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(of Unesco)

Ninth Session of the International Coordination
Group for the Tsunami Warning System in the Pacific

Honolulu, Hawaii, USA, 13-17 March 1984

SUMMARY REPORT

TABLE OF CONTENTS

SUMMARY REPORT		Page
1.	Opening of the Session	1
2.	Administrative Arrangements	2
3.	Intersessional Activities	3
4.	Implementation of Actions identified by the Eighth Session of ITSU	8
5.	Future activities of the Group	10
6.	Proposals to enhance training and education of Tsunami Specialists from developing Member States of the region and regional co-operation	11
7.	Review of the Items of Reference and relationship of ITSU, ITIC and PTWC	13
8.	Post of Associate Director of ITIC - Status and Plans	14
9.	Co-operation with other International Bodies involved in Tsunami matters	14
10.	Election of the Chairman and Vice-Chairman of the Group	15
11.	Proposals for 1984-85 Draft Programme	16
12.	Date and Place of Next Session	16
13.	Adoption of the Summary Report, Resolutions and Recommendations	16
14.	Closure of the Session	16
ANNEXES		
I	Agenda	
II	Resolutions and Recommendations adopted by the Ninth Session of the ICG/ITSU	
III	List of Participants	
IV	List of Abbreviations and Acronyms	

1. OPENING OF THE SESSION

1 The Ninth Session of the IOC International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) was opened by the Chairman, Mr. Gerry Dohler, at 9:00 a.m. on 13 March 1984. He welcomed Mrs. Eileen Anderson, Mayor of Honolulu, Dr. Fujio Matsuda, President, University of Hawaii, Dr. Victor Hao Li, President, East-West Center, and all those present at the session.

2 He expressed his sincere thanks to the host organization and gave a short review of the history of the IOC involvement in tsunami research and warning and of the activities of the Group in these fields. He then identified as the main objective of the Group to provide accurate and reliable Tsunami Warning Services with the aim to reduce the loss of life and property. The Chairman stressed that the improvement of reporting stations and establishment of additional regional tsunami warning centers in the Pacific should continue to be considered as actions of high priority in the work plan of the Group.

3 In conclusion the Chairman invited Mr. Richard H. Hagemeyer, Head of the U.S. Delegation, to introduce the speakers of the host country.

4 The Mayor of the City and County of Honolulu, the Honorable Eileen Anderson officially welcomed the delegates and observers of the Session. She made reference to the agenda of the meeting and the importance of the objectives of the Session. She called attention to Hawaii's vulnerability to tsunamis and gave examples of the large destructive tsunamis that have struck these islands in the last forty years. Finally she urged participants to work hard during the Session to accomplish their goals but also to try to find the time to enjoy Hawaii's beauty and interesting sites.

5 On behalf of the Board of Regents of the University of Hawaii, Dr. Fujio Matsuda extended his warmest welcome to all the participants. He drew attention of the participants to the importance of tsunami studies and warning for Hawaii in spite of two decades of relative calm. He stressed that the May 26, 1983, tsunami in the Sea of Japan had served to remind everybody of the need to keep working on the problem of tsunami warnings. Dr. F. Matsuda then provided the participants with information on the involvement of the University of Hawaii (UH) in tsunami research, inter alia, on the activities of the Joint Institute for Marine and Atmospheric Research (JIMAR), and the University of Hawaii Environmental Center. He emphasized that the University of Hawaii intends to continue "to play an active role in the effort to make the Pacific Basin a safe place in which to live."

6 Dr. Victor Hao Li welcomed the participants and provided information on the involvement of the East-West Center, through its Pacific Islands Development Programme (PIDP), in disaster preparedness, