федерацией

заинтересованность принять 25-ю сессию МКГ/СПЦТО, отметив юбилейный характер этой сессии.

1 WELCOME AND OPENING OF THE SESSION

1 The meeting started at 8:15 on Monday 16th February 2009 with a welcome offered by Reverend Neru Tiatia followed by the traditional Samoan ceremony ***Ava o le Feiloaiga***, the Samoan formal and official ceremony of acceptance and welcoming of visitors.

2 The Head of the Tsunami Unit of the Intergovernmental Oceanographic Commission IOC of UNESCO, Dr. Peter Koltermann on behalf of the Assistant Director General of UNESCO and Executive Secretary of the IOC, Dr. Patricio Bernal welcomed the participants. He reminded the essential influence that PTWS has had in the development and deployment of tsunami warning systems throughout the world after the Indian Ocean Tsunami. His welcome speech is in ANNEX IV.

3 The Acting Chairman of the ICG/PTWS, Giorgio de la Torre welcomed all participants. He recalled that 44 years ago the Member States of IOC decided to create the International Coordination Group for Tsunami in the Pacific Ocean (ITSU) and underscored that this commitment must remain permanent. He expressed his thanks to the Government of Samoa for their kind and warm reception and swift organisation of the meeting. His welcome speech is in ANNEX IV.

4 His Excellency, the Associate Minister of the Ministry for the Natural Resources and the Environment MNRE of the Government of Samoa., Fonootoe Pierre Lauofo, on behalf of the Government of Samoa officially welcomed the participants to Samoa. He reminded participants that Samoa's vulnerability to tsunamis is rated as "extreme" because of its proximity to the Tongan trench. He informed that the Government of Samoa has recently make progress through enacting Disaster and Emergency legislation and by developing a Disaster Management Plan. He reported that using new technologies and with the active participation of community leaders, Samoa is making progress in terms of tsunami preparedness, in the framework of the PTWS. He then informed that Samoa does have a seismic station (in partnership with the government of USA) and a sea level gauge (in partnership with the Government of Australia) and expects to strength this basic network very soon. He then formally opened the 23rd Session of the PTWS. His welcome speech is in ANNEX IV.

2 ORGANIZATION OF THE SESSION

2.1 ADOPTION OF AGENDA

5 The acting Chairman of the ICG/PTWS, Lt. Giorgio de La Torre, chaired the meeting. He introduced the Draft Provisional Agenda prepared by the Secretariat following the guidance provided by the PTWS Steering Committee.

6 Following a suggestion of Australia an item on the Pacific Wave Exercise 2008 was included as item 3.6.3

7 USA suggested including an item about latest information available to Member States on tsunami hazards and other information that USA would like to share with Member States. The Chairman suggested including this under the National Report of USA in item 3.5.

8 The **ICG adopted** the Agenda as in ANNEX I

2.2 DESIGNATION OF THE RAPPORTEUR

9 The Chairman requested the Group to nominate the Rapporteur. Samoa was invited and accepted to provide the role of Rapporteur.

10 The **ICG** accepted the proposal and **thanked** Samoa for providing the Rapporteur

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

11 The Technical Secretary of the ICG/PTWS Mr Peter Koltermann introduced this item and presented the documentation for the session. He indicated that all documents were made available in advance through the meeting website as per the List of Documents presented in ANNEX II. He suggested modifying the Timetable to take into account the changes adopted to the Agenda, which was accepted.

12 USA asked the Secretariat about how the Group would deal with the core documents given the fact that some where made available only recently. The Technical Secretariat explained the process leading to finalise the core documents, which required the active participation of the Steering Committee and have some unforeseen delays. He suggested that the Group may decide to work intrasessionally to finalise some of these documents with a view to approve them.

13 The Chairman asked Ms Filomena Nelson (Samoa) to inform the Group about local arrangements. Ms Nelson, on behalf of the local organisers, informed delegates about local arrangements for the meeting including a field trip to the Samoa Early Warning System for Tsunami starting at 16:30 on Tuesday 17th February. She also informed that a reception will be offered by Samoa on Monday 16th February at 6 PM..

14 The Chairman then informed the meeting about how he intended to conduct the Session and requested comments about the proposed sessional Working Groups.

15 New Zealand, seconded by Australia, proposed to establish a sessional Working Group on Seismic Data Exchange focusing on the South West Pacific region, to take advantage of the presence of delegates from countries that are actively working on bilateral contributions for seismic instrumentation, including China. USA suggested to establish a sessionnal Working Group to consider the Draft PTWS Medium Term Strategy, the Draft PTWS Working Group Structure and Overall Governance and the Draft PTWS Implementation Plan, considering they are all three connected.

16 The **ICG agreed** to establish the following intrasessional open ended Commissions and Working Groups:

- Elections Commission, composed by Australia, Chile, France (Chair) and USA
- Recommendations Commission, composed by Australia, France, Japan, New Zealand and USA (Chair)
- Programme and Budget Commission, composed by USA
- PTWS Medium Term Strategy, PTWS Working Group Structure and Overall Governance and PTWS Implementation Plan, composed by Australia, Chile, China, France, Japan, Malaysia, New Zealand, Samoa (Chair) and USA (Vice-Chair)
- Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS), composed by Australia, Japan, Samoa and USA (Chair).
- Seismic Data Exchange, composed by Australia, Canada, Chile, China, France, Fiji, Malaysia, New Zealand (Chairman), Papua New Guinea, Solomon Islands, Tonga, Vanuatu and USA

17 Upon the suggestion of USA a sessional meeting of Working Group III on Pacific Emergency Communications was also organised.

18 The Chairman announced of the forth-coming Election of Officers, and reminded the ICG of the deadline for nominations by Member States in writing, according to IOC Rules and Procedures, as of February 16, 2009, at 18:00 hrs local time

3 REPORT ON INTERSESSIONAL ACTIVITIES

3.1 IOC EXECUTIVE SECRETARY'S REPORT

19 Mr Peter Koltermann, Head of the Tsunami Unit of the IOC, presented, on behalf of Mr. Patricio Bernal the report of the IOC Executive Secretary. In his report he indicated that preparing for the next biennial budget 2010 – 2011, the IOC has proposed to enhance its staff envelope by creating posts, *inter alia*, at the UNESCO Office in Apia, to be based in Suva, Fiji a National Officer (NOC) to promote IOC's programmes, in particular on Tsunami Warning Systems and disaster risk reduction activities. This also responds to views expressed by countries in the South West Pacific which the Director General of UNESCO visited in spring of 2008. He then highlighted the agreement with CTBTO to make their IMS seismic data available to Tsunami Warning Centres (TWCs), where UNESCO has the role of confirming that a national TWC has been established by a member state of CTBTO. This agreement has an important bearing on how the seismic network will be organized in the future in the Pacific to ensure full and adequate availability of the data to the system.

20 In his report the Executive Secretary informed the PTWS that to review the commonalities of the four existing Tsunami Warning Systems (TWSs), to harmonize and facilitate their cooperation and to analyse how to develop a sustainable structure for the future, a Global Meeting on Tsunami Warning Systems is being called for March 24 – 27, 2009 in Paris, France. The meeting is open to ICGs officers and chairs of their Working Groups and invited technical experts. This meeting will also deliver input into the next meeting of the Working Group on Tsunamis and Other Ocean Hazards Warning and Mitigation Systems (TOWS) that will propose to the IOC 25th Assembly in June 2009 how to effectively and efficiently coordinate its warning systems for tsunami and ocean-related hazards.

21 He also signalled that the IOC Secretariat is developing a transition strategy for its tsunami programme. Part of it is the transfer of the ICGs Secretariats to regions. Another is the establishment of Tsunami Information Centres for each system, also in the field. For the NEAMTWS the secretariat has been established as of 1 January, 2009 in Bonn, Germany. It also serves to liaise with the European Union and the ISDR Early Warning Platform. For the IOTWS the J-TIC has been very active, and continued support is being negotiated to increase the support available in the Indian Ocean region.

22 USA asked about the possibility of having a TOWS meeting in connection with the Global Meeting 24-27 March 2009 in Paris. The Secretariat answered that the TOWS Chairs were requested to evaluate that option.

23 USA requested information about the status of sea level monitoring coordination. The Secretariat responded that this is being addressed by the PTWS Working Group 2 and should be reported under the respective agenda item.

24 The **ICG noted** the Report of the IOC Executive Secretary

3.2 ICG/PTWS CHAIRMAN'S REPORT

25 The Chair presented his Report for the intersessional period 2007 – 2009 emphasising the cooperation among the Officers, the Steering Committee and the Secretariat, that lead to organise the 23rd PTWS meeting with timely and key documents for consideration of Member States.

26 He indicated that during this meeting Member States will actively discuss important topics for the system and will take decisions in order to improve the effectiveness of the tsunami warning and mitigation efforts in the Pacific. Among them, the PTWS Medium Term Strategy for the period 2009 – 2014 as well as its Implementation Plan, in view of the adoption of such important planning tools. In a similar way, Member States will have to define the most suitable and effective working structure to achieve the proposed strategic objectives as well as to generate operational products.

27 The Chairman commented on the results and benefits of the recently adopted governance structure of the ICG/PTWS which is another important topic that will be reported and discussed by Member States, which is extremely positive, considering the need of continuously improving the decision making process of the ICG.

28 Australia thanked the Chairman for having accepted the role of acting Chairman and for having successfully coordinated the work of the PTWS during the intersessional time. USA echoed the comments of Australia, reminded the importance of the discussions on PTWS held at the 41st IOC Executive Council and expressed USA's positive appreciation of recent developments of PTWS in the intersessional period. He indicated that USA is particularly pleased by the regional work implemented by PTWS.

29 The **ICG noted** the Report of the Chairman

3.3 ICG/PTWS SECRETARIAT'S REPORT

30 The Head of the Tsunami Unit of the IOC, Mr. Peter Koltermann presented a summary of the activities developed by the Secretariat in the intersessional period. He reported that since the ICG/PTWS last met in Guayaquil, Ecuador, 17–21 September 2007 (PTWS-XXII) extensive work has been planned and mostly carried out to implement the decisions and recommendations. In particular the newly established Steering Committee reviewed at its 1st meeting (PTWS-SC1) defined deliverables to be prepared and presented to the PTWS-XXIII. The PTWS Secretariat in due course had assisted the Steering Committee in the preparation of PTWS-SC1, and its documentation.

31 In preparation of PTWS-SC1, the Secretariat had invited member states to nominate members for Working Groups. Since the response was slow, the Secretariat again reminded Member States of the opportunity to get involved in the PTWS. This again was not meeting the expectations raised at PTWS-XXII. The Steering Committee decided to submit a document on the PTWS Working Group Structure to PTWS XXIII that is expected to clarify the membership and stimulate Member States to actively participate at WGs.

32 He also reported that lead by the former Chair of the PTWS, Mr Stephenson and Director ITIC Dr Kong the ITSU Master Plan (IOC/INF 1124), was put in its final format for future reference and is available to PTWS Member States in electronic form.

33 The Steering Committee had also agreed that "based on the PTWS Medium Term Strategy and the PTWS Users Guide, the ICG/PTWS Secretariat shall produce a first draft ICG/PTWS Implementation Plan and after review by the Steering Committee submit to ICG/PTWS XXIII".. Subsequently the Director PTWC was tasked with the role of finalizing the PTWS Users Guide document. The final contributions to the PTWS Users Guide now called

Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS), were received by the Secretariat in February 2009, and subsequently was published. Since a final revision of some figures is still outstanding, hard copies of the present status of the Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) are made available to this ICG session only. The final document will be published as IOC Technical Series 87. Because of this delay, the Secretariat now submits to the ICG/PTWS-XXIII only a generic draft PTWS Implementation Plan (IOC Technical Series, 86) that in particular requires further input from member states. The Secretariat regrets this unfortunate delay and proposes to develop it further during the intersessional period for the next meeting of the PTWS Steering Committee.

34 Mr Koltermann reported that as agreed at PTWS-XXII the Exercise Pacific Wave 08 was announced to Member States, and the PACWAVE 08 Manual (IOC Technical Series 82) published. This exercise was accompanied by extensive media activities by the IOC Secretariat, UNESCO and IOC's ITIC to make member states aware of this important event, and to encourage non members to join the PTWS. The report of PACWAVE 08 is to become available as IOC/INF-1254 Exercise Pacific Wave '08: Summary Report.

35 Australia thanked the Secretariat for the support provided to the PTWS and encouraged the Secretariat to continue improving its support to Member States. Australia particularly requested that the reports of meetings be provided as soon as possible after the meetings close and commented on the short time between the announcement of the Exercise Pac Wave 08 and the actual exercise. The Secretariat shared the concerns of Australia about the delay in getting the report of PTWS XXII edited and printed and presented excuses for the time it took. He suggested that PTWS and its Secretariat are in a learning curve with respect to procedures and expect that this will smooth procedures and will avoid delays in the future.

36 Samoa expressed its thanks to the Director General of UNESCO for the decision of establishing a NOC in Suva, Fiji as a positive step and signal towards South West Pacific Islands. USA asked if the NOC could also take responsibilities for the PTWS Secretariat. Mr Koltermann responded that while the NOC will represent all IOC the priority assignment is with Disaster Risk Reduction and tsunami and therefore could take a relevant role on tsunami for the region but not clearly the Secretariat for PTWS. USA indicated that the Secretariat is very relevant for Member States and added that it is critical that the ICG deliver the Report of PTWS XXIII very soon to inform the meetings of the Caribbean, the Global Meeting, Indian Ocean and the Assembly. The Chairman indicated that member States are available to support the Secretariat in its efforts to produce the required documents in time.

37 The **ICG noted** the Report of the ICG/PTWS Secretariat.

3.3.1 ITIC REPORT

38 The ITIC Director, Dr. Laura Kong, provided a report on the intersessional activities of the ITIC. Summarising activities conducted in 2006-2008 she reported that ITIC participated in 20 meetings globally as a technical expert on tsunami warning and mitigation to the ICG and its working groups and other tsunami workshops, conducted 15 trainings globally concentrating on tsunami warning center and emergency response standard operating procedures for successful end-to-end warning, developed and distributed tsunami warning decision support tools and tsunami awareness materials.

39 Under the ITIC Training Program (ITP) which provides in-country training, 178 scientists and government officials from 49 Caribbean and Pacific countries were trained in 2 1-week trainings in 2007, and about 190 participants from 20 Indian Ocean and Pacific countries were trained through 6 1-week trainings in 2008 and 2009. She highlighted the IOC Project Strengthening Tsunami Warning and Emergency Responses: Training Workshops on the Development of SOPs for Indian Ocean and Southeast Asian Countries in which, Indonesia,

Malaysia, Philippines, Singapore, Thailand and Vietnam have benefited. She thanked Malaysia for inviting the ITIC to conduct training in seismology and tsunami warning in 2006, 2007, and 2008, in which Thailand and Vietnam were also invited.

40 ITIC's Director also provided a short summary of the freely available tsunami warning decision support tools. A Handout is available describing each in detail, and the software is being distributed. The tools included a Heads-up SMS Text Alert from the PTWC (through the RANET project), the ITIC Tsunami Bulletin Board email list serve for tsunami scientists and professionals, a real-time earthquake display which includes PTWC and WC/ATWC reported results and messages (CISN, provided by USGS and NOAA), sea level monitoring tools supported by PTWC (Tide Tool, a tsunami warning center operations tool), and IOC (Sea Level Monitoring facility web site), historical tsunami databases (offline from Russia and NGDC/ITIC (beta available), and online from the WDC/NGDC), and tsunami travel time software and mapmaking.

41 She summarized intersessional activities for the ITIC library, information requests, newsletter and awareness materials. A handout is available describing available education and awareness materials and is accompanied by a DVD providing electronic copies. In 2008, new versions of Tsunami, Great Waves, and Tsunami Glossary 2008 and a DVD documenting a school tsunami evacuation drill were completed. In 2009, a Global Tsunami Sources poster has been completed; she thanked Chile for printing the posters that are available at this meeting for taking home. She referred to ITIC's staffing, expressing her gratitude to Chile and Japan for having contributed to ITIC with SHOA and JMA staff respectively.

42 Japan expressed appreciation to IOC and ITIC for having given an opportunity of JMA's dispatching a technical staff to ITIC to join its international activities. Japan expressed its hope that her two-year work and products would contribute to ITIC's future activities.

43 Australia thanked ITIC for its valuable contribution. They inquired whether the ITIC work plan would be tabled at this meeting. The ITIC Director responded that the PTWS work plan approved by the PTWS Steering committee focused on the same items as before, namely, the ITP in Hawaii, production of the PTWS Tsunami Newsletter, support of Information Services (library and web/electronic materials), and development and distribution of tsunami awareness materials. The IOC and sources outside of the NOAA would provide all international travel and other project activities.

44 The USA reported that an Implementation Partnership Agreement (IPA), which included the work plan, is close to being concluded between NOAA and the IOC for ITIC. The USA provided a copy of the ITIC work plan to Member States. He further noted that the 2006 US Tsunami Public Education Act specifically mentions the ITIC as providing international tsunami support in collaboration with the IOC.

45 Tonga asked if in the future some training organised by ITIC will be run in the South Pacific Islands. ITIC Director responded that in coordination with the Secretariat they will explore opportunities for training to be developed in the region. The USA reported that through the WMO Voluntary Contribution Program, training funds may be applied for. He gave the example of the Pacific Desk for meteorology, wherein a meteorologist spends 6 weeks in Hawaii to build their knowledge skills and experience. The same mechanism could be done with the cooperation of IOC. He indicated that the benefits of the past ITP-Hawaii trainings are already seen at this PTWS meeting, where we have four ICG participants who have attended the ITP-Hawaii in recent years.

46 Australia seconded the idea of using the WMO model and recalled that several initiatives are in course in the region and these may be combined to make possible having training opportunities for tsunami within the region. The Secretariat reminded that while training opportunities seems to be relevant for all Member States, funds are required for these to

happen and that even if the PTWS XXII called Member States to consider contributing to a PTWS Trust Fund there have been no contributions received in the intersessional period. ITIC Director and the Secretariat called Member States to contribute funds towards training activities in the South West Pacific region.

47 The ITIC informed the Group that countries have also supported national trainings, inviting ITIC to provide the training, and also invited neighbouring countries at the same time. Dr. Kong gave the example again for Southeast Asia, where Malaysia has asked ITIC to provide training in seismology and tsunami warning three times and invited neighbouring countries. She also called attention to the need to focus on Central America, pending funding resources.

48 Malaysia thanked ITIC for supporting the organisation and participation in the Workshops on Seismology and Tsunami Warning organised by Malaysia. He announced a third version of this Workshop in 2009 and invited ITIC and Member States to explore the option of attending these Workshops.

49 The Chairman called on countries to step up to find funds and work cooperatively to sponsor trainings, and work with the ITIC to make proposals and carry out the training. Training in both tsunami warning operations and emergency response is still needed in almost all regions. He thanked ITIC Director for her report and reminded the important role of Disaster Management agencies in tsunami preparedness. He suggested that Member States make efforts to engage more these agencies in the work of PTWS.

50 The **ICG noted** the Report of the ITIC's Director.

3.4 WORKING GROUPS REPORT

51 The Chair asked the Chairman of the Working Group on the South East Pacific (SEP WG), Capt. Andres Enriquez, to present its report.

52 Capt. Enriquez recalled the M7.6 Aug 15, 2007 Pisco-Peru earthquake (reported 500 deaths, more than 1,000 injured and 600,000 affected) and tsunami (3 deaths near Pisco). This event highlighted gaps in communication between countries and in monitoring in the region, and resulted in the establishment of the SEP WG at PTWS XXII. In the intersessional period several activities of the WG have taken place. The SEP WG met in February 2008 hosted by Peru with focus on improvement of seismology and sea level measurement networks and better use of earthquake methods of monitoring and detection. The Permanent Commission of the South East Pacific (CPPS) has helped to support SEP WG efforts.

53 As a result of the increased regional cooperation communications were improved among the tsunami warning centers of SEP WG countries (Colombia, Chile, Ecuador and Peru), training in SIFT/MOST was provided in Valparaiso, Chile, by NOAA/PMEL with trainees from all 4 countries, and one participant from French West Indies. The SEP WG has participated collaboratively in PTWS activities and in PacWave08.

54 In Chile, tsunami inundation maps for four new locations were done (Easter Island, Puerto Aysen, Puerto Chacabuco and Maullin locations), DART maintenance off northern Chile was performed and Chilean NTWC attended tsunami related training at the University of Hawaii in November 2008. As well, a new seismic network including GPS technology will be installed in the next four years.

55 In Peru, there is improvement in communications and in additional training plus new Tide Gauges. In Colombia, new Tide Gauges have being installed in Tumaco, Buenaventura and Isla Malpelo.

56 Each country is working independently to improve their systems, but will continue to collaborate and cooperate to improve the performance of PTWS within the region. The highest priority is to improve regional seismic monitoring and obtain real time sea level data transmission. Capt. Enriquez reported that more communications exercises are also planned, in order to improve existing information exchange protocols developed by the SEP WG in 2008.

57 The **ICG decided** to continue the Working Group on the South East Pacific.

58 The Chairman of the Working Group VII on the South West Pacific (SWP WG), Dr. Ken Gledhill, presented the report of the Working Group recent meeting in Apia, Samoa, 13 February 2009. Activities of the Working Group in the intersessional period included:

- SWP WG, February 13 2009 in Samoa
- Two donor funded projects have made a major contribution towards the objectives of the WG :
    a. Probabilistic tsunami hazard of the SW Pacific (AusAid funded). This work was carried out by Geoscience Australia in collaboration with SOPAC. Phases 1 and 2 have been completed, and there is interest in a Phase 3 which would provide tools for responders and applied results.
    b. "National Capacity Assessment of Pacific Islands Applied Geoscience Commission (SOPAC) Member Countries: Tsunami Warning and Mitigation Systems " being carried out by BoM (AusAid funded). This project is about 60% complete.
- Improvements in detection (seismic and sea level) are ongoing, but there is much still to be done. The group identified data sharing is an important issue for tsunami warning purposes.

59 General challenges identified by the SWP WG are:

- Data available to all who need it;
- Telecommunications challenges (internet speed, data gathering, and timeline alert dissemination);
- Continue to fill in gaps in the detection network;
- Local Tsunami Warning – the role of warning and preparedness.

60 In particular, Pacific Island Country challenges are:

- Authority and responsibility within country;
- Communications, including last mile, and redundancy to ensure information gets through (common to all hazards)
- Usage of outreach and tsunami assessment tools
- Interoperability; clarity and conciseness so confusion is minimized especially when there are multiple information providers
- Tsunami response plans are in progress and need to be completed

61 The Chairman of the SWP WG indicated that many action items from the WG require action by WG members, however, some will require action by the ICG and therefore presented several recommendations to the ICG.

62 Australia applauded the excellent regional representation and participation to the SWP WG and indicated that this was a valuable mechanism for improving tsunami mitigation in the region.

63 The **ICG decided** to continue the Working Group on the South West Pacific (SWP WG) and **further decided** that:

- the appropriate PTWS technical working groups review how the commissioning of new sea-level stations is communicated and makes recommendations for improvements
- in future regional organisations and donors be invited to attend appropriate working group meetings as observers
- the appropriate PTWS technical working group discusses tsunami SOPs and provide recommendations and guidance to PICs on criteria and actions after receiving PTWC and NWPTAC messages. Reporting on warning centre progress to implement threat-based warning criteria is also requested.

64 The Chair of the Working Group on Sea Level Information and Data Exchange, Dr. Rick Bailey (Australia), provided a report on the activities of the Group, which did not meet during the intersessional period but corresponded by email. The WG encompasses coastal and deep ocean sensors, upgrades and improvements in technologies.

65 He provided a status report based on the available National Reports. He summarized the sea level situation in Australia, New Zealand, France, Japan, Chile, for coastal stations and tsunameters, the latter with and expansion from 4 in 2005 to more than 40 presently. He also informed that the WG has discussed by email and at previous meetings on network design and guidelines, location guidelines and design criteria, operational status and coordination on new installations.

66 He showed an assessment of timeliness (transmission frequency) and availability of sea level data accessed by PTWC, including the priority stations that were located within 1 hour of the source and with highest priority for upgrade. He indicated that yet a number of stations within the 1-hour envelope are not transmitting in the recommended 5-minute frequency.

67 On data exchange aspects, he summarized that WMO/CBS has endorsed the CREX code tables as a standard for transmission of coastal gauge sea level data on the GTS. CREX tables for transmission of deep ocean data is under development. The use and adoption of the CREX code is unfortunately still limited causing issues for interoperability.

68 On data access and visualization, real-time data may be accessed through GTS, by ftp, and also directly from a number of network providers (Australia, Univ. of Hawaii Sea Level Center). He indicated that there are a number of tools available to support data visualisation.

69 Dr. Bailey expressed that in principle, the WG agreed to the TOWS recommendation that sea level data coordination come under GLOSS if:

- Workshop occurs as recommended by ICG/PTWS XXII
- Review of the ToRs and membership of GLOSS occurs
- User requirements are determined by a Task Team under the Warnings WG
- In principle, the WG agreed with the TOWS recommendation that technical coordination of tsunameters come under the DBCP

70 The Technical Secretary suggested to include the information provided by the WG on Sea Level Information and Data Exchange in the PTWS Implementation Plan and reported that

only Australia, Malaysia, New Zealand, Russian Federation and the USA have nominated experts to this important WG

71 The USA noted that budget restrictions are a constraint that is preventing this WG from meeting in person. He thanked the acting ICG Chairman for his efforts to step up after the former Chair resigned and noted the importance of the current WG on sea level.

72 Australia clarified that the WG did meet during the session at PTWS-XXII. He stated that it is now important for the different ICG related WGs to meet to work together on common issues and technical aspects.

73 The USA commented on the IOC Data Exchange Policy, emphasizing it is crucial to get it implemented. He noted that the Mauritius Declaration modified it slightly and suggested that the IOC Data Exchange Policy be also amended.

74 The **ICG noted** the report of the Working Group on Sea Level Information and Data Exchange.

3.5 NATIONAL PROGRESS REPORTS

75 The Chairman reminded the Meeting that reports have been requested in a standard format, and have been received in advance of the Session and posted to the PTWS web site. He asked Delegates, if they so wished, to make short presentations focussed on topics in their National Reports that they may wish to highlight or enlarge upon.

76 Dr. Dominique Reymond (**France**), head of the Tahiti French warning center, provided a report on the recent activities performed in CPPT (Centre Polynesien de Prevention des Tsunamis- CEA-DASE). Data of the French Polynesia seismic network are transmitted in real time to CPPT through VPN. CPPT also received 1second sampled data of more than 40 IRIS stations to evaluate the seismic parameters, in particular the centroid moment tensor. In addition thanks to several Member States included Australia and Chile, data of more than 30 tide gage stations are received in CPPT. Early 2009, France has implemented one new tide gage in Tubuai and 4 new stations will be implemented in French Polynesia in 2009 and 2010.

77 The sirens network is currently composed in French Polynesia of 138 stations connected through Inmarsat. The New Caledonia and Loyalties, Wallis and Futuna network will be composed of more than 60 sirens.

78 Dr. Francois Schindele reported that France is planning to implement 9 tide gages along the French territories coasts (New Caledonia, Loyalties islands, Wallis and Futuna). France will provide the equipment for another set of 6 stations to be implemented on other Pacific countries coastlines close to the seismic zones, 1 in Samoa, two in Solomon, one in Tonga and two in Vanuatu.

79 **New Zealand** reported information on upgrades to its sea level network to 20 stations with some cooperation with Australia. They are compiling a tsunami database for local, regional, and distant source at three different magnitudes. In Dec 2007, multi-media messaging system was started and is now fully functional. The New Zealand National Tsunami Warning Plan has been finalized provided roles and responsibilities and alerting. In Preparedness, there is a national tsunami signage standard, guidelines on evacuation planning and mass evacuation, and currently focusing on developing national standards for alerting, including development of a tool recommending public alert system. New Zealand has conducted seven seminars regionally to introduce, explain, and obtain feedback from local communities before finalizing.

80 A brief report highlighting the intersessional and future tsunami-related activities of the **United States** was given by the PTWC Director, Dr. Charles McCreery. He noted that during the intersessional period the U.S. completed the deployment of its Pacific-wide array of 32 deep ocean tsunameters, or DART gauges. These gauges can provide data critical for quickly detecting and measuring a tsunami, as well as effectively constraining numerical tsunami forecast models. He explained, however, that at present there are problems with 10 of the gauges. While disappointing, this situation is the result of operating in a remote and severe environment and that efforts are underway to restore the DARTs to good working order. He pointed out that the U.S. now operates a total of 160 sea level gauges in the Pacific that are used by PTWC for tsunami detection and measurement. He then noted that PTWC and WCATWC have continued their progress in implementing the SIFT tsunami forecast model developed by the NOAA Pacific Marine Environmental Laboratory (PMEL). During the intersessional period PMEL transferred the capability to ingest DART data and use it to constrain a forecast. The last capability remaining to be transferred to the two Tsunami Warning Centers is the ability to forward run coastal inundation models in real time when a tsunami is underway and as the deep ocean forecast evolves. The U.S. also helped conduct and participated in Exercise Pacific Wave 08.

81 The PTWC Director informed the Group the US Tsunami Program would soon be receiving a significant one-time four-year-long boost in funding. This will provide the opportunity to make or accelerate many improvements to the US system. Of note will be a modernization of the IT infrastructure to support the continually increasing amount and complexity of data being ingested and analyzed by the Centers and to support the continually increasing forecast capabilities and associated product development of the Centers. The first stage of this effort will be the development of a uniform website for the two Centers and associated web-based services such as RSS and CAP feeds and graphical products. Also facilitated will be the restoration of several coastal sea level gauges operated by PTWC that fill gaps in the coverage provided by gauges of other US and PTWS MS organizations. Lastly, the Director reiterated that PTWC and ITIC are planning to move from their current locations to a new consolidated NOAA facility located on Ford Island inside Pearl Harbor, Hawaii. The move is scheduled for sometime in the year 2013 and it will provide for a more secure and effective PTWC operations center, provide room for growth, and enable closer cooperation and coordination with the other co-located NOAA offices.

82 **Canada** reported that it continues to provide data from 5 water level recorders on Canada's Pacific coast to WCATWS, and thus to PTWS. At the request of WCATWS the number of seismographs in Canada that are available in real time for use by the tsunami warning centers was increased from 9 to 13 in 2008.

83 Canada is evaluating a system for rapid recognition of tsunamigenic ground motion in coastal regions based on differential GPS. A prototype system has been in operation since May, 2008 displaying real time displacement information on a password protected website. Evaluation of the robustness of the software, noise levels, communications links and display format continues. Results are encouraging and it appears to be a technique that could provide automated, rapid, unambiguous real-time deformation information to tsunami warning centers to augment their decision processes and parallel independent information to local officials at a modest cost.

84 The NEPTUNE Canada underwater cable observatory has completed phase one, the installation of the cable. 800 kilometers of powered fiber optic cable has been laid in a large loop extending 250 kilometers offshore. Phase two, the installation of the instruments will be completed in 2009 and 2010. Instruments will include pressure gauges for detection of tsunami waves, broadband seismographs and strong motion seismographs.

85 **Australia** highlighted that the Joint Australian Tsunami Warning Centre (JATWC) was launched with (a) forecast model/observations verified threat-based warnings for Australia and

(b) stratified level of warnings (3 levels) to facilitate emergency response. Regular national exercises/testing and participation in the PacWave 08 and IO Wave 09 has also be scheduled but not primarily dependent on regional systems. Emergency manager training and community education programmes and awareness materials. Australia indicated that Observational systems have greatly expanded in the SW Pacific as part of the Australian Tsunami Warning System (ATWS) objective to facilitate the operation of the PTWS, with all data made freely and timely available on the GTS and via internet to all countries, and especially the PTWC to support its role in the region. Furthermore, and as reported by the SWP WG two AusAID funded projects linked to ATWS are underpinning large part of the SW Pacific WG Action Plan, actively engaging countries in the region.

86 **Samoa** reported that prior disaster management carried out actions on an ad hoc basis, but now follows a structure. The National Disaster Plan contains now response to different hazards, including tsunamis for disaster risk reduction. Disaster Advisory Committee enabled a system for dissemination of alerts in a timely manner. Challenges are in redundant communications, especially in rural area and countries outside Samoa. In 2008, a disaster mobile communication system was implemented. Samoa thanked the government China for assistance in seismic monitoring and reported that they are setting up for a national seismic data center. Details on the Samoan tsunami early warning system were provided during the site visit,

87 Mr. Mohd Rosaidi Che Abas (**Malaysia**) reported that its TWC was established in 2005 to inform agencies and the public within 15 min of the event. Data are obtained through the IRIS DMS to supplement their national network. A data sharing link has been established with Indonesia BMG since both countries have adjacent lands. Currently, they plan to have a 20-station network, and a number of stations are already in place. A third deep-ocean buoy will be installed in the Sulu Sea. Coastal cameras are installed for real-time viewing. He described their seismic monitoring, which uses Antelope with Seiscomp3 and early Bird as backup. Malaysia is developing a tsunami database for Indian Ocean sources and have chosen tsunami forecast points and will compute a total of 11300 scenarios. Several software are used to evaluate the hazard. For the future, Malaysia plan to develop a database for the western Pacific (total more than 55,000 scenarios). For alert dissemination, he described several methods to ensure redundancy, including television. A Fixed Line Alert system (auto-call telephone with prescribed message) is in place, and siren systems continue to be installed. Malaysia reported that its deep-ocean instruments are not stable and as a result, it would not feel comfortable to share the data until it became more reliable and of higher quality.

88 Malaysia reported on the outcomes of the 2nd International Roundtable in October 2008, in Kota Kinabalu, Malaysia, included on the following recommendations:

- ICG/PTWS and IOTWS to develop operational standards for multi purpose sea level stations in Southeast Asia, South China Sea region, and the Western Pacific Marginal Seas Region
- IOC Member States should endorse a Medium Term Strategy and Implementation Plans, especially to include the South China Sea Region. This was an outcome of the 2nd International Roundtable in which a significant hazard was shown.
- ITIC and JTIC should continue to train and provide training
- Regional partnerships should be continued
- Sea level data transmission through GTS is strongly encouraged.

89 Malaysia also reported on the training in seismology and tsunami warning in August 2008, and announced that a 4th training will be conducted in 2009 for which the ITIC has been invited to organize and provide training.

90 **China** highlighted its work in developing a tsunami database, with its main focus of effort on the South China Sea. The State Oceanic Administration (SOA) plans to deploy two deep-ocean buoys in Manila Trench. Under the IOC WESTPAC coordination, China will host a workshop on marine hazards later in 2009.

91 **Japan** reported on its progresses in the following items. It mentioned JMA's domestic tsunami warning/advisory service during the intersessional period referring to its having issued three tsunami advisories since September 2007, two of which had been issued within 5 minutes for local tsunamis. Regarding introduction of a new technology, it mentioned that JMA had started in July 2008 to use offshore GPS buoys installed by the Ministry of Land, Infrastructure, Transport and Tourism, which are expected to detect approaching tsunami earlier than the tide gauges on coasts. About capacity building activities, Japan mentioned a training course on Tsunami Disaster Mitigation newly established in September 2006 by the International Institute of Seismology and Earthquake of Building Research Institute in partnership with the Japan International Cooperation Agency (JICA). It also mentioned a support project by the Japanese government to construct earthquake observation networks in Fiji and Tonga, adding its hope that these training and the earthquake observation networks would contribute to tsunami disaster mitigation for the Pacific.

92 The **Korea** Meteorological Administration oversees the seismic monitoring and tsunami warning in Korea. Their seismic network has been upgraded continuously since 2002. In 2008, three borehole sensors were installed. Currently, seismic data is exchanged with Japan. Tsunami simulations are being carried out to support tsunami warning decision-making mitigation/preparedness. Korea participated in PacWave2008. The Director General of the Earthquake Department oversees the tsunami warning services. The National Oceanographic Research Institute (NORI) operates the coastal sea level network and provides data within 1 minute to public website.

93 **Fiji** highlighted key points of its National Report. Mineral Resource Department has been conducting tsunami awareness at March 2005. To date, 383 communities and 97 schools around the coasts have been covered. Materials include ppt presentations, brochures, video clips, and other materials. In 2007, a tabletop tsunami exercise was conducted to test the tsunami SOPs. Fiji expressed their appreciation to the ITIC for its tsunami awareness materials and to PTWC for providing timely warning messages.

3.6 WARNING & ADVISORY SERVICES REPORT

3.6.1 PTWC REPORT

94 The PTWC Director, Dr. Charles McCreery, gave a report on intersessional and future improvements and activities of the Pacific Tsunami Warning Center (PTWC). PTWC is one of two U.S. tsunami warning centers, the other being the West Coast and Alaska Tsunami Warning Center (WCATWC). He reviewed the current areas of responsibility of the two warning centers for US coasts as well as coasts of the other countries in the Pacific Ocean, Indian Ocean and Caribbean Sea. For the Indian Ocean and Caribbean, PTWC is providing interim services until the capability exists within the region.

95 During the intersessional period, PTWC responded to more than 1000 earthquakes and issued preliminary reports on 820 of them. Sixty-three earthquakes resulted in the issuance of Tsunami Information Bulletins (Mw 6.5 to 7.5). One Fixed Regional Warning was issued for an Mw 7.7 earthquake off the coast of northern Chile, but a destructive tsunami was not generated. In Hawaii, 9 information statements were issued by PTWC for small local earthquakes. In the Indian Ocean, 9 Information Bulletins and 7 Watch Bulletins were issued. In the Caribbean, 7 Information Statements were issued.

96 The PTWC Director then described recent operational enhancements, which include the ingest of data from the completed array of 32 Pacific DARTs, the ingest of data from many upgraded or new Pacific coastal sea level gauges, and the ability of PTWC and WCATWC to now constrain SIFT forecasts with DART data. He described the methodology using the November 2006 Kuril Islands tsunami as an example. He further explained that in order to make an accurate forecast at the coast, a coastal inundation model must be run in real time. Such models currently take only about 5 minutes to run on a modern personal computer.

97 Seventy-five coastal models are being made by the USA for USA coasts, but not for the coasts of other Pacific Member States. PTWC is working with Chile on a pilot project to demonstrate a method for countries to run their own coastal inundation model during events, using the SIFT deep ocean forecast to provide boundary conditions. This can be a way for countries to produce an accurate forecast for selected locations along their coast.

98 PTWC also helped plan, conduct, and evaluate Exercise Pacific Wave 08, and it worked with the JMA NWPTAC and WC/ATWC to prepare and issue dummy bulletins for the exercise.

99 Lastly the PTWC Director described planned enhancements to PTWC and informed the Group of a one-time four-year funding boost that will accelerate progress. Among the projects targeted for this funding are a modernization and convergence of PTWC's and WCATWC's IT infrastructure, development of a unified PTWC and WCATWC website, and the repair/maintenance/upgrade of PTWC coastal sea level stations that fill gaps in Pacific coverage.

100 Australia inquired about how to gather Member State feedback regarding improvements to PTWC messages. Some topics for feedback could be:

- The implementation of threat-based warning criteria rather than earthquake magnitude, distance to epicenter, and/or time left to expected arrival criteria.
- Understanding and usefulness of message content by emergency managers.
- Types of graphical products

101 The Chair recalled similar discussions made at the ICG/PTWS-XXII meeting, and inquired whether a task team should be formed to focus on and prioritize on what actions are needed to improve warning services, and to assist PTWC in implementation. The ITIC responded that the monitoring and recommending of technical improvements to warning services is part of its mandate and functions and that it would be willing to assist in this process.

102 The PTWC Director inquired of the Technical Secretary as to whether the Global Coordination Meeting scheduled for late March in Paris will begin to address this topic at the global level. The Technical Secretary responded that the meeting would most probably identify needs related to the structure and content of messages, but not go into detail regarding solutions. The issue of consistency of messages between regions is an important one and he noted that this is a long-term effort and should be addressed at a global scale in due time.

103 Australia commented that ongoing and future directions for improving services is needed, and should be part of the long-term vision included in the PTWS Medium Term Strategy.

104 The PTWC Director indicated that PTWC appreciates and needs feedback on how to improve its services.

105 The Chair summarized the discussion and called on Member States to become active in not only providing feedback, but also solutions, as this would move the process forward much faster. He asked the Group to consider mechanisms and make recommendation on what to do, via a Task Team, through ITIC, or by other means.

106 Japan mentioned that the recipient countries of tsunami warning products should play a principal role in a new established Task Team for Enhancing Tsunami Warning Productions, because it would not be the providers but the recipient countries that could recognize the present problems on this issue.

107 **The ICG approved** Recommendation ICG/PTWS XXIII.1.

3.6.2 JMA REPORT

108 Yuji Nishimae, representing the Japan Meteorological Agency (JMA) offered an outline of NWPTAC service during the intersessional period.

109 He described that the NWPTAC issued advisories for 21 major earthquakes in the Northwestern Pacific region from September 2007 to January 2009, all of which were delivered within 30 minutes after the occurrences.

110 He also mentioned a case of two earthquakes which continuously occurred near New Guinea on January 3, 2009. Tsunami prediction content described in each NWPTA corresponding to each earthquake seemed different despite they had almost the same locations and magnitudes. Conducting thorough investigation the JMA found insufficiency of the assumed fault distribution for the tsunami prediction. Accordingly the JMA decided to improve the tsunami forecast database of NWPTAC this year adding new seismic faults possible to occur not only around this area but in the necessary locations.

111 Mr. Nishimae referred to the communication tests conducted by NWPTAC to confirm the communications status on distributing messages. Mentioning the result of the latest test, he indicated that the NWPTAC had not received an acknowledgement from some recipients. He requested all recipient countries to send the acknowledgement during the communication test, and also to review their presently registered fax numbers and e-mail addresses to abolish unnecessary ones for avoiding possible transmitting delay due to increasing numbers and addresses to send NWPTA.

112 The **ICG thanked** JMA for its Report

3.6.3 PACIFIC WAVE EXERCISE 2008

113 The PTWC Director, Dr. Charles McCreery, summarized the conduct and post-exercise evaluation of Exercise Pacific Wave 08 (PacWave08). Each country, once it received the international message, could carry the exercise downstream at a level and according to procedures of own their choosing.

114 He summarized the participation and response of countries, noting that most countries participated and 33 evaluations forms were returned from 27 countries, an improvement from Exercise Pacific Wave 06. He reviewed the objectives of the exercise that included the validation of message dissemination by the international TWCs; validation of the timely receipt of messages by the national tsunami warning focal points; validation of an appropriate decision-making process; validation of timely and comprehensive dissemination within each Member State

115 For results, he reported:

- Messages were timely, and mechanisms worked (FAX, email, GTS) and were generally received within 10 minutes of issuance.
- For national dissemination, national TWCs were successful in disseminating through a variety of methods.
- Dissemination to the public was made through a variety of methods

- The elapsed time on average between earthquake and public notification was 57 minutes. This is acceptable for a distant event, but not acceptable for a local event. In the future, this elapsed time should be reduced.

116 The detailed compilation and general assessment outcomes were:

- Exercise planning and conduct were satisfactory, but several months of lead time is needed between the announcement of the exercise and its execution.
- Each country had specific goals and they carried out the exercise accordingly.
- Lessons learned from Exercise Pacific Wave 06 (EPW06) were used to improve the response in PacWave 08
- The real time conduct of the exercise was more realistic than the compressed time used in EPW06, and should be used in the future.
- The exercise was viewed as important and it helped to improve the development of national tsunami plans.
- For the dissemination structure, processes and plans exist, but more improvement is needed at the local / community level. In island states, remote and geographical challenges continue in communications
- The Exercise helped to increase public awareness of the tsunami hazard.

117 On communications

- The exercise was good for testing the timeliness and comprehensiveness of dissemination methods
- Wide notification remains a challenge. Some methods are in place, but more effective methods are needed.

118 General Recommendations highlights were:

- Continue to hold a PacWave regularly, but perhaps not annually
- Conduct future exercises in real-time
- Tsunami Warning Focal Point information needs to be continually reviewed and updated
- Improvement of message content still is requested

119 The USA asked about the plans for inclusion of graphical products. One concern is on the required bandwidth, and another about potential confusion in interpreting new graphical products. He asked whether an exercise might useful to test such products and to address these concerns. PTWC replied that graphics cannot be included on the GTS or AFTN, but it could be done by FAX, email, and through the web. He suggested that the US warning centers can develop 'experimental' products and those can be tested any time.

120 The USA requested that PTWC consult with JMA and then provide input to the Implementation Plan, based on PacWave08.

121 Australia inquired on PTWC communication test for the PTWS. PTWC Director informed that it did two tests during the intersessional periods, but it has been challenging since the warning dissemination contact list, both official through the IOC and by request to the PTWC, is very large and there is a shortage of staff to be able to follow-up on each contact point failure. PTWC Director agreed that their goal continues to be to conduct such tests quarterly.

122 Australia emphasized the need and importance of having a version of the list of focal points which could be reviewed.

123 Australia reminded the Group that a recommendation from the SWP-WG WG was to form a Task Team to develop action plans from the recommendations of PacWave06.

124 The Technical Secretary noted that is has been a challenge to update and maintain the PTWS Tsunami National Contacts (TNC) and Tsunami Warning Focal Points (TWFP) database previously handled by ITIC. He noted the importance of the official database confirmed through official channels (Foreign Ministry and/or UNESCO Permanent Delegation), acknowledged that there are gaps and confirmed this can be improved. He asked Member States to review and continue to update the information to the IOC.

125 The Chair asked where Member States should be able to find out this information so that they can review it.

126 The Technical Secretary indicated that the National Report contains the full information for each Member States, while not always formally approved through agreed diplomatic channels, with all contact details for TWFP deleted before posting publicly. He asked Member States for input on what is needed and the best mechanism so that the Secretariat can take action. He noted that the international TWC sometimes have contacts that are additional to the IOC TWFP lists.

127 The Chair asked PTWC on the advice for the development of scenarios and input needed. PTWC replied that there is no single source that will affect all countries. A further challenge is that during the exercise, the messages contained readings across the Pacific that were usually not based on actual data, so there is always a need for countries to perhaps be involved in the construct of the messages. The Exercise Manual is usually straightforward and followed the EPW06 manual. He noted that the PacWave08 Post-Exercise Evaluation may need further refinement, and indicated that this may take time. For instance, social science is not included.

128 The USA recommended that these requests be considered by the Recommendations Committee to take action. The Committee can then identify the most useful course of action. The Chairman again called for Member States to actively participate and contribute to improving the system.

129 The USA inquired on the sunset of the current PacWave08 Task Team since the Report is not completely done. The Technical Secretary responded that under the current TORs, the Task Team will dissolve when the report is completed.

130 A discussion on the dates of PacWave10 was taken, given the dates of the next ICG. Samoa noted that it currently carries out its exercise in November and asked for consideration on the data of the exercise. New Zealand indicated that October is National Disaster Awareness Month and would prefer to have the exercise in October. Australia noted that Indian Ocean Exercise is planned for later 2009, and for some countries this would require two major exercises close to each other, which is not realistic in general.

131 Australia reminded the ICG that the Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) still needed action.

132 The **ICG decided** to set the dates of PacWave10 to be preferably in the fourth quarter of 2010.

133 **The ICG approved** the Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) with the inclusion of the recommendations and suggestions of the sessional Working Group.

134 **The ICG approved** Recommendation ICG/PTWS XXIII.2.

135 **The ICG approved** Recommendation ICG/PTWS XXIII.3.

3.7 STATUS OF PROGRESS IN OTHER ICGS

136 The Technical Secretary reported that this information is provided electronically on the PTWS web site for Member States to assess. He noted that amongst the different ICGs, there is still a need to consolidate globally, He called attention to technical considerations such as seismic and sea level topics, which could have global standards, while still retaining the importance of recognizing regional specifics.

137 He noted that the situation in the NEAMTWS is quite complex because of pre-existing arrangements. The Indian Ocean system was reviewed for lessons learned in developing NEAMTWS. He reported that the next ICG/IOTWS is April 7-9 2009, in Hyderabad, India (Editor Note: this was initially reported in Bangkok, Thailand).

138 CARIBE-EWS is continuing to develop, again unique from the Pacific and Indian Ocean, due to pre-existing infrastructure and networks. The next ICG/CARIBE-EWS will be March 16-18, 2009, in Martinique.

139 All systems are reporting that they will be operational in 2010-2011. The transition phase of each developing system has not been discussed in the NEAMTWS and CARIBE-EWS, only in the IOTWS.

140 The Vice-Chair IOTWS reported that the Regional Tsunami Watch Providers are starting to come online and there is a shadowing of the interim system. The system is threat-based. There are planned at least 3 watch providers, and coordination is still needed for seismic, sea level, and earthquake source characterization (e.g., data sharing and rules of authority). He noted that this is not 'regional' by geography, but for the entire basin, unlike the Pacific.

3.8 REPORT FROM UN AN NON UN ORGANISATIONS

141 The Chairman asked representatives of UN and other Organizations to report to the Meeting.

142 Dr. Laura Kong of the ITIC made the presentation on behalf of the World Data Center. The ICSU World Data Center for Geophysics and Marine Geology, hosted by the USA NOAA National Geophysical Data Center, oversees the management of global and regional geophysical and marine geological data, including natural hazards (tsunami earthquake, volcanic eruption). It collaborates nationally and internationally. It has a policy for free and open data exchange. It includes data on global historical destructive or tsunamigenic events, tsunami deposits, tsunami references, damage photos. DART data, high-resolution global tide gauge data, and bathymetry / topography data. These data are essential for tsunami forecast and warning, inundation modelling, and hazard assessment, and required for tsunami research, preparedness, mitigation, and education.

143 Hazard data are provided through web-enabled graphical tools, and KML files are available for download. Sea level data currently archived are the US 1-min (CO-OPS) and 15-sec (WC/ATWC) tide gauge, and the unprocessed DART data. The Global Historical Database contains tsunami events, run-ups, significant earthquakes, and volcanic eruptions; information from WC/ATWC and JMA has been added and Pacific events and run-ups have been verified against source documents. Currently, the database contains 1,272 events with 415 events having more than 1-meter maximum runup, and 10.796 run-up data points with 4,334 of these more than 1 m in height. These data are provided to the TWCs through an XML web service. An offline tool, emulating its online search and display tool, has been developed with ITIC and a

beta version is available for testing from ITIC and NGDC. A Global Tsunamis poster was created in 2009 by NGDC and ITIC, and printed by Chile SHOA. The web site also hosts an interactive tsunami travel time tool containing maps for selected sources and coastal cities in the Pacific and Indian Oceans and Caribbean Sea. During the intersessional period, the WDC / NGDC hosted two workshops, one on Tsunami Wave and Water Level Data in July 2007 at the XXIV IUGG Session in Italy, and one on Tsunami Data and Information Management in July 2008 in the USA; it will host a workshop on Open Ocean and Coastal Measurements of Tsunami Waves at the IUGG Tsunami Commission 24th International Tsunami Symposium July 14-19, 2009 in Novosibirsk, Russia.

144 Henry Taiki of the WMO RA-V reported that WMO strongly supports the leadership of UNESCO-IOC in coordinating the tsunami early warning systems. It is committed to working together with UNESCO-IOC, ISDR and other key partners on international, regional, subregional and national levels to combine relevant capabilities and build on them to ensure that tsunami early warning systems are available not only to countries in the Pacific region, but also to other regions at risk. He reported on the Pacific Tsunami Warning System Operations Seminar, which was held in Kuala Lumpur, Malaysia, in April 2007, co-sponsored and co-organized by ICG/PTWS, WMO and SPREP. He indicated that over 60 National Meteorological and Hydrological Services in the world have their governments' mandate to provide seismic and tsunami early warnings. They are also responsible for monitoring, analysing, preparing and issuing around the clock warnings for a wide range of hazards related to weather and water, such as tropical cyclones, storm surges and floods which threaten the region.

145 Mr Taiki recalled that the Global Telecommunications System (GTS) is the coordinated global system of telecommunication facilities and arrangements for the rapid collection, exchange and distribution of observations and processed information within the framework of the World Weather Watch (WWW). It is implemented and operated by National Meteorological Services of WMO Members. The GTS consists of an integrated network of point-to-point circuits, and multi-point circuits, which interconnect meteorological telecommunication centres, composed of a combination of terrestrial and satellite telecommunication links. Both private and public (internet) networks are utilized. Meteorological Telecommunications Centres are responsible for receiving data and relaying it selectively on the GTS circuits. For Pacific Rim nations, the principal centres are Washington, Tokyo and Melbourne. Within the South Pacific, Wellington operates a Regional Telecommunications Hub, providing communications between a number of South Pacific countries and Melbourne.

146 Each of these centres has a designated focal point that can assist PTWS member states with any issues related to data transmission for receipt of warnings products. Contact information for each focal point can be made available upon request.

147 In addition to providing the telecommunication infrastructure, WMO member countries operate their centres through approved practices for protocols, data management practices including development of codes for data exchange, procedures for publication of new observations and bulletins of information, and performance measurements.

148 Within the Southwest Pacific, there are ongoing activities to improve the telecommunications infrastructure where deficiencies exist. Activities are coordinated through the WMO Regional Association V World Weather Watch Sub Group on the GTS Information Systems and Services. It was hoped that a meeting of this group could have been held back to back with the ICG/PTWS 23rd session, but this was not possible. It is hoped that a new date for this meeting can be confirmed in the very near future.

149 The key challenge remains the delivery of communication solutions that are technologically appropriate for the countries concerned, robust enough to remain operational in a tropical environment, and finally solutions that are able to operate effectively over the long term. Recent examples of systems deployed with the assistance of the WMO Voluntary

Cooperation Programme (VCP) funding include EMWIN, RANET, and HF Email. The most likely solutions develop in the near future are one-way or two-way space-based systems.

150 Finally, WMO highlighted that it hosts the GEOSS (Global Earth Observations Systems of Systems) Secretariat in Geneva, and sees an opportunity for more Pacific nations to join GEOSS and participate and contribute to GEOSS programmes.

151 Michael Bonte provided a summary on SOPAC activities. He underscored that SOPAC is mandated to coordinate disaster risk management in the region. It continues to facilitate the conduct of the annual Disaster Management Office meeting, and are happy to announce that the next RMSD meeting will be held back-to-back in order to emphasize the importance of both stakeholders working together to mitigate national hazards. He highlighted initiatives, which were already mentioned as part of SWP WG Report, which are:

- Tsunami Capacity Assessment (through BOM) – 9 have been completed to date
- Tsunami Inundation Capacity Building – modelling for Tonga, Niue, and planned for Samoa in the future; part of this project was to determine the availability of the needed resolution bathymetry;
- High-resolution data was collected by SOPAC under another project for 10 countries in the Pacific; data is available from SOPAC web site;
- in Nov 2007, an expert meeting on tsunami risks in the Pacific region that conducted; a pilot study in Vanuatu which will include looking for tsunami sediments;
- contributions to the post-tsunami survey of the Solomon Islands (provision of satellite imagery) and working with scientists;
- Capacity building in GIS tools and use of satellite information for disaster risk reduction.

152 Kosi Latu, Acting Director provided an overview of SPREP's activities and role in the region. It is based in Apia and focuses on the environment and sustainable development. Close partnerships exist with SOPAC and WMO on activities, and he welcomed cooperation with other regional organizations. Two programs are in biodiversity of coastal zones, and also on climate change pollution, waste management, and mainstreaming disaster management to better manage natural resources. Both programs are related to tsunamis. The Pacific island Forum leaders urgently directed SPREP to carry out a comprehensive review of the region's meteorological services, in order to consider how to build and improve on the existing infrastructures to support early warning. He noted links to the strategic plan for meteorological services, which have been asked to become an important stakeholder in tsunami early warning.

153 He reported on the use of 12-stations sea level network that has been operating for more than 10 years for climate change research. He applauded the 1st joint meeting for Disaster Management Offices and Meteorological Services and noted that since resources are limited, it is essential establish linkages and cooperation of regional organizations and partners on topics of sea level rise, coastal management, and disaster risk reduction as they relate to tsunami warning and mitigation.

154 Bernie Kilonsky of the University of Hawaii Sea Level made the report on behalf of the GLOSS Group of Experts. GLOSS has been asked to become more involved starting just before the 2004 Indian Ocean tsunami to become more involved in the Pacific to support tsunami warning. Prior, its focus has been on sea level recording to support climate change and research applications. He reminded the Group that it was at the ICG/PTWS XXI (Valparaiso, Chile) meeting that GLOSS was asked to check into more frequent transmission. GLOSS reported progress on this task at the Sea Level WG meeting in Melbourne and again at

the SL WG meeting in Ecuador. Finally, it was requested to report in session to the ICG/PTWS XXIII in Samoa.

155 In 2005 through Recommendation ITSU-XX.2, GLOSS was asked to request an allocation of slots that transmitted more frequently using the GOES satellites which services both the Pacific and Caribbean. In 2007 at PTWS-XXII, it was reported that GLOSS had arranged for two channels that would support a higher frequency of transmission for international users. These channels were to be used to upgrade the basin-wide system and GLOSS and PTWC were asked to assist in the identification and prioritization of sites for new or upgraded installation. It was also agreed that priority would be given to those locations within 1 hr of a tsunami source zone. For these sites, a transmission frequency interval of 5 minutes was recommended and in other places a interval of 15 minutes was deemed desirable. Countries were asked to provide their needs and requirements to the PTWC, University of Hawaii Sea Level Center, GLOSS, or ITIC. After PTWC processes and priorities the request, countries can become a GOES user sponsored by PTWC. These countries then become a bonafide users, and can then more easily pursue improving other services through direct interaction with NOAA NESDIS, who manages the GOES system. To date, requests have been received from Canada, Chile, Colombia, Ecuador, France, New Zealand, Peru, Samoa, Tonga, and Vanuatu. Other ICG/PTWS countries are encouraged to submit any upgrade request to the above mentioned coordinating agencies.

156 Another technology, especially outside the GOES satellite footprint, being considered is the use of the BGAN Satellite system operated by INMARSAT. GLOSS has been testing its use for data transfer and possible sending of useful text messages for communication and downlink at IOC IODE for inclusion in the GLOSS Sea Level Monitoring Facility. In the future, this system may be useful for enabling real-time, data-on-user demand, and as a backup to the existing means through the GTS.

157 The IOC clarified that the BODC archiving is presently for GLOSS high-freq data, and does not include non-GLOSS stations, and that PTWC and the UHSLC are archiving all the data messages transmitted to them via the GTS.

158 Chile thanked GLOSS, PTWC, ITIC, and the IOC Secretariat for facilitating the access of their stations which would be essential for local tsunami confirmation.

159 GLOSS informed the Group that the current 15-minute transmission limitation for the Japan MTSAT and European Union EUMETSAT is due to a limited downlink capacity wherein only 1-min transmissions slots are possible. GLOSS will be talking to China on possible use of their geostationary satellite. When the downlink capacity is limited to a 1-min transmission slot, this means only 6 sites transmitting on a 5 minute cycle can be accommodated per channel. In contrast, GOES permits a 10-sec transmission and so more stations can be accommodated per channel.

160 Japan mentioned that they had a plan to launch new geostationary meteorological satellites replacing present MTSAT and there would be a possibility to shorten the present 15 minutes interval of tidal data transmission.

161 Australia asked GLOSS if it will also expand its responsibility to archive non-GLOSS stations, noting that the GLOSS Core network focuses on climate and a number of tsunami gauges would not meet those requirements. Also, if GLOSS is to support tsunami monitoring and warning, a redefinition of the Core Network should be considered. The PTWS Technical Secretary reported that the GLOSS Group of Experts will meet in May to review its standards on station location, and user needs (both for climate and for real-time monitoring for tsunamis and storm surge). In the past, it has used categories of Core and non-Core Network, and the standards required for each were set separately.

162 The USA reported that at the IOC Executive Council a similar discussion took place. He noted that GLOSS requirements should not drive tsunami warning requirements, especially since the funding and maintenance levels are different. Under JCOMM, there was a request to review those requirements for the global tsunami system. He recognized the already accomplished upgrades, but noted that if GLOSS will have a responsibility for tsunamis, then the definition of the Core Network needs to be expanded to include tsunami warning requirements.

163 The USA reported that RANET project has a prototype communication system called Chatty Beetle that is using BGAN transmission for emergency alerting. The requirement was to have a tool that is simple to deploy, has a terminal with 2-way connectivity to be able to send a simple text message as a heads-up especially for remote locations. SPREP is facilitating the deployment and piloting in the Pacific Islands.

164 The Chairman thanked the organizations for their information and welcomed their cooperation with the PTWS.

165 **The ICG approved** Recommendation ICG/PTWS XXIII.4.

4 POLICY MATTERS

166 The Chairman introduced this item, noting that decisions and actions that reflect the state of the PTWS and its performance and that provide guidance to the ICG for its development are formulated in three key documents prepared for this meeting. He also noted that they have been produced in response to discussions held at the 1st Meeting of the PTWS Steering Committee. These discussions took into account the deliberations of the IOC Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (TOWS-WG) which is charged to review the organization and governance of the four Tsunami Warning Systems the IOC has been mandated to establish and co-ordinate. He then requested the Secretariat to introduce the Framework for The Global Tsunami and Other Ocean-Related Hazards Early Warning System (GOHWMS)

167 The Head of the Tsunami Unit Mr Peter Koltermann indicated that while the Pacific provided experience and know-how in the aftermath of the Indian Ocean Tsunami, there were region-specific issues that were recognized, addressed, and then implemented by the developing systems. As a result, to some extent the systems have developed independently. In order to move towards an interoperable global system, the IOC engaged other UN organizations and continues to facilitate the optimization of tsunami systems through IOC partners and programmes that traditionally have been involved, such as WMO, GLOSS and JCOMM. As well, new partnerships have been established with organisations like CTBTO to access seismic monitoring data and data transmission providers such as Inmarsat.

168 To accomplish an end-to-end system, the IOC was requested to coordinate a framework. It did that through the formation of the ad hoc Working Group on Global Ocean-related Hazards Early Warning and Mitigation System (GOHWMS WG) that looked at the present situation, the requirements, and recommended a framework to be developed. The IOC Assembly reviewed the outcomes of the GOHWMS WG and discussed governance; it established the Working Group on Tsunamis and Other Hazards related to Sea Level Warning and Mitigation Systems (TOWS WG) for this task, specifically to advise on the co-ordinated development and implementation activities of the ICGs. TOWS WG approved at its first meeting the Framework for The Global Tsunami and Other Ocean-Related Hazards Early Warning System (GOHWMS).

169 He then described the contents of the Framework (GOHWMS). He highlighted Table 2 on the characteristics of hazards creating coastal inundation and common topics. He noted the

need to harmonize standards and practices, if possible, so as to be the most effective and efficient.

170 The Chairman then reported that the PTWS Steering Committee considered this Framework and other documents and agreed on the need for the PTWS to review its existing practices and identify new directions it might take.

4.1 ADOPTION OF THE PTWS MEDIUM TERM STRATEGY 2009-2013

171 The Vice-Chair Yohei Hasegawa (Japan) provided background and information on the development of the Medium Term Strategy for the PTWS. He explained that the Strategy is based on the ITSU Master Plan, which comprehensively described the current situation, needs of the system through 2004, and gaps and actions. Since the Master Plan was comprehensive, and to facilitate priority actions, focus the use of limited resources and make the objectives clearer, the Medium Term Strategy was developed. He provided details for each pillar, describing the activity, responsible entities, and strategic objective and products, and mechanisms to meet the goal. Details are provided in the Medium Term Strategy document.

172 Activities for hazard assessment should be conducted at and by Member States with support from research communities. Activities for warning should be recognized in 3 scales, National/Local, Regional and Ocean-wide warning, among which National/Local system should have the first priority to establish. Activities on preparedness focus on products needed to enable successful evacuation of a prepared and informed public.

173 Mr. Hasegawa indicated that interoperability was essential for the best use of limited resources and for establishing sustainable systems, not only among National/Local systems or regional, international systems, but among tsunami and other ocean-related hazards systems. Research is also essential to successfully meet the objectives of the three pillars. Close cooperation with the relevant research communities is important, and the research community should also be engaged to provide some solutions. He also stressed on necessity of pre-assessing new research results from the viewpoint of not only effectiveness but robustness and sustainability before introducing them into an operational system.

174 The Chairwoman of the Intrasessional Working Group on PTWS Medium Term Strategy, PTWS Working Group Structure and Overall Governance and PTWS Implementation Plan, Filomena Nelson (Samoa), introduced the discussions and preliminary comments from the group. The group considered the Global Framework and Resolution EC-41.6. The group suggested to acknowledge the Global Framework and provided a Mission Statement to introduce the PTWS Medium Term Strategy (PTWS MTS) as follows:

175 “An interoperable tsunami warning and mitigation system based on coordinated Member State contributions that use best practices and operational technologies to provide timely and effective advice to National Tsunami Warning Centres. As a result, PTWS communities at risk are aware of the tsunami threat, reduce risk, and are prepared to act to save lives.)"

176 The Working Group also suggested to incorporate in the introduction a paragraph that relates to the GOHWMS, describe the need for local commitment/responsibility and reference to state of the art and best practices. As well the group recommended to introduce each Pillar and suggested modifying the three Pillars as the following:

- Hazard and Risk Assessment
- Detection and Warning
- Resilience

177 The Group clarified that interoperability capacity building and research are foundations elements. It also recommended to highlight the need of a strategy for sustainability. It also

178 Australia reminded that the Group agreed to rewrite the Strategic Objectives under each Pillar and summarized this in a table for the ICG.

179 New Zealand thanked the Vice-Chair of ICG/PTWS Mr Yohei Hasegawa (Japan) for developing his presentation of the draft MTS. Commented that the proposed changes to the title of the Pillars is a positive one but warned that resilience is a term that have different meanings and wanted to re-state the term Preparedness at the third pillar. New Zealand suggested to specify the scope of each Pillar (Strategic Objective) to avoid confusion on the terminology. The Secretariat confirmed that the term Preparedness is more generally accepted.

180 New Zealand requested a clarification from the Secretariat with respect to the role of core IOC programmes that relates to sea level monitoring (GLOSS) in respect of the ICG Working Groups. The Secretariat suggested that GLOSS should keep and maintain a role on the definition of standards. New Zealand commented that on seismic aspects the IOC does not have a background and could not have a role on the definition of standards. The Secretariat commented that the seismic community has a role and a place for cooperating on seismic monitoring for tsunamis within IOC.

181 Australia commented that the warning centers may have needs at the regional level that ICGs could afford through the Working Groups. USA commented that there is no debate about the role of GLOSS and the role of standard settings that it performs. On sea level there has been good progress on standards through the ICG Working Groups particularly in the IOTWS. The Secretariat is then correct in that GLOSS do have a role in general standard setting but there is still some aspects that need dialog at the ICG level, for example on the specifics of tsunameters (DART buoys).

182 The Chairman requested guidance from the Secretariat with respect to the next steps bearing in mind that the intraesessional WG is suggesting to adopt the PTWS MTS at this meeting and pass the decision on the Working Group Structure and the Implementation Plan for the Steering Committee. The Secretariat suggested three different options among which the ICG retained to adopt the PTWS MTS, adopt the Working Group Structure and adopt in principle the PTWS Implementation Plan and empower the Steering Committee to finalize it. With this guidance, approved by the ICG, the Working Group met again during the meeting and delivered its final recommendations in plenary.

183 The group then met again and USA made a presentation overview of the sessional working group's efforts. He thanked all the contributors, noting this marks a new milestone for the PTWS to move forward. He indicated that the PTWS Working Group Structure derives from the PTWS MTS and details the methods and ways in which the strategic objectives will be met. The vision of the PTWS MTS is to have an interoperable, coordinated system contributed by all, with the end result that PTWS communities are aware, are acting to reduce their risk, and are prepared to act.

184 Three pillars are supported by four foundational elements. The pillars are

- Risk Assessment and Reduction
- Detection, Warning and Dissemination
- Awareness and Response

185 The four supporting foundational elements are

- Interoperability
- Research

- Capacity Building
- Funding and Sustainability

186 Papua New Guinea noted a gap in the Working Group Structure. He asked that the PTWS serve as a facilitator for countries, as appropriate; to ensure an interoperable system, for example, data sharing is integral and any assistance should seek to achieve this goal.

187 France noted the need to acknowledge that the Strategy presently is focused on earthquake sources. Detection and warning for tsunamis generated by other sources (landslides, volcanic-related) research is now needed in order to continuously improve. To accommodate this, the research description should be generalized to allow for research on other tsunami sources.

188 The Technical Secretary highlighted section 1.4 as not being consistent and asked to be able to modify the text accordingly. Member States agreed and the USA indicated its interest in reviewing the changes to be introduced by the Secretariat.

189 **The ICG approved** the PTWS Medium Term Strategy 2009-2014 as in ANNEX V and **approved** Recommendation ICG/PTWS XXIII.5.

4.2 ADOPTION OF THE PTWS IMPLEMENTATION PLAN

190 The Secretariat (Bernardo Aliaga) provided a summary of the process taken to develop the PTWS Implementation Plan. The examination focused by regions for each pillar. He indicated that for the Hazard Assessment pillar in the Draft PTWS MTS, Central America and the South West Pacific islands seems to be the weakest in terms of availability of tsunami inundation and tsunami hazard mapping. Therefore the proposed focus on these two regions at this component in the draft Implementation Plan For each, of the main pillars depicted in the draft PTWS MTS the Secretariat proposed a short list of actions and regional focuses on the various topics, including Tsunami Warning, Tsunami Awareness materials, Drills and Exercises.

191 **The ICG approved** in principle the PTWS Implementation Plan **and instructed** the PTWS Steering Committee to finalize it as soon as possible.

4.3 WORKING GROUP STRUCTURE AND OVERALL GOVERNANCE

192 Ken Gledhill (New Zealand) provided a summary of the proposed Working Group Structure, developed by the PTWS Steering Committee with support from the Secretariat. The proposed structure included 4 technical working groups and 3 regional working groups. It was felt that in the Pacific, the complexity and level of development is unique by region, and so regional groups are very necessary for successful action to occur. In the case of the regional working groups then the number and geographical scope remain the same but the terms of reference may need to be revisited. He emphasized that active Chairs and Vice-Chairs are essential for progress. In the views of the Steering Committee it should be considered whether some current Working Groups might be better constituted as a Task Team, for specific tasks under the umbrella of a Working Group.

193 After the sessional group met for the first time Mr. Ken Gledhill (New Zealand) reported on their behalf and indicated th the group consensual opinion is that the Working Groups and Task Teams are the mechanisms available for the ICG/PTWS to carry out the work identified in the Medium Term Strategy (MTS). From an overall IOC and efficiency point of view it is important to coordinate and cooperate with the ICGs for other oceans regarding activities that have common characteristics or common issues. It would therefore be generally preferable (if at all possible) that PTWS Working Groups have the same or similar structure to those of other ICGs.

194 In light of the above considerations the sessional Working Group proposed to have three Technical Working Groups as follows.

- 1. Tsunami Risk Assessment and Reduction;
- 2. Tsunami Detection, Warning and Dissemination;
- 3. Tsunami Response and Awareness Preparedness.

195 As well, The Regional Working Groups currently in existence should be confirmed unless a ICG/PTWS meeting decides to dissolve one or more of them. Similarly, the ICG/PTWS meeting may also constitute new Regional Working Groups as required. The current Regional Working Groups are:

- Central American Pacific Coast;
- South East Pacific Region;
- South West Pacific Region.

196 The Chairman commented that in his understanding the proposed structure open the possibility for regional working groups to ask advice from the technical working groups as needed. Mr Gledhill confirmed that this is the intention.

197 On behalf of the intrasessional Working Group Dr. Gledhill then summarized the changes from the initial draft to the document been suggested for approval, noting the change from four to three technical Working Groups, and the inclusion of a new regional Working Group on the South China Sea. The Technical Secretary also suggested changes to properly follow the rules and procedures of the IOC and to secure the appropriated members are included.

198 The **ICG decided** to establish a new Regional Working Group for the South China Sea.

199 The **ICG approved** the PTWS Working Group Structure as in ANNEX VI.

200 The **ICG appointed** the following Working Group Chairs for the next intersessional period:

- WG 1: Risk Assessment and Reduction – Dr. Francois Schindele (France)
- WG 2: Detection, Warning, and Dissemination – David McKinnie (USA)
- WG 3: Awareness and Response – David Coetzee (New Zealand)
- Regional Working Group on the South China Sea - Dr. Mohamed Rosaidi (Malaysia)

201 The Working Groups for the South West Pacific, South East Pacific, and Central America already have Chairs, which are

- South West Pacific –Ken Gledhill (New Zealand)
- South East Pacific –Capt. Andres Enriquez (Chile, 2008)
- Central America –Dr. Alejandro Rodrigues (Nicaragua)

4.4 SECRETARIAT TO ICG/PTWS

202 The Chair invited the Secretariat to inform the Meeting about developments in the PTWS Secretariat and plans for its future. The Head of the Tsunami Unit confirmed the intention of reinforcing the work of PTWS in the South West Pacific by hiring a National Officer to be placed under the office of UNESCO in Apia, Samoa. He also informed under this item on the status of implementations of the PTWS XXIII Recommendations.

203 The USA delegation commented that the PTWS is making progress and the documents that the secretariat has been able to finalize with the support of member States (PTWS Users Guide, PTWS MTS, PTWS Working Group Structure) are key ones that also point in the direction of making progress in the PTWS.

204 **The ICG took note** of the proposal of the Secretariat to hire a National Officer to deal with tsunami and disaster risk reduction issues under the office of UNESCO in Apia, Samoa.

5 PROGRAMME AND BUDGET FOR 2010-2011

205 The Chair invited Edward Young (USA) Chair of the Sessional Commission on Programme and Budget to present the Report. He reported that the Commission analyzed the status and suggested that the Steering Committee is proposed to be charged with developing a financial strategy in line with the PTWS Medium Term Strategy and the PTWS Implementation Plan. At this stage the ICG discussed the Terms of Reference of the PTWS Steering Committee.

206 Japan noted an inconsistency of the draft recommendation proposing Terms of Reference for the PTWS Steering Committee with respect to the approved Recommendation PTWS-XXII.6. This was corrected. Japan indicated it could not confirm NWPTAC participation in the PTWS Steering Committee, and requested that it be removed for the time being. Australia and France emphasized the need to have both warning centers as they have an important role. On the recommendation of Australia, seconded by New Zealand and USA, and considering Japan's statement the ICG agreed to include as representative of the Tsunami Warning Centers the PTWC Director only.

207 Chile recognized the long-standing importance of ITIC and asked that ITIC be placed on the Steering Committee. This proposal was not retained by the ICG but following a suggestion by USA agreed that this could be revisited at a later date.

208 Following a suggestion from France seconded by New Zealand the Chair suggested that a kick-off meeting of the PTWS Steering Committee before leaving Samoa, which was accepted by the Group.

209 **The ICG approved** Recommendation ICG/PTWS XXIII.6.

6 NEXT MEETING

6.1 CONFIRMATION OF DATE AND PLACE OF ICG/PTWS XXIV

210 The Secretariat recalled that at PTWS XXII the Government of Japan indicated its willingness to host the XXIV Session. However, the Secretariat has been advised that for internal reasons Japan is not longer able to pursue this option. The Chairman requested comments or offers from the floor. No Member States offered to host ICG/PTWS XXIV during the meeting. The delegation of USA commented on the opportunity for the dates for the next meeting in order to maximise the impact on the decisions of the IOC Assembly including on the programme and budget aspects. The Secretariat indicated that in order to report directly to the Assembly in 2011 the meeting should happen before June 2011. With respect to the impact on the budget the Secretariat answered that the impact on the budget is not linked to the date the meeting takes place. He indicated that the budget planning process in UNESCO starts 2 years ahead of the actual planning period therefore the probability of having a direct impact on the process is relatively low. Finally he indicated that autumn 2010 or spring 2011 could be appropriated dates for having the option of reporting directly to the Assembly.

211 The **ICG agreed** that the Steering Committee shall have the role of approach Member States to define candidates to host the 24th Session of the ICG/PTWS. The **ICG recommended** that the 24th session takes place between October 2010 and March 2011..

6.2 TARGET DATE FOR ICG/PTWS XXV

212 The Secretariat informed that the Russian Federation has initially expressed interest to host the 25th Session of the ICG/PTWS.

213 The **ICG noted** the expression of interest of the Russian Federation to host the 25th Session of the ICG/PTWS and highlighted the commemorative aspects of this Session.

7 OFFICERS ELECTION

214 The Chair handed over the chairmanship of this part of the Meeting to the Chair of the Election Committee, Francois Schindele (France). Mr. Schindele recalled that the Election of Officers of the ICG/PTWS was announced with the Invitation in CL 2282, providing the required forms. Open for nominations were the positions of one chair and two vice-chairs. The deadline for nominations was set in the Draft Agenda and confirmed in the adopted Agenda as Monday, February 16, 2009, at 18.00 Local Time.

215 Before the deadline, nominations have been received by the Secretariat for all open Officers positions. For each position one nomination each was received.

216 Each nomination was duly dated, timed and signed by the Secretariat. The details were checked for completeness.

217 The nominations are:

Chair: Giorgio de la TORRE, Ecuador

- Seconded by Japan and France
- nomination form received, on Feb, 16, 2009, at 17:33,
- CV on record from previous election

Vice-Chair; Filomena NELSON, Samoa

- Seconded by New Zealand and Chile
- nomination form received, on Feb, 16,, 2009, at 15:56,
- CV included

Vice-Chair; Yohei HASEGAWA, Japan

- Seconded by Malaysia and New Zealand
- nomination form received, on Feb, 16, 2009, at 15:59,
- CV included

218 The Elections Commission composed of Australia, Chile, France and the USA, chaired by France met on Feb 18, 2009 at 10:05. It duly scrutinized the nomination papers. They were considered complete, correct and in the required form and format.

219 The Chairman countersigned each nomination form in the presence of the Commission.

220 The **ICG elected** the Officers by acclamation and **welcomed** the elected Chair who will take office after the Closure of this Session. He then asked the Acting Chairman, to return to chair the meeting.

8 ANY OTHER BUSINESS

221 Under this agenda item the chair invited the remaining sessional working groups to report to the plenary

222 Mr. Ken Gledhill (New Zealand) reported on behalf of the Sessional Working Group on Seismic Data Exchange. He indicated that the group heard reports from China, Japan and Australia on plans to establish seismograph stations in the SW Pacific region.

223 China reported that their policy is to use Chinese instruments if appropriate ones are available. Samoa has a signed MOU with China under which a network will be established by July 2010. Data sharing policy will be up to Samoa. China will provide stations, a data centre, software and training. Other South West Pacific countries could apply to China via their governments as Vanuatu is also in the process of doing so.

224 There was no representative from the appropriate Japanese organization present, but it was stated that it would be possible for Japanese data to be shared, pending confirmation by responsible organizations. Fiji and Tonga stated that they intend to share data between themselves and with the international community, and that the equipment to be installed in both countries will be compatible.

225 Australia reported that they have installed one station in Niue, and are about to install two in Papua New Guinea. These installations will be complete by July 2009. This data is available directly from Geosciences Australia or from IRIS via the Seedlink protocol.

226 Discussion about data exchange protocols and data bandwidth issues then took place. It was felt that to overcome technical issues a Task Team may be required. The fact that data from seismograph stations is useful for research and earthquake catalogue creation and not just tsunami warning was noted. PTWC pointed out that the SW Pacific was one of the poorly covered regions and this restricted the speed and accuracy of tsunami response for the region.

227 The group recommended that:

1. SW Pacific Countries with existing or planned broadband seismograph stations share the data in real-time with their neighbours and internationally, including making the data available to Tsunami Warning Centres;

2. SW Pacific Countries with existing or planned broadband seismograph stations be encouraged to joint FDSN, use the standards developed by FDSN for data exchange and take advantage of the data archiving provided by FDSN;

3. A Task Team be formed (under SWP WG or PTWS) to assist South West Pacific Countries achieve data sharing;

4. Donors are encouraged to help South West Pacific countries achieve data sharing in coordination with the proposed Task Team.

228 The USA delegation asked if the Working Group also discussed about seismic data exchange in other regions covered by the PTWS. Mr Gledhill clarified that the group only discussed about the South West Pacific situation. The Secretariat commented that the exchange of data is an issue of interest to all regions. The Chairman suggested to establish the Task Team requested under the relevant technical Working Group.

229 **The ICG approved** Recommendation ICG/PTWS-XXIII.7.

9 ADOPTIONS OF DECISIONS AND RECOMMENDATIONS

230 The **ICG reviewed** the status of the Working Groups established by PTWS XXII and decided to continue the Working Group on Pacific Emergency Communications as a Task Team under the Working Group on Detection, Warning and Dissemination.

231 **The ICG approved** Recommendation ICG/PTWS XXIII.8

232 On behalf of PTWS Member States, the USA expressed Member States' gratitude and appreciation to the government of Samoa for hosting the PTWS-XXIII. He noted the progress of the meeting, and congratulated Samoa on being elected as a PTWS Vice-Chair. The Group looked forward to working with her to ensure that important and critical issues for the Pacific, and especially the South West Pacific, are addressed during the intersessional period.

233 **The ICG approved** Recommendation ICG/PTWS XXIII.9

234 Based on the reports of the intersessional and intrasessional Working Groups and the discussions in plenary, the **ICG adopted** nine Recommendations as in ANNEX III.

10 CLOSE OF THE MEETING

235 The Chair thanked Member States for their participation, commitment, and hard work during PTWS-XXIII. Key documents were approved to move the system forward toward implementing an end-to-end system. He highlighted the important accomplishments, including the approval of the PTWS Medium Term Strategy to provide clear guidance on where to go and what will be achieved, and a Working Group Structure that is streamlined and focuses the needs of the PTWS both technically and regionally. He thanked the Secretariat for providing a draft of the PTWS Implementation Plan and looked forward to working with the Steering Committee to finalize this living document. He stated that Member States must all work together if we are to improve the PTWS system to continue to save lives from tsunamis.

236 He enjoyed again seeing familiar colleagues and welcomed new colleagues.

237 He thanked Samoa for hosting the meeting. The 'awa sharing at the opening ceremony and the cultural show at the reception gave us a glimpse of the rich culture and tradition that is still a part of their daily lives.

238 The Vice-Chair from Japan thanked the Group for its earnest discussion, dedication, and enthusiasm and their commitment to work with and for everyone for the next two years.

239 The Vice-Chair from Samoa thanked the Group for supporting her efforts.

240 The Chief Executive Officer of the Ministry of Natural Resources and Environment closed the meeting on behalf of the government of Samoa. He thanked the Secretariat, Delegates, Organizations, and Participants for coming to his country to continue their work on addressing the tsunami hazard. He noted that it was very good to be able to put faces to the names that his colleagues in the Meteorology and Disaster Management had been talking about. He thanked all for their kind words of appreciation. He wished his Pacific Island colleagues well wishes, and to all, safe travels and see you again.

241 The Chair closed the meeting at 1930. He looked forward to meet all at the PTWS-XXIV.

ANNEX I

AGENDA

Twenty-third Session of the Intergovernmental Coordination Group for the Pacific Ocean Tsunami Warning and Mitigation System (ICG/PTWS-XXIII)

Apia, Samoa
16–18 February 2009

1. WELCOME AND OPENING OF SESSION

2. ORGANIZATION OF THE SESSION

- 2.1 ADOPTION OF AGENDA
- 2.2 DESIGNATION OF THE RAPPORTEUR
- 2.3. CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

3. REPORT ON INTERSESSIONAL ACTIVITIES

- 3.1 IOC EXECUTIVE SECRETARY'S REPORT
- 3.2 CHAIRMAN'S REPORT
- 3.3PTWS SECRETARIAT REPORT
- 3.3.1 ITIC'S REPORT
- 3.4 WORKING GROUP REPORTS
- 3.5 NATIONAL PROGRESS REPORTS
- 3.6 WARNING & ADVISORY SERVICES REPORT
- 3.6.1 PTWC
- 3.6.2 NWPTAC
- 3.6.3 REPORT ON PACWAVE08
- 3.7 STATUS OF PROGRESS IN OTHER ICGS
- 3.8 REPORTS FROM UN AND NON UN ORGANISATIONS

4. POLICY MATTERS

- 4.1. ADOPTION OF THE PTWS MEDIUM-TERM STRATEGY 2009-2014
- 4.2 ADOPTION OF THE PTWS IMPLEMENTATION PLAN
- 4.3 WORKING GROUP STRUCTURE AND OVERALL GOVERNANCE
- 4.3.1. DELIVERABLES
- 4.3.2. REVIEW OF TERMS-OF-REFERENCE OF WORKING GROUPS
- 4.4 SECRETARIAT TO ICG/PTWS

5. PROGRAMME AND BUDGET FOR 2010-2011

6. NEXT MEETING

- 6.1 CONFIRMATION OF DATE AND PLACE OF ICG/PTWS XXIV
- 6.2 TARGET DATE FOR ICG/PTWS XXV

7. OFFICERS ELECTIONS

8. ANY OTHER BUSINESS

9. ADOPTION OF DECISIONS AND RECOMMENDATIONS

10. CLOSE OF THE MEETING

ANNEX II

LIST OF DOCUMENTS

Working Documents

Doc. No.	Document title
ICG/PTWS-XXIII/1 Prov. Rev 1	Provisional Agenda (English only)
ICG/PTWS-XXIII/1 Prov.Add. Rev. 2	Provisional Timetable (English only)
ICG/PTWS-XXIII/2 Prov.	Provisional annotated agenda (English)
ICG/PTWS-XXIII/3	Draft Summary Report (to be prepared after the session)
ICG/PTWS-XXIII/4	Provisional List of Documents (this document) (English only)
ICG/PTWS-XXIII/5	IOC Executive Secretary's Report (English only)
ICG/PTWS-XXIII/6	Chairman's Report (English only)
ICG/PTWS-XXIII/7	ITIC Report (English only)
ICG/PTWS-XXIII/8	ICG/PTWS Secretariat's report (English only)
ICG/PTWS-XXIII/9	ICG/PTWS Recommendations Status Report (English only)
ICG/PTWS-XXIII/10	Warning & Advisory Services Report, PTWC and NWPTAC (English only)
ICG/PTWS-XXIII/11	Working Group V: Sub regional Working Group for the South West Pacific (English only)
ICG/PTWS-XXIII/12	Working Group VII: Sub regional Working Group for the South East Pacific (English only)
ICG/PTWS-XXIII/13	Draft PTWS Medium Term Strategy 2009-2013 (English/Spanish)
ICG/PTWS-XXIII/14	PTWS Working Group Structure and Overall Governance (English/Spanish)
IOC Technical Series, 86	PTWS Implementation Plan, 2009 (English only)
IOC Technical Series, 87	Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) (English only)

Information Documents

Doc. No.	Document title
	Information for participants (venue, hotels, airport,bus) (see website)
	Signed Host Agreement (see website)
ICG/PTWS-XXIII/Inf. 1	List of PTWS National Contacts (English only, see ITIC website)
ICG/PTWS-XXIII/Inf. 2	IOC Assembly Resolution Resolution IV-6 (English/Spanish)
IOC/PTWS-XXII/3	Summary Report of the Twenty-second Session of the Intergovernmental Coordination Group for Pacific Ocean Tsunami Warning and Mitigation System (ICG/PTWS-XXII) (Executive Summmary in English French, Russian and Spanish)
CL 2282	Letter of Invitation to ICG/PTWS-XXIII (English/Spanish/French)
IOC/PTWS-XXII/Inf.3	PTWS Users Operational Guide (English)
IOC/INF-1202.rev Dec. 08	National Report Format (English only)

ANNEX III

RECOMMENDATIONS

Recommendation ICG/PTWS-XXIII.1

ENHANCING TSUNAMI WARNING PRODUCTS

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

Noting that some Member States have expressed a need to review the current content, format and dissemination of the international tsunami warning messages,

Further noting that the tsunami forecasting capabilities of the international Tsunami Warning Centers (TWCs) will continue to improve in speed, accuracy, and resolution,

Considering the existing body of social science knowledge regarding effective hazard warning,

Further considering the diversity of the Member States and their tsunami warning requirements,

Acknowledging and appreciating the willingness of the international TWCs to consider changes to their products and dissemination that will improve their effectiveness and functionality,

Agrees that a Task Team composed of representatives from recipient Member States with PTWC and other regional warning centres be formed under the Working Group on Detection, Warning and Dissemination to:

1. Review the capabilities and plans of the international TWCs with respect to their operational products and product dissemination for the PTWS
2. Gather feedback from Member States regarding international TWC current and planned product content, format, and dissemination
3. Consider best practices based on social science as well as the experiences of the Member States
4. Consider the global harmonization of tsunami warning products and terminology
5. Develop recommendations to improve current products and /or develop new products

Requests the Task Team Chair to provide a report on the recommendations and any implementations at ICG/PTWS-XXIV.

Financial implications: None

Recommendation ICG/PTWS-XXIII.2

PTWS EXERCISES

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

Recognizing that the PTWS requires regular testing and review,

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

Acknowledging the preliminary results of the Exercise Pacific Wave 08 (PACWAVE08) presented at the ICG/PTWS-XXIII meeting,

Realising that conducting the PACWAVE08 in real time allowed for better visualization of the tsunami propagation, and as a result, actions were taken, and

Noting that participating countries disseminated exercise information to emergency services for immediate actions, and

Noting that there were communications problems that arose in reaching the farthest islands within some island countries,

Recognising that the exercise was a good vehicle to publicize awareness of tsunami preparedness,

Recognizing the continuing challenges to and opportunities for more effective tsunami early warning demonstrated by PACWAVE08,

Recommends that a third end-to-end tsunami exercise be carried out during October 2010,

Encourages the conduct of separate regional exercises that take into account regional tsunami hazards as well as regional challenges and synergies regarding tsunami preparedness, warning and response.

Decides that a Task Team be formed under Working Group 2 with the following Terms of Reference:

(i) Review the PACWAVE08 evaluation report

(ii) Identify lessons learned and develop recommendations based on the PACWAVE08 evaluation and submit recommendations to the PTWS Steering Committee

(iii) Design and carry out a third end-to-end Pacific-wide exercise with the following characteristics:

a. The exercise will take place preferably in the fourth quarter of 2010

b. The exercise scenario be a major tsunami originating in the central south Pacific (e.g., Tonga-Kermadec) to complement previous scenarios in other places

c. The exercise date be finalized by the Task Team and the exercise announced to Member States at least 180 days in advance of the exercise date

d. The exercise manual including instructions to Member States regarding their participation and the evaluation instrument be prepared with content and structure similar to what was prepared for the previous two Pacific-wide exercises, but taking into account lessons learned and any need to collect additional information

e. The exercise manual be distributed to Member States at least 90 days in advance of the exercise date

f. Participating Member States be asked to complete and return the evaluation instrument no more than 90 days following the exercise

g. The exercise be played out in real time

h. The exercise be considered as a way to test new products from the international TWCs including graphical products

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Financial implications: None

Recommendation ICG/PTWS-XXIII.3

OFFICIAL CONTACTS AND SHARING OF INFORMATION

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

Noting continuing difficulty in keeping multiple databases of Tsunami National Contacts and Tsunami Warning Focal Points uniform and current,

Recognising the need for a shared electronic repository to enable the publication of and access to key PTWS documents and other information by Member States,

Requests that the Secretariat urgently develop a web site that provides for:

- The Member States to review and update data concerning Tsunami National Contacts consistent with the UNESCO IOC rules established for such processes;
- Member States to review and update data concerning Tsunami Warning Focal Points consistent with the UNESCO IOC rules established for such processes;
- The IOC Tsunami Unit to make available in a timely manner official PTWS and other system documents;
- Member States to publish and access documents and information that may be of relevance to the international tsunami community, and especially for the Pacific;
- Parts of the website containing all Tsunami Warning Focal Point information and other protected information to be password protected and accessible by all confirmed National Contacts and Tsunami Warning Focal Points.
- Provide PTWS Member States a schedule and plan for carrying out this recommendation within 60 days.

Further Requests that the Secretariat urgently:

- consult with the international Tsunami Warning Centers (TWCs) to consider how to use Communication Tests as a mechanism to review and update Tsunami Warning Focal Point information;
- recommend and then implement an effective method in which to conduct, analyze, and report on the results of Communication Tests for the PTWS

And **requests** that ITIC facilitate the exchange of information in Working Groups and Task Teams during the intersessional periods.

_____
Financial implications: To be determined

Recommendation ICG/PTWS-XXIII.4

REQUEST FOR IOC REVIEW OF GLOSS TERMS OF REFERENCE

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

Acknowledging the efforts of the GLOSS members to expand the sea level collection network and upgrade existing sites for use by the tsunami community, and

Noting the work of the GLOSS GE to enable the near real time transmission of sea level data to tsunami warning centres, and

Noting the efforts of the GLOSS GE to improve existing sampling and communication schemes in support the operational needs of the tsunami community

Noting the contribution of sea level networks not currently in GLOSS

Noting the scheduling of a workshop as recommended ICG/PTWS XXII

Agrees in principle to support the TOWS recommendation for sea level data coordination under GLOSS

Recommends that IOC review and if necessary change the GLOSS TOR to reflect the operational requirements of tsunami warning and mitigation systems.

_____
Financial implications: None

Recommendation ICG/PTWS-XXIII.5

PTWS MEDIUM TERM STRATEGY 2009-2013, WORKING GROUP STRUCTURE AND IMPLEMENTATION PLAN 2009-2011

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

Recognising that Recommendation ICG/PTWS-XXII.6 decided the formation of a Steering Committee and charged the Steering Committee to develop a Medium Term Strategy, Implementation Plan and evaluate inter-sessional Working Groups, and

Noting the reports received from the Steering Committee on a Draft PTWS Medium Strategy for the period 2009-2013, Implementation Plan 2009-2011 and Draft Working Group Structure,

Adopts the Medium Term Strategy (MTS) noting in particular the MTS is based on three pillars:
1. Risk Assessment and Reduction
2. Detection, warning and Dissemination

3. Awareness and Response

Requests Member States to ensure the MTS is referred to appropriate ministries in their countries, so that the MTS is acknowledged and recognised in planning and funding considerations.

Adopts the following concept for Working Groups of the ICG/PTWS:
- Technical Working Groups, that are closely aligned to those for the other ICGs
- Regional Working Groups, charged with identifying and coordinating work specific to the region
- Task Teams, that can be created under Technical or Regional Working Groups to conduct specific short term and well-demarcated tasks as part of the wider objectives of the Working Group.

Abolishes the existing inter-sessional Working Groups 1, 2, 3 and 4 and discontinues their membership,

Agrees to continue with the current Regional Working Groups and membership for:
1. Central American Pacific Coast
2. South East Pacific Region
3. South West Pacific Region, and

Establishes the Working Group for the South China Sea.

Decides to align the Technical Working Groups with the Medium Term Strategy, and therefore to have three Technical Working Groups as follows:
1. Risk Assessment and Reduction
2. Detection, warning and Dissemination
3. Awareness and Response

Agrees to the Terms of Reference for the respective Working Groups as specified in the report of the Steering Committee on the PTWS Working Group Structure (ANNEX VI TO THIS REPORT),

Decides to appoint, according to Rule 25.3 of the IOC Rules and Procedures as Chair of the Technical Working Groups 1, 2 and 3 and the Regional Working Group for the South China Sea:
- Risk Assessment and Reduction:
  Dr Francois Schindele (France)
- Detection, warning and Dissemination:
  Dr David McKinnie (United States)
- Awareness and Response:
  Mr David Coetzee (New Zealand), and
- South China Sea:
  Dr Mohd Rosaidi (Malaysia)

for the first term of office,

Expresses appreciation for the support by the Secretariat in preparing the PTWS Implementation Plan 2009, and

Adopts the Implementation Plan 2009-2011 in principle, but;

Requests the Steering Committee to urgently review and adjust the PTWS Implementation Plan 2009-2011 where necessary, to ensure the Plan recognises and aligns with the MTS and new Working Group Structure.

Requests the IOC Exec Sec to invite nominations to all Working Groups.

Financial implications: None

Recommendation ICG/PTWS-XXIII.6

STEERING COMMITTEE OF THE ICG/PTWS

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

Recalling that the Recommendation ICG/PTWS-XXII.6 "Pacific Tsunami Warning and Mitigation System" established the Steering Committee of the PTWS with the following membership:
a. Elected Officers (Chair and Vice Chairs),
b. Current intersessional Working Group Chairs
c. Other members' representatives by invitation

Considering the requirement for ongoing coordination and advice on the implementation of the PTWS in the intersessional period, including strategic direction and planning, monitoring of implementation and coordination of Working Group activities.

Thanking the members of the Steering Committee for having provided drafts documents for consideration at the ICG/PTWS XXIII, namely the Draft PTWS Medium Term Strategy 2009-2013 and the Draft PTWS Working Group Structure

Decides that the ICG/PTWS Steering Committee shall continue and will exercise the responsibilities delegated to it by the ICG/PTWS, acting on its behalf in the implementation of the decisions.

Decides that the membership of the Steering Committee will be extended to be as follows:

a. Elected Officers (Chair and Vice Chairs),
b. Technical Working Group and Regional Working Group Chairs
c. Director of PTWC, or their representative
d. Other members' representatives by invitation of the Chair

Decides that the ICG/PTWS Steering Committee will act in an advisory capacity to the Chair of the ICG/PTWS during the inter-sessional period.

Further decides that the Steering Committee shall hold at least one meeting during the interval between ICG/PTWS sessions. It will also meet immediately prior to the opening date of the next ICG /PTWS meeting. At this meeting the Steering Committee may propose in addition to the composition of the Elections and Recommendations Committees other sessional Working Groups. It will discuss issues to be raised and discussed at the ICG/PTWS Meeting to facilitate successful outcomes.

Decides that the Steering Committee shall, in the inter-sessionnal period 2009-2011, coordinate and integrate the work of ICG/PTWS, as implemented through the various working groups, teams and rapporteurs, including but not limited to:
a. Finalize the Draft Implementation Plan 2009–2011
b. Develop a Strategy for funding PTWS activities
c. Monitor performance of the PTWS

Financial implications: None

Recommendation ICG/PTWS-XXIII.7

SEISMIC DATA EXCHANGE IN THE SOUTH WEST PACIFIC

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

Acknowledging that a sessional meeting held during ICG/PTWS-XXIII discussed the matter of sharing of seismic data in the South West Pacific, and

Noting reports from China, Japan and Australia on plans to establish seismograph stations in the South West Pacific region over the period 2009-2010, where as some Pacific Island countries have already applied for such support and others are in the process of requesting support, and

Noting that concerned members expressed their willingness to share seismic data, and that data from stations installed by Australia is available directly from Geoscience Australia or from IRIS via the Seedlink protocol,

Recognising that technical issues (such as data exchange protocols and data bandwith) will need to be addressed in order to achieve data sharing,

Noting that data from seismograph stations is useful for research and earthquake catalogue creation and not just tsunami warning,

Recognising Recommendation ICG/PTWS-XXII.1 on Sea-Level Measurement, Data Collection and Exchange,

Agrees that South West Pacific countries with existing or planned broadband seismograph stations share the data in real-time with their neighbours and internationally, including making the data available to Tsunami Warning Centres;

Encourages South West Pacific countries with existing or planned broadband seismograph stations to joint FDSN, use the standards developed by FDSN for data exchange and take advantage of the data archiving provided by FDSN;

Decides that a Task Team be formed under inter-sessional Working Group 2: Detection, warning and Dissemination to assist South West Pacific Countries achieve data sharing;

Agrees that the Terms of Reference for the Task Team are:

1. To advocate seismic data sharing in the region;

2. To advise South West Pacific countries on data sharing protocols, techniques and technologies;

3. To work with SWP Countries and donors to ensure a common data sharing policy;

4. To ensure the recommendations of the ICG/PTWS-XXIII Sessional Working Group on Data Exchange in the South West Pacific are achieved.

Requests that donors are encouraged to help South West Pacific countries achieve data sharing in coordination with the proposed Task Team.

Financial implications: None

Recommendation ICG/PTWS-XXIII.8

PACIFIC EMERGENCY COMMUNICATIONS

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

Noting Recommendation ICG/PTWS-XXII.2, whereby it was decided to establish an inter-sessional Working Group on Pacific Emergency Communications with the following terms of reference:

1. To encourage member states to develop arrangements for the transmission and receipts of tsunami warning alerts from international centres, and the dissemination of alerts and public safety actions within their countries;

2. To provide a forum to identify methods and systems currently available and planned for the future for alert dissemination within Member States, and internationally across the Pacific, and between oceanic basins;

3. To consult with National Tsunami Warning Focal Points to determine appropriate requirements for the dissemination of alerts from the Tsunami Warning Centers and exchange of information for the confirmation of reception.

Confirming that the proposed program of action for the inter-sessional period (February 19, 2009 – ICG/PTWS XXIV to include:

1. A study to take stock of existing communication technologies and mediums available and in use around the world including the Pacific, examine gaps in regional and national warning systems, and to explore ways of how these means of communication could be used to receive and disseminate alerts.

2. To review emerging communications technologies and assess the capacity for use in regional and national warning systems.

3. Depending on the recommendation from 1 and 2, develop designs to incorporate various means of communication to enable receipt and dissemination of tsunami alerts, e.g. the issues to consider here is whether this can be replicated and well receive by member states and or whether such design is appropriate and meet local needs.

4. Explore and develop ways to promote the use of these means of communication including funding, where appropriate.

5. Investigate new partnerships, e.g. WMO, SPREP, SOPAC, ASEAN, etc. who are working on emergency communications issues.

6. Use web-based resources and information from members and compile information with firm recommendations on next steps as well as viability of using available means of communication.

Recognising the Medium Term Strategy and Working Group structure adopted by ICG/PTWS XXIII,

Confirms in view of the above Medium Term Strategy and the Working Group structure, the transition of this Working Group into a Task Team under inter-sessional Working Group 2: Tsunami Detection, Warning, and Dissemination, and the Task Team to continue with the

membership, terms of reference and programme of actions as established for the original Working Group on Pacific Emergency Communications.

Requests that the Secretariat solicit funds from donors to convene an inter-sessional meeting and Early Warning Communications Workshop during the inter-sessional period.

Financial implications: To be determined

Recommendation ICG/PTWS-XXIII.9

APPRECIATION TO THE GOVERNMENT OF SAMOA

The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, **expresses** its gratitude and appreciation to the Government of Samoa for hosting the 23rd Session of the PTWS in Apia

The ICG:

Notes that this is the third time a small Pacific Island Member State has hosted an ICG/PTWS session. The Government of Samoa's kind hospitality highlights the importance of critical issues for the Pacific, including timely access to data, warning and advisory information, and hazard resilient coastal communities,

Notes the development of a comprehensive strategic plan and associated implementation plan to guide enhancement of tsunami warning and mitigation in the Pacific Region, and

Acknowledges Samoa's leadership as a demonstration of the commitment to PTWS that results in an effective and robust tsunami warning and mitigation system, in particular in the South West Pacific region.

Financial implications: none

ANNEX IV

SPEECHES

A. Welcome Speech by Patricio Bernal, IOC Executive Secretary[2]

Reverend Neru Tiatia

Your Excellency, the Associate Minister of the Ministry for the Natural Resources and the Environment (MNRE) of the Government of Samoa., Fonootoe Pierre Lauofo,

Your Excellency, the Chief Executive Officer of the MNRE, Tu'u'u Dr. Ieti Taulealo

Dear Chairman of the ICG/PTWS, Giorgio de la Torre

Dear Chairwoman of PTWS WG III, Ms Filomena Nelson

Your Excellencies, Distinguished Delegates, Dear Colleagues,

I sincerely regret that I cannot share with you personally the great progress I have noted in the recent development of the PTWS. The PTWS had a great influence on the IOC when it responded to the tsunami disaster in the Indian Ocean. Within now five years three more Tsunami Warning Systems covering all oceans at risk are close to becoming operational. Until such time and since April 2005 the PTWC and the NWPTAC provide the essential cover for all new TWSs. We are all a grateful to the Governments of Japan and the USA to provide this interim service.

Meeting in Apia highlights a major threat to a group of counties affected not only by tsunami, particularly from near-shore sources, but also from climate change. The islands in the South Pacific also have to face the potential impact these threats have: developing economies can be heavily set back; new industries such as tourism are vague. They want not only beautiful beaches, charming people, and clean blue oceans, they need safe beaches.

The visit of the Director General of UNESCO , Mr. Matsuura in the spring 2008 to the island states in the Southwest Pacific underlined the interest and commitment of the Organization to their development, preserving their cultural heritage and assisting their aspirations to provide better services to their people. During his visit, the tsunami risk in this region was discussed, and the interest in the services provided by the PTWS and coordinated by the IOC was applauded. Applause is nice, but we all have to improve and extend those services. That is no mean task, and I see with great appreciation how the PTWS is moving fast to modernize and enhance the "system". To be successful, and meet the underlining urgency we all have to work hard, and for the Secretariat I can assure you the full and lasting support for your work.

I want to thank the Government of Samoa for the invitation to meet here, and the opportunity to convene a meeting with many representatives from this region. I wish you all a successful and effective meeting, and a few days on this lovely island. May all visitors take a bit of Fa'a Samoa along.

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[2] Delivered on his behalf by Mr. Peter Koltermann, Head of the IOC Tsunami Unit

B. Welcome Speech by Lt. Giorgio de La Torre, Chair (a.i), ICG/PTWS

Reverend Neru Tiatia

Your Excellency, the Associate Minister of the Ministry for the Natural Resources and the Environment (MNRE) of the Government of Samoa., Fonootoe Pierre Lauofo,

Mr. Peter Koltermann, Head of the IOC Tsunami Unit

Dear colleagues,

Forty four years ago, during the fourth session of the IOC Assembly, member states decided to create the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU). Subsequently, the Thirty-ninth Session of the Executive Council decided to rename ITSU to be the Pacific Tsunami Warning and Mitigation System (PTWS) and to provide its continuity through the Intergovernmental Coordination Group for the Pacific Ocean Tsunami Warning and Mitigation System (ICG/PTWS).

In this connection, and after a year and a half of our last meeting in Guayaquil-Ecuador, the official delegations of 21 countries are here in SAMOA, ready to celebrate the twenty-third Session of the Intergovernmental Coordination Group for the Pacific Ocean Tsunami Warning and Mitigation System (ICG/PTWS-XXIII).

During the next three days, member states will actively discuss important topics for the system and will take decisions in order to improve the effectiveness of the tsunami warning and mitigation efforts in the Pacific. Among them, the PTWS Medium Term Strategy for the period 2009 – 2014 as well as its Implementation Plan will certainly concentrate our attention, because of the implications related to the adoption of such important planning tools. In a similar way, member states will have to define the most suitable and effective working structure to achieve the proposed strategic objectives as well as to generate their operational products.

The results and benefits of the recently adopted governance structure of the ICG/PTWS is another important topic that will be reported and discussed by member states, which is extremely positive, if we consider the need of continuously improving the decision making process within our system.

For this reason and in my position of acting interim Chairman of the Group, I would like to express on behalf of all member states, my deep appreciation to the Government of SAMOA for hosting this important event, and particularly for the hospitality shown by the people of this wonderful country. To all the member states represented in this meeting, thank you for your presence, once again you have committed to the common effort of saving lives not only in your own countries but also in the entire Pacific basin.

This commitment must be permanent since it is the only effective way of achieving the objectives of our system. Therefore, the establishment of a strong sense of ownership and the adoption of individual responsibilities are our next challenge. A challenge that will require more initiative than intelligence, particularly during periods of global economic restrictions that affect our ability to generate all the required resources.

The time to put this basic principle in practice has begun this morning. Dear friends and colleagues, welcome to this new opportunity of making a difference, welcome to the XXIII Session of the ICG-PTWS.

C. Welcome Speech by Fonotoe P.F. Laufou , Associate Minister of the Ministry for the Natural Resources and the Environment (MNRE) of the Government of Samoa

Reverend Neru Tiatia,
Mr. Peter Kolterman,
Lt. Giorgio De La Torre,
Distinguished Delegates and Participants,

The Government of Samoa is so grateful to all of you for choosing Samoa as the host country for this 23rd Session of your group. And thus on behalf of our Government I officially welcome you all to our country and while you are in Samoa I would urge you, to spare some time to absorb what Samoa has to offer.

As you converge on Apia to deliberate on how to live with a tsunami which is a National Disaster, I see it fitting to reflect on a natural disaster occurring in the Pacific, i.e.; the Victorian Forest Fires. It is a very sad occurrence indeed. But it does illustrate the uncompromising and unpredictable nature of natural disasters. I would therefore ask that in our prayers, we remember the people of Australia and particularly those in the State of Victoria who have lost loved ones and properties as a consequence of this terrible event.

Now Samoa's, vulnerability to Tsunamis is rated as "extreme" because of its proximity to the Tongan Trench and also being surrounded by Pacific Rim countries with active Seismic activities.

I am happy to advise the excellent progress has been made by Samoa in recent years such as enacting Disaster and Emergency legislation, developing a Disaster Management Plan with its Hazard Plans and Agency Response Plans. We do have a National Disaster Council (NDC) but my personal commendation goes out to members of the Advisory Committee and especially the staff of the Disaster Management Office (DMO) for the excellent progress made to date.

Of course the implementation of National Disaster Plans would require the active support and concerted commitment of regional and international development partners. Surely, the main focus of these plans must be to ensure that the essential issues of Preparation Response and Recovery are brought home particularly to village leaders and communities through the country.

We have developed a National Tsunami Early Warning System which involves the utilization of modern technology and cooperation from selected village leaders and members of the wider community. I am sure the participants from Samoa during your deliberations will elaborate on the aspects of this system and also the encouraging results of the 2 National drills conducted to test the system. I'm convince that the involvement of village community leaders in such a system is crucial to its success. The protection of human life and property from natural disasters is in my respectful view, the obligation of every democratic government towards its citizens. The right to the protection of life and property is one of the Pillars of our democratic system. A democratic system which is embraced by Samoan customs and Christian principles

At present Samoa has only one seismic station in partnership with the USA, and a Tide Gauge in partnership with the Government of Australia. Efforts to enhance Samoa's capacity to manage national seismic activities by acquiring a modern seismic monitoring facility will hopefully be realized with the support of the Peoples Republic of China.

Samoa is aware that a Tsunami generated at the Tongan trench for example by a large earthquake could hit Samoa in 5 minutes from time of inception, before a warning is received from the Pacific Tsunami Warning Centre in Honolulu. And therefore the urgent need for a Tsunami Early Warning System for this part of the Pacific is recognized. The establishment of such a Centre may be a dream, will be seen as carrying out of our Governments obligation fro the protection of human life and property. We all appreciate that investing in the establishment of

an infrastructure to mitigate Tsunami impacts is far more cost effective than rebuilding lives and entire communities after a Tsunami.

I am informed that this is your 23rd Session, and although you have made great progress along the way, I know it has been difficult. I can see that the way forward is still not easy. But if we are to achieve our aims and accomplish our goals, then we must sail on the boat of hardship.

In conclusion, I wish you success in your meeting and may you have enjoyable stay in Samoa. I now declare this meeting OPEN.

Soifua

Fonotoe P.F. Laufou
Associate Minister MNRE

ANNEX V

PTWS MEDIUM TERM STRATEGY 2009–2013

I. Introduction

1.1. Purpose of the document

The PTWS Medium Term Strategy (PTWS MTS) describes the basic directions towards continuously improving the Pacific Tsunami Warning & Mitigation System to meet stakeholder requirements during the period 2009-2013. It focuses on describing general, common but essential, strategic objectives to ensure an effective and efficient, tsunami warning and mitigation system that is interoperable wherever possible with the other ocean basins and seas. The PTWS working group structure derives from the PTWS MTS and is described in the PTWS Working group Structure. And details of the methods to accomplish these strategic objectives are defined in the PTWS Implementation Plan.

1.2. Vision

The MTS envisions that the PTWS is:

> *An interoperable tsunami warning and mitigation system based on coordinated Member State contributions that uses best practices and operational technologies to provide timely and effective advice to National Tsunami Warning Centres. As a result, PTWS communities at risk are* aware *of the tsunami threat,* reduce *risk, and are* prepared *to act to save lives.*

1.3. Context

The Pacific Ocean basin is the largest, most diverse, and most tsunami-prone of any of the earth's ocean basins. Pacific Ocean nations face and must be prepared for distant, and local tsunami threats. In the past, Member States depended primarily on Pacific Tsunami Warning Center (PTWC) and Northwest Pacific Tsunami Advisory Centre (NWPTAC) advice to inform National Tsunami Warning Centre decisions. But a new awareness of local and regional threats demands that Member States commit to address these threats through improved and expanded National Tsunami Warning Centre capacities and through formal regional collaboration. The result is an interoperable network of National and Regional tsunami warning and advisory centres that complement the distant tsunami advice PTWS and NWPTAC provide. This MTS provides the framework for MS to take responsibility and ownership for their National systems and to engage in the international coordination and collaboration process through the ICG/PTWS.

1.4. Framework for The Global Tsunami and Other Ocean-Related Hazards Early Warning System (GOHWMS)

The Pacific Tsunami Warning and Mitigation Systems operates as an important component within the global tsunami warning and other ocean-related hazards early warning systems. The governance of PTWS is provided through an Intergovernmental Coordination Group (ICG), under the Intergovernmental Oceanographic Commission (IOC) of UNESCO. The PTWS reflects the key principles of the Framework for the Global Tsunami and other Ocean-related Hazards Early Warning System (GOHWMS):

- Identifying warning and mitigation system requirements unique to the Pacific Ocean basin

- Capitalizing, to the extent practicable, on existing international groups with relevant responsibilities such as GLOSS and JCOMM

- Harmonising structure, standards, and practices among ICGs

- Integrating with other international systems and organizations such as WMO and ISDR

- Collaborate on research and development across ICGs

1.5 Strategic Pillars

Considering the important role the GOHWMS plays and the unique requirements of the Pacific Ocean basin, the Pacific Tsunami Warning and Mitigation Systems Medium Term Strategy is comprised of three Pillars supported by three foundational elements. The three Pillars are:

- Risk Assessment and Reduction: *hazard and risk identification and risk reduction*
- Detection, Warning and Dissemination: *rapid detection and warning dissemination down to the last mile*
- Awareness and Response: *public education, emergency planning and response*

The supporting foundational elements are:

- Interoperability: free, open and functional exchange of tsunami information
- Research: *enhanced understanding and improved technologies and techniques*
- Capacity Building: *training and technology transfer*
- Funding and Sustainability: *resources to sustain an effective PTWS*

1.6 Document Structure

Section II provides an analysis of the current state of the PTWS. Section III describes the three pillars. Section IV reviews the Foundational Elements, and Section V discusses Implementation.

II. Analysis of the Current State of the PTWS

The current state of the PTWS can be summarized as follows:

2.1 Whilst there has been significant progress, risk assessments and reduction still incomplete for many areas.

2.2 Whilst there has been a considerable expansion in the amount of seismic and sea level data to detect tsunami threat, the data is not always interoperable or made timely available to the warning centres. Exchanging observational data between neighboring Member States (sometimes even within a single Member State) and across the region remains a challenge.

2.3 Pacific-wide and Regional Warning/Advisory services provided by PTWC, WCATWC and NWPTAC have been robustly operated with high reliability. Although centers have been making ceaseless efforts to improve their services by introducing new technologies as well as to maintain the operational systems, the Pacific in some areas may potentially

soon lag behind the capabilities being developed in the other ocean basins for more threat based tsunami warnings.

2.4 Some 24/7 robust Local/National Warning systems have been developed and others are still under construction for determination of local, regional and ocean-wide tsunami threat. Establishing a 24/7 robust national systems remain great challenges.

2.5 A positive tendency is that Member States' awareness of the urgent necessity for preparing countermeasures against tsunami threats has been increasing, especially after the 2004 Indian Ocean Tsunami disaster. Still, there is a need for more risk assessment, capacity building, disaster prevention education and other activities to achieve further and sufficient tsunami preparedness and sustainability of operational systems.

2.6 Whilst there are now semi-regular, internationally coordinated exercises for the PTWS, there is minimal routine monitoring of system performance to underpin continuous improvement and ensure messages are delivered in a timely and accurate manner down to the "last mile".

2.7 Whilst awareness and preparedness is improving around the region, considerable effort is required to ensure all communities at risk are aware the threat and able to respond safely.

2.8 Member States are the main contributors to the PTWS. The budget for the ICG/PTWS provided by the governing body, UNESCO/IOC, and donated by Member States is not adequate to support all critical ICG/PTWS activities. Other PTWS activities highly depend on national regular budgets. For example, national and regional tsunami warning/advisory operational centers, which are not included in the PTWS budget, nor are extra budgetary contributions offered by concerned organizations such as ISDR, UNDP and aid or technical agencies such as AusAID, USAid, JICA, Cosude or DIPECHO.

III Strategic Pillars

3.1 Introduction

To formulate the PTWS Medium Term Strategy MTS we should consider the present situation described in section II and develop realistic strategic objectives that are achievable in 5 years. The driving question is "What can be done even with the present limited resources to at least make the populations at risk safer?" The response to this question makes it possible to prioritize the activities for improving the various components of the entire PTWS. These priorities may also be considered by aid and technical cooperation agencies as guidance for their support to the PTWS.

The next sections describe the strategic objectives to be accomplished and the contents of each pillar as well as offering suggested priority actions. Needless to say the ICG/PTWS and Member States will support the activities addressing these strategic objectives as much as possible. It is important to encourage Member States initiative as the main stakeholders and actors in these activities.

3.1.2 **Pillar 1: Risk Assessment and Reduction**

Tsunami risk consists of several components such as hazard assessment (specifying tsunami sources and waves height along the coast), and risk assessment, estimating tsunami effects to the coasts or estimating damages. Its final aim is to know where the dangerous places are and how strongly a tsunami could affect those areas. To put it straight, risk and hazard assessment is to be conducted at and by each Member State who knows the natural and social conditions of its coastal area more than any other countries, utilizing the recent and historical data completed

by existing scenarios of Pacific-wide tsunamis and developing local scenarios as well. This assessment is an unavoidable starting point for efficient tsunami preparedness activities.

Risk assessment is fundamental to the other pillars. It is also required for disaster risk reduction—activities that reduce community exposure to tsunami and other ocean-related threats.

Strategic Objective
Member States will specify and detail danger levels and dangerous areas at their own coast brought by tsunami phenomenon.

Member States should develop risk reduction strategies through appropriate agencies and organizations to reduce, where possible, community exposure to threats from tsunamis and other ocean-related hazards.

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Developing a tsunami hazard maps based on recent and historical data and/or numerical simulation is the ideal goal. Simple and rough estimation, like using altitude data of coastal topography as inundation criterion, can serve temporarily until more accurate mapping develops in the future including through paleo-tsunami research.

Suggested Mechanisms:
Steps for tsunami risk assessment in Member States include:

1st: Specify tsunami sources capable of generating tsunamis that affect its own coastal area. Local source or distant source? Which source is more likely to affect the coast?
-> Specify them from the past tsunami records or consideration of tectonic circumstances. Data of past earthquakes and tsunamis are important, but past tsunami databases may lack the severest case(s). So it would be advisable to assume the largest scale of geophysically possible cases as well as referring to the past databases.
-> Utilize maximum tsunami height distribution charts of wide areas by numerical simulation that can indicate tsunami energy direction.

2nd: Specify danger level at each coast or dangerous area
-> by numerical simulation, recent and past records and other available means
Post tsunami reconnaissance surveys after recent or new event provide unique detailed data valuable for risk and hazard assessment. Such survey must be organized and carried out quickly and thoroughly after
each tsunami occurs,

Since the work for the above steps includes technical and research capabilities, capacities and skills, it needs support from or cooperation with research communities. To make it relevant and timely a compromise solution should be sought in terms of accuracy in the short term, because it would take long time and large budgets to pursue it due to its continuous improvement.

In the long term, it would be ideal to have Member States' own available experts who can deal with various technical matters. Such human resources development is essential for the sustainability of the system. It requires training courses, overseas or national opportunities for graduate or postgraduate education and scientific and technical networking.

3rd : Specify appropriate strategies and techniques for reducing Member State communities' exposure to tsunami and other ocean-related threats.

3.2 Pillar II: Detection, Warning and Dissemination

An effective tsunami warning system involves the rapid detection and quantification of the earthquake source, forecasting and verification of wave propagation and the likely threatened areas, development and dissemination to the "last mile" of information about the threat to enable communities to respond.

- ***Detection*** involves the implementation and development of seismic and sea level observing systems that enable rapid assessment and verification of the threat.

- ***Warning*** involves the rapid detection of local earthquakes capable of generating local tsunamis, forecasting of wave propagation and potential impacts for regional and ocean wide tsunamis, and conveying that information in interoperable message formats.

- ***Dissemination*** involves the timely and accurate distribution of threat and warning information from and between warning centres, and from National Tsunami Warning Centres to the community.

Since the Pacific is the world's largest ocean and has tsunami sources in widespread regions, it is appropriate to consider it in several geographical scales when we deal with tsunami warning systems. Tsunami warning systems of the PTWS have the following 3 scales:

a. *Local warning (or National warning)*

b. *Regional warning*

c. *Ocean-wide warning*

The followings are descriptions of improvements needed for warning systems of each scale.

a. *Local warning (or National warning)*
Local warning systems or national warning systems are the most crucial part in the entire end-to-end system for both local and distant tsunamis, due to the inalienable national responsibility for informing communities at risk and urge or order immediate evacuation.

This system should be established or improved prior to the regional or ocean-wide system.

Strategic Objective

Develop National warning center or function by each MS.
Establish emergency response mechanism on a 24/7 basis among concerned organizations.
Build optimized procedure for all steps; from issuing warnings to evacuation. Master the procedure by continuous practices including through full-scale evacuation exercises and drills down to the "last mile".
Utilise new and available technologies and develop arrangements for the transmission and receipts of tsunami warnings alerts from international centres, and the dissemination of alerts and public safety actions within countries.

Contents

Build (or improve) observational networks for seismic and sea level data and online communication system(s) to rapidly collect these data. Establish or reinforce capabilities to analyze those data, evaluate tsunami effects and issue tsunami warnings through improved communication networks for delivering warnings and information.

Suggested Mechanisms:
-> Improvement of seismic and sea level observation networks requires considerable funding and human resources, so that it may be difficult for many countries to achieve this strategic objective.
-> Address improvements by better focusing on hazard assessment and building on efficient use of existing support mechanisms and international networks (such as CTBTO, FDSN and IRIS for seismic monitoring and GLOSS for sea level monitoring).
-> While the precise production and definition of a tsunami warning requires specific capabilities, the delivery of warnings to the population is usually provided through other mechanisms by mandated agencies (Interior, Cabinet, Civil Defence, Hydrometeorological and Weather Services). Early involvement of these bodies in the national tasks of the PTWS may help save time and money.

note: For local tsunamis, which occur just near the coast of a particular country, there is usually a very short time until the tsunami hits the coast. Therefore, local or national warning system should develop community awareness beforehand and initiate emergency action on their own, without waiting for information from overseas organizations. For distant tsunamis, local and national systems securely receive information from international centers, evaluate the effect on domestic coast and decide to issue national warnings.

b. *Regional warning*

Regional systems are for protection from tsunamis that affect several Member States within the Pacific Ocean but do not have an impact over the whole ocean like the 1960 Chilean Tsunami. In other words regional systems are the systems whose area of responsibility (AoR) [3] is a part of the Pacific Ocean. There are already two established regional systems, which are operated by WCATWC and NWPTAC respectively. Meanwhile there are other regions where new regional systems may be required, particularly for the regions that are adjacent to tsunami generation source and have many nations within small area. In such regions cooperation among neighboring Member States of exchanging or integrating real-time seismic and sea level data is essential. In that regard some regional systems should be considered with high priority just like local system establishment. (e.g. system in the Southwest Pacific region where proper detection of earthquakes is difficult in a single country due to sparse distribution of small islands)

Strategic Objective

Existent two regional systems:

At least, maintain the present level of operational services provided by WCATWC and NWPTAC.

Achieve further improvement on Warning/Advisory services by these Centers, to include more specific information on the tsunami threat

Other new regional systems:

Develop regional warning systems to provide warning service for the region as required.

Utilise Regional Working Groups to coordinate and share information on user requirements and communication issues and develop capacity on a regional basis

Contents

Existent two regional systems:

The USA and Japan continue their operational services in close cooperation for providing effective Warning/Advisory Services consistent with the PTWC's Warning/Advisory service.

[3] AoR of regional systems depend on cases. Some are fairly wide so that the systems have characteristics of ocean-wide system, some others are smaller and the systems have characteristics of local systems to some extent. For example, WCATWC and NWPTAC are the former and Pacific side of Central America system would be the latter.

WCATWC will target providing tsunami height estimations.
Improve tsunami estimation accuracy.
Improve earthquake determination (location, depth and M) accuracy.

Other new regional systems:
Share real-time seismic and sea level data among Member States within the region.
Establish regional warning center if required and ensure steady operation.

Suggested Mechanisms:

Existent two regional systems:
The USA and Japan will continue their longstanding contributions to maintain stable operation and to improve their Tsunami Warning/Advisory services.

Other new regional systems:
Promote cooperation and coordination through regional Working Groups of the ICG/PTWS, receiving and using information and advice from technical Working Groups WGs
Funding is a challenge, but it should be on the countries' own expenses along with efforts to obtain support by international aid funds.

note: If all the Member States in the region have capabilities to individually analyze the shared observational data and evaluate the tsunami impact on their own coasts, establishing a regional center that provides tsunami warning for the whole area of the region may be unnecessary. In that case each MS delivers its domestic tsunami warning in the same manner as in local systems.

c. *Ocean-wide warning*

Ocean-wide system deals with tsunamis capable of expanding in a vast area of the Pacific Ocean, affecting a number of countries. This system uses global observational networks of seismic and sea level data, and also requires prompt and reliable communication means to deliver warnings to scattered countries around the Pacific Ocean. This warning information has the role of triggering the national warning procedure in each MS for ocean-wide tsunamis.

Strategic Objective

At least, maintain the present level of operational services provided by the PTWC.
Achieve further improvement on Warning/Advisory services by the PTWC.
Utilise Regional Working Groups to coordinate and share information on user requirements and communication issues and develop capacity on a regional basis.

Contents

The USA continues its operational services in close cooperation with other regional centers for providing consistent and effective Warning/Advisory Services. Any further improvement of the PTWS will be constructed on the basis of this present ocean-wide system and service.
PTWC will target providing tsunami height estimations.
Improve tsunami estimation accuracy.
Improve earthquake determination (location, depth and M) accuracy.
Keep the Tsunami Warning Focal Point (TWFP) list up to date and as complete and reliable as possible.

Suggested Mechanisms:

The USA will continue their longstanding contributions to maintain stable operation and to improve their Tsunami Warning/Advisory services.
The ICG/PTWS will reinforce its mechanisms for obtaining and updating the TWFP list.

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note: What is most important for tsunami warning systems of any scale described above (a., b. and c.) is to guarantee stability, reliability and sustainability in the end-to-end operation, from receiving/delivering warning at centers down to the population evacuation, and the system should always be ready (24/7) for the occurrence of this quite rare natural phenomenon. In other words, the primary aim for a warning system should be to maintain the system as a whole and keep the necessary reliability after its construction, or to develop such system as to be easy to maintain and to assure reliability.

From that standpoint state-of-the-art technologies should be carefully assessed before bringing these into operational systems. It is essential to evaluate the newest, promising technologies from the viewpoints of not only effectiveness or attractive prospects but also operational reliability and robustness, when considering introducing them into the warning system.

Detection

Detection involves the implementation and development of seismic and sea level observing systems that enable rapid assessment and verification of the threat to enhance the accuracy and timeliness of threat information.

Strategic Objective

Enhance seismic and sea level monitoring capability.
Development of cost efficient sea level observing technologies to maximize the return from resources and underpin sustainability of the system.

Contents

Improve accuracy of earthquake location and size by making available all present and future seismic data collected by national and internationally coordinated networks (such as CTBTO, IRIS, FDSN).
Develop national capability with access to interoperable neighbouring seismic information for detecting local tsunami threat.
Coordinate and share information on the development of analysis techniques.
Timely access for tsunami warning centres to all currently available and suitable sea level station data in agreed standard format (CREX). Priority should be given to stations within 1-hour travel time from known sources.

Pillar 3: Awareness and Response

It is essential that the communities that are vulnerable to the effects of tsunami are made aware of its effects and how to respond when it happens through simple cost-effective and cultural sensitive awareness programmes. Such programs would include developing and disseminating information through the media, workshops/seminars, awareness materials, Internet, signage and billboards. If not already in existence, tsunami related curriculum programs should be developed to build that inherent capability in the young adults and children.

Due to the nature of tsunamis, Member Sates must be able to respond however this will require putting in place systems and processes to enable cost effective response coordination. These systems and processes would include response management structures, evacuation plans and maps, communication systems to enable such amongst emergency services, emergency operation centers, shelters and other basic necessities to support evacuees/victims, medical, search and rescue infrastructures.

Member States should also plan and conduct exercises on regular basis to test early warning systems and emergency evacuation.

To ensure that Government officials, NGOs, private sector and community representatives are able to provide the required response, sustainable capacity building programs should be developed and delivered.

Strategic Objectives:

- Strengthen public awareness of tsunami and associated hazards and how to prepare to respond;
- Develop and conduct exercises to test early warning systems and evacuation mechanisms;
- Establish rapid and effective evacuation mechanism given the risk assessment guidance and data;
- Develop and deliver suitable and sustainable capacity building programs to facilitate effective and efficient response and coordination;
- Establish and or strengthen appropriate response structures to facilitate effective coordination;
- Develop tsunami related curriculum programs for all levels of education to build an inherent capability and raise the interest of young people in the disaster management field providing a source of career development and support to the Member States in the future to plan, respond to and recover from tsunamis; and
- Mainstream awareness and response programs into Member States development strategies and sector plans to facilitate acquiring of resources to enable implementation of required response infrastructures/mechanisms;

Suggested Mechanisms:

i) Training and instruction to responsible officials of government and awareness raising programmes for the public. Make use of various training and educational programs offered by various organizations. First investigate what programs exist by questioning offering organizations and Member States actually using them, and then compile a list of them as reference information for all Member States

ii) Translating existing good educational materials into local languages and delivering these materials to the people is one of the best ways for disaster prevention education;
   - ❖ Investigate what materials and supporting system exist by questioning the offering organizations and Member States that are actually using them
   - ❖ For both of the above, it is very important to collect past activities and evaluate their effectiveness for further improvement.
   - ❖ Regarding capacity building and improving public awareness, ITIC takes the main role of activities described above as its main task.

iii) Full scale evacuation exercises and drills should be considered as reliable preparedness tools to test both warning systems and evacuation plans. It also helps to strengthen awareness of both local governments and population.

IV. Foundational Elements

4.1 Interoperability

Taken together, the GOHWMS and PTWS MTS require three kinds of interoperability:

First, National Tsunami Warning and Mitigation Systems must be interoperable among PTWS Member States and with the PTWC and NWPTAC to ensure full and open access to tsunami-relevant observational data, analysis, advisory and warning information, operational techniques and technologies, and best practices. More effective National Tsunami Warning and Mitigation Systems will result.

Second, the PTWS must be interoperable with other ocean-related hazards warning and mitigation systems to use and share data, analyses, and awareness and preparedness, and other common elements of such systems. Synergies will result that will increase the effectiveness of National Tsunami Warning and Mitigation Systems, regional warning centre operations, and drive down the costs of operating and maintaining ocean-related hazard and mitigation systems.

Third, the PTWS must be interoperable with other ICGs in the context of the GOHWMS framework. Again, improvements in effectiveness and efficiency will result—for Member States both individually and collectively.

For enhancing such interoperability, IOC created the TOWS-WG to coordinate activities of the ICGs and of relevant organizations dealing with other ocean-related hazards. From recognizing that the ICG/PTWS (and its predecessor ICG/ITSU) has been continuously operated and successfully contributed to tsunami disaster mitigation in the Pacific for these forty years, the ICG/PTWS should share its experiences and knowledge within TOWS-WG and learn from new developments in other regions.

4.2 Research

Each of the three pillars requires on-going research and development to advance all elements of the PTWS. Investigations of the tsunami phenomena, including tsunami caused by landslides, volcanoes, and other sources and new developments, whether in tsunami detection, tsunameter technology or innovative GPS applications, new threat-based forecast systems, developments in operations and communications technologies, or innovative approaches to community preparedness need to be monitored, evaluated, and publicized to Member States. Such advances are critical supports to the three central pillars of the PTWS MTS.

There are many new research programs and technologies being conducted and developed. Since these are leading edge activities, many of them provide interesting and relevant results in theory, but they need to be validated in experimental stage in order to be put into practical use. Therefore we have to pre-assess new research results or technologies from various viewpoints such as relevance, effectiveness, efficiency, robustness, ease of maintenance easiness and sustainability before officially introducing them into operational systems.

PTWS needs to promote closer cooperation with relevant research communities. PTWS also should take the role of requesting research communities to conduct or develop research or technology necessary for improving tsunami warning and mitigation system and contribute to solving problems discovered or highlighted through our actual system operations or various other activities.

4.3 Capacity Building

An effective tsunami warning and mitigation system requires ongoing capacity building and training to support all three strategic pillars. Capacity building activities must be carried out continuously and forever in the three strategic pillars. Each country must be able to understand its risk and know ways in which they can mitigate the hazard, provide warning guidance to its populations in a timely manner, and be able to carry out awareness and preparedness activities to sustain knowledge and ability-to-respond across generations.

The building of national human resource capacities that can develop, guide and lead these activities in each country is essential. Substantial experience, knowledge, and best practices have been accumulated over the years by Member States prone to tsunamis. This should be shared widely through trainings and workshops. Training courses and national, cross-sector and inter-regional workshops are excellent ways in which to build these skill sets and at the same time, to improve the networking between countries during a real event.

As these skills are developed over time, trainings should be regularly conducted, and also be continually refreshed as new methods, technologies, and practices are identified. An example of regular training already available within the PTWS is the ITSU Training Programme organized by the ITIC for PTWS Member States since the 1970s; such a programme--and others--can be expanded and/or customized to encompass and meet the needs of all countries.

4.4 Funding and System Sustainability

Like any system, a robust, effective PTWS requires substantial investment to be viable and evolve to meet new needs and incorporate new technologies. There is a need for renewed Member State commitment to invest in National Tsunami Warning and Mitigation Systems and to contribute—in whatever way possible—to the operation of the PTWS. In addition, there is a need engage donor agencies and organizations to support all elements of the end-to-end tsunami warning and mitigation system in the Pacific Ocean.

Implementing this Medium Term Strategy will require additional investments from within and outside the PTWS Member States. A separate supporting funding and sustainability strategy is needed to realize these investments.

V. Implementation

The PTWS Steering Committee will coordinate and monitor MTS implementation.

ANNEX VI

PTWS WORKING GROUP STRUCTURE

1.0 Introduction

At the ICG/PTWS XXII meeting held in Guayaquil, Ecuador it was resolved to change the governance structure of PTWS and establish an ICG/PTWS Steering Committee with membership from:

a. Elected Officers (Chair and Vice Chairs);
b. Current [intersessional] Working Group Chairs;
c. Other member state's representatives by invitation.

The Steering Committee was charged with evaluating the need for provisional Intersessional Working Groups as required in the following areas:

a. Monitoring
b. Assessment
c. Interoperability
d. Awareness
e. Regional.

This paper defines an Intersessional Working Group structure based on the PTWS Medium Term Strategy and the recommendations of ICG/PTWS XXII and XXIII.

2.0 Requirements of the Working Group Structure

The Working Groups and Task Teams are the mechanisms available for the ICG/PTWS to carry out the work identified in the Medium Term Strategy (MTS). From an overall IOC and efficiency point of view it is important to coordinate and cooperate with the ICGs for other oceans regarding activities that have common characteristics or common issues. It would therefore be generally preferable (if at all possible) that PTWS Working Groups have the same or similar structure to those of other ICGs.

Considering the overall PTWS structure and IOC definitions, Working Groups should be used for longer term (a five year time frame) activities and Task Team should be used for well defined short-term activities. In this way Working Groups can be used as the mechanism for implementation of the MTS of PTWS, and Tasks Teams can be seen as a means of carrying out defined tasks within [one or more] Working Groups.

Regional coordination requires considerable time indicating that Working Groups are more appropriate than Task Teams for regional issues. Similarly, to enhance the awareness and ownership of sub-regional issues, Working Group should provide more visibility than Task Teams.

The Pacific is the only region in which Regional working groups are used, so this could be seen as contradicting the aim of coordinating the Working Group structures between ICGs. However, the Pacific is both the largest and most complex region covered by the IOC ICGs making the use of this mechanism necessary. Situations to issues often differ between Regions, underlining the requirement of retaining a Regional Working Group structure within the ICG/PTWS.

Leadership is essential in ensuring progress is made on the objectives of the MTS, and can have much to do with the duration of activities being carried out by Working Groups and Task Teams..

3.0 Proposed Structure

We propose a structure for PTWS Working Groups and Task Teams which varies from that used in other ICGs, but are as closely related as possible. The concept is to have *Technical Working Groups (TWG)* that are closely aligned to those for the other ICGs, and *Regional Working Groups (RWG)* charged with identifying and coordinating work which is specific to the Region. In general Task Teams will be formed to carry out work with a defined duration as part of Technical Working Group activities, or as defined by the full ICG/PTWS session or the PTWS Steering Committee. The structure of the TWGs will be defined by the requirements of the MTS, and the Regional Working Groups will be constituted and dissolved by an ICG/PTWS meeting to carry out identified Regional work in line with the MTS.

In light of the above considerations we propose to have three Technical Working Groups as follows.

1. Tsunami Risk Assessment and Reduction;
2. Tsunami Detection, Warning and Dissemination;
3. Tsunami Awareness and Response.

The term “Interoperability” now has two meanings as applied to tsunami warning. One meaning is to ensure consistency with other ICGs and to consider other ocean hazards. The other is to have standard warning formats and procedures for tsunami warning systems. The former can be and should be considered in developing each component of tsunami warning systems in the corresponding WGs, and an independent “Interoperable” WG is unnecessary. The latter has been pursued by the current WG “Interoperability of regional, sub-regional and national warning systems in the Pacific”, and would become a part of the proposed TWG 2.

When establishing Regional warning systems the RWGs should pay attention to interoperability, and for national warning systems WG 2 can advise Member States to ensure interoperability.

The Regional Working Groups currently in existence should be confirmed unless a ICG/PTWS meeting decides to dissolve one or more of them. Similarly, the ICG/PTWS meeting may also constitute new Regional Working Groups as required. The Regional Working Groups are:

1. Central American Pacific Coast;
2. Southeast Pacific Region;
3. Southwest Pacific Region;
4. South China Sea Region.

The Technical Working Groups give technical support to the Regional Working Groups, while the Regional Working Groups give the Technical Working Groups feedback of their experiences of system establishment in the regions.

Task Teams should be formed within the TWGs to address particular issues. For example there may be Task Teams within the Detection, Warning and Dissemination (WG 2) on the technologies used for earthquake detection (seismic observation) and tsunami detection (sea

level observation). In the same way, the currently existing working groups that deal with specific technical matters could be transformed into Task Teams. “Sea-Level Measurement”, “Data Collection and Exchange” and “Rapid Near-field Recognition of Tsunamigenic Earthquakes and Associated Tsunamis” working group, and “Pacific Emergency Communications and Technologies” working group can be a Task Teams in the proposed TWG 2.

The scope of the TWGs is designed to cover the requirements of the MTS which covers the full range of PTWS activities. These are outlined in the sections below.

Provisional Terms of Reference for these proposed Working Groups are provided as appendices to this document. It is recommended that the Regional Working Groups be confirmed with the existing ToR, membership and officers; the ToR are included in appendix 2 for information purposes only.

3.1 Working Group on Tsunami Risk Assessment and Reduction

The assessment of tsunami hazard and risk is the focus of this working group. It includes examination and introduction of methods of assessing tsunami sources, estimating tsunami heights at coasts, building tsunami hazard maps, and mitigation. The work of this working group relates to pillar one of the MTS.

3.2 Working Group on Tsunami Detection, Warning and Dissemination

The focus of this working group is the improvement to the detection and monitoring system for tsunami warning. It includes the examination and introduction of techniques for measuring sea level, seismic and other kinds of data, data communications and evaluation. Disseminating tsunami warnings that are easy to understand to the people at risk promptly and securely is also the focus of this working group. It includes examination and introduction of appropriate format or contents in warning/information message, emergency communication techniques etc. The work of this working group relates to pillar two of the MTS.

3.3 Working Group on Tsunami Awareness and Response

This working group promotes good practice examples of capacity and resilience building and emergency management to improve the management of tsunami risk through mitigation, preparedness and response activities. These activities are performed both on administrative organization level and on general public level. Capacity building and training are examples for the former, and tsunami awareness public education is one for the latter. The work of this working group relates to pillar three of the MTS.

4.0 Steering Committee Role.

The Steering Committee will have the role of coordinating the activities of the working groups during the intersessional period. Steering Committee meetings during the interval between ICG/PTWS sessions should review the progress of working group activities to ensure progress is being made.

APPENDIX 1: TECHNICAL WORKING GROUPS

Provisional Terms-of-Reference Working Group 1: Tsunami Risk Assessment and Reduction

1. Review and report on existing arrangements with regard to tsunami hazard identification and characterization.
2. 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. Review details on models that are currently used or in development and desirable standards of documentation (model inputs and outputs etc.).
4. Explore cooperation regarding coastal inundation models, including appropriate requirements for bathymetry.
5. Develop guidance on mandatory metadata including details of bathymetry, hydrography and topography.
6. Consider the issue of assessing hazard, vulnerability and risk, including the facilitation of access to models and mitigation measures.
7. Liaise with Working Groups from the other ocean basins, as well as other working groups within ICG/PTWS to coordinate and ensure efficient and effective information for tsunami warning and mitigation.

The Group will be composed of members nominated by Member States, with a chairperson and a vice-chairperson to be elected.

Provisional Terms-of-Reference Working Group 2: Tsunami Detection, Warning and Dissemination

1. Review and report on existing arrangements with regard to seismic, sea level and other kind of measurements, data collection and exchange;
2. Advise on how best to ensure that all events likely to cause tsunami can be reliably located and sized in a timely manner;
3. Review and make recommendations regarding upgrades and enhancements to the PTWS seismic and sea level stations and networks, communications, processing and analysis to further reduce the time required for source characterization to meet desired warning responses;
4. Liaise with the appropriate organizations and relevant experts to ensure effective data representation and code forms are used for the exchange of data (standards, metadata requirements);
5. Review and report on various means of transmitting data to warning centers, and conduct tests of latency (timeliness) of transmissions as required;
6. Coordinate the development and operational implementation of [the upstream part of] warning systems in the Pacific;
7. Liaise with Working Groups from the other ocean basins, as well as other working groups within ICG/PTWS to coordinate and ensure efficient and effective information for tsunami warning and mitigation.

The Group will be composed of members nominated by Member States, with a chairperson and a vice-chairperson to be elected.

Provisional Terms-of-Reference Working Group 3: Tsunami Awareness and Response

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

- Preparedness: capacity assessments, education for public awareness, training, response and evacuation planning and exercising.

2. Develop and codify good practices in emergency operations and evacuation plans and procedures through consistent Standard Operating Procedures (SOPs) and drills.
3. Liaise with Working Groups from the other ocean basins, as well as other working groups within ICG/PTWS to coordinate and ensure efficient and effective information for tsunami warning and mitigation.

The Group will be composed of members nominated by Member States, with a chairperson and a vice-chairperson to be elected.

APPENDIX 2: REGIONAL WORKING GROUPS

(Reference only)

Provisional Terms-of-Reference for the Regional Working Group on Tsunami Warning and Mitigation in the Southeast Pacific Region

1. To evaluate capabilities of countries in the South East Pacific Region for providing end-to-end tsunami warning and mitigation services,

2. To ascertain requirements from countries in the Southeast Pacific Region for the tsunami warning and mitigation services,

3. To promote and facilitate tsunami hazard and risk studies in the region,

4. To facilitate cooperation in the establishment and upgrading of seismic and sea level stations and networks and communication systems in the region, and their interoperability in accordance with ICG/PTWS requirements,

5. To improve the education programs with a regional criteria based on the regional social, cultural and economical reality,

6. To facilitate capacity building and the sharing of tsunami information in the region, including the free and open exchange of data,

The Group will be composed of representatives nominated by the Member States of Colombia, Ecuador, Peru and Chile, with a chairperson and a vice-chairperson to be elected.

Provisional Terms-of-reference for the Regional Working Group on Tsunami Warning and Mitigation in the Southwest Pacific Region

1. To evaluate capabilities of countries in the Southwest Pacific Region for providing end-to-end tsunami warning and mitigation services,

2. To ascertain requirements from countries in the Southwest Pacific Region for the tsunami warning and mitigation services,

3. To facilitate tsunami hazard and risk studies in the region,

4. To facilitate cooperation in the establishment and upgrading of seismic and sea level stations and networks in the region, and the interoperability of these systems in accordance with ICG/PTWS requirements,

5. To facilitate capacity building and the sharing of tsunami information in the region, including the effectiveness of ICG/PTWS services and the free and open exchange of data,

6. To support the further development of the virtual centre of expertise in a multi-hazards context within SOPAC in line with the regional Early Warning Strategy,

7. To facilitate the inclusion of tsunami hazard and response information into curricula, and development and dissemination of educational materials,

The Group will be composed of members nominated by Member States in the region, with full representation of SOPAC recommended, and including France with a chairperson and a vice-chairperson to be elected.

Provisional Terms-of-reference for the Regional Working Group on Tsunami Warning and Mitigation on the Central American Pacific Coast

1. To assist the Central American countries in the development, improvement and implementation of their National Tsunami Warning and Mitigation Systems, and the countries which are becoming new members of ICG/PTWS in their integration into the ICG/PTWS,

2. To recommend CEPREDENAC to determine whether the National Tsunami Warning Centres of Nicaragua or El Salvador (or of both countries cooperating) could act as interim Regional Tsunami Warning Centre disseminating warnings to all Central American countries,

3. To invite CEPREDENAC to consider the implementation of a Technical Committee for the Development of Regional Tsunami Warning and Mitigation Systems,

4. To implement a regional communications and warning plan,

5. To facilitate Tsunami Hazard and Risk studies in the Central American Region.

The Group will be composed of member from Member States Nicaragua, El Salvador, Guatemala, Costa Rica, and Honduras and Panama (as soon as they finalized the formal procedure of joining ICG/PTWS), with a chairperson and a vice-chairperson to be elected.

Provisional Terms of Reference for the Regional Working Group on Tsunami Warning and Mitigation in the South China Sea Region

1. To evaluate capabilities of countries in the South China Sea Region for providing end-to-end tsunami warning and mitigation services,

2. To ascertain requirements from countries in the South China Sea for the tsunami warning and mitigation services,

3. To promote and facilitate tsunami hazard and risk studies in the region,

4. To facilitate cooperation in the establishment and upgrading of seismic and sea level stations and networks and communication systems in the region,

5. To facilitate improvement of the education programs on tsunami mitigation in the region,

6. To facilitate capacity building and the sharing of tsunami information in the region, including the free and open exchange of data.

The Group will be composed of members nominated by Member States in the region with a chairperson and a vice-chairperson to be elected

ANNEX VII

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ANNEX VIII

LIST OF ACRONYMS

ADRC	Asian Disaster Reduction Center
AOR	Atlantic of Responsibility
ASEAN	Association of South-East Asian Nations
ATWS	Australian Tsunami Warning System
BODC	British Oceanographic Data Centre
BOM	Bureau of Meteorology
CAP	Caribbean Action Plan
CARIBE-EWS	Tsunami and Other Coastal Hazards Warning System for the Caribbean Adjacent Regions
CPPS	Permanent Commission for the South Pacific
CPPT	Polynesian Tsunami Warning Centre
CREX	Character Form for the Representation and Exchange of Data
CTBTO	Comprehensive Nuclear Test Ban Treaty Organization
DART	Deep-ocean Assessment & Reporting of Tsunamis
DHN	Dirección de Hidrografía y Navegación
DMO	Disaster Management Office
EC	European Community
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
FDSN	Federation of Digital Broad-Band Seismographic Networks
GEOSS	Global Earth Observation System of Systems
GIS	Geographic Information System
GLOSS	Global Sea Level Observing System
GOES	USA Geostationary Weather Satellite
GOHWMS-WG	Ad-hoc Working Group on the Framework for the Global Tsunami and other Ocean-Related Hazards Early Warning System
GPS	Global Positioning System
GSN	Global Seismographic Network
GTDB	Global Tsunami Data Base
GTS	Global Telecommunication System (WMO)
HTDB	Historical Tsunami Data Base
IAPA	Inter-American Press Association
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	Intergovernmental Coordination Group
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

ICG/NEAMTWS	Intergovernmental Coordination Group Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas
ICG/PTWS	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System
IFRC	International Federation of Red Cross & Red Crescent Societies
IHO	International Hydrographic Organization
INMARSAT	International Marine/Maritime Satellite
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IODE	International Oceanographic Data & Information Exchange
IOTWS	Indian Ocean Tsunami Warning & Mitigation System
IPA	UNESCO Implementation Partnership Agreement
IRIS	Incorporated Research Institutions for Seismology
ISDR	International Strategy for Disaster Reduction
IT	Information Technology
ITDB	Integrated Tsunami Data Base
ITIC	International Tsunami Information Centre
ITP	International Tsunameter Partnership
IUGG	International Union of Geodesy & Geophysics
JCOMM	IOC-WMO Joint Technical Committee for Oceanography & Marine Meteorology
JICA	Japan International Cooperating Agency
JMA	Japan Meteorological Agency
MOU	Memorandum of Understanding/Agreement
MS	Member State
MTS	Medium-Term Strategy
MTSAT	Japan Geostationary Satellite
NEAMTWS	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
NESDIS	National Environmental Satellite, Data and Information Service
NGDC	National Geophysical Data Center
NOAA	National Oceanic & Atmospheric Administration (USA)
NOC	National Oceanographic Centre
NORI	National Oceanographic Research Institute
NTHMP	National Tsunami Hazard Mitigation Program
NTL/ICMMG	Novosibirsk Tsunami Laboratory of the Institute of Computational Mathematics & Mathematical Geophysics
NWPTAC	Northwest Pacific Tsunami Advisory Center
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PIC	Pacific Island Countries
PMEL	Pacific Marine Environmental Laboratory
PTWC	Pacific Tsunami Warning Center (USA)
RANET	Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information
SEP	South East Pacific

SHOA	Servicio Hidrográfico y Oceanográfico de la Armada de Chile (Naval Hydrographic & Oceanographic Service of the Chilean Navy)
SMD	Samoa Meteorology Division
SOA	State Oceanic Administration
SOP	Standard Operational Procedures
SOPAC	Pacific Applied Geosciences Commission
SPREP	Pacific Regional Environment Programme
TBB	Tsunami Bulletin Board
TNC	Tsunami National Contact
TWC	Tsunami Warning Centre
TWFP	Tsunami Warning Focal Point
TREMORS	Tsunami Risk Evaluation from Seismic Moment through a Real-time System
TTT	Tsunami Travel Time
TWS	Tsunami Warning System
UHSLC	University of Hawaii Sea-Level Centre
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific & Cultural Organization
USGS	U.S. Geological Survey
VCP	Voluntary Cooperation Programme
WC/ATWC	West Coast/Alaska Tsunami Warning Center (USA)
WDC	World Data Center
WMO	World Meteorological Organization
WMO-CBS	World Meteorological Organization/Copenhagen Business Scholl
WWW	World Weather Watch
XML	Extensible Mark-up Language

In this Series *Languages*

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

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

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

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114.	Second Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Hyderabad, India, 14–16 December 2005	E only
115.	Second Session of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology, Halifax, Canada, 19–27 September 2005 (Abridged final report with resolutions and recommendations)	E, F, R, S
116.	Sixth Session of the IOC Regional Committee for the Western Indian Ocean (IOCWIO), Maputo, Mozambique, 2–4 November 2005 (* Executive Summary available separately in E, F, S & R)	E*
117.	Fourth Session of the IOC Regional Committee for the Central Indian Ocean, Colombo, Sri Lanka 8–10 December 2005 (* Executive Summary available separately in E, F, S & R)	E*
118.	Thirty-eighth Session of the Executive Council, Paris, 20 June 2005 (Electronic copy only)	E, F, R, S
119.	Thirty-ninth Session of the Executive Council, Paris, 21–28 June 2006	E, F, R, S
120.	Third Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), Bali, Indonesia, 31 July–2 August 2006 (*Executive Summary available separately in E,F,S & R)	E*
121.	Second Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Nice, France, 22–24 May 2006	E only
122.	Seventh Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 16–18 March 2005 (* Executive Summary available separately in E, F, S & R)	E*
123.	Fourth Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS-IV), Mombasa, Kenya, 30 February-2 March 2007 (* Executive Summary available separately in E, F, S & R)	E*
124.	Nineteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange, Trieste, Italy, 12–16 March 2007 (* Executive Summary available separately in E, F, S & R)	E*
125.	Third Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Bonn, Germany, 7–9 February 2007 (* Executive Summary available separately in E, F, S & R)	E*
126.	Second Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Cumaná, Venezuela, 15–19 January 2007 (* Executive Summary available separately in E, F, S & R)	E*
127.	Twenty-first Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Melbourne, Australia, 3–5 May 2006 (* Executive Summary available separately in E, F, S & R)	E*
128.	Twenty-fourth Session of the Assembly, Paris, 19–28 June 2007	E, F, S, R
129.	Fourth Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas, Lisbon, Portugal, 21–23 November 2007 (* Executive Summary available separately in E, F, S & R)	E*
130.	Twenty-second Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Guayaquil, Ecuador, 17–21 September 2007 (* Executive Summary available in E, F, S & R included)	E*
131.	Forty-first Session of the Executive Council, Paris, 24 June–1 July 2008	E, F, R, S
132.	Third Session of the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, Panama City, Panama, 12–14 March 2008 (* Executive Summary available separately in E, F, S & R)	E*
133.	Eighth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms, Paris, France, 17–20 April 2007 (* Executive Summary available separately in E, F, S & R)	E*
134.	Twenty-third Session of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System, Apia, Samoa, 16–18 February 2009 (* Executive Summary available separately in E, F, S & R)	E*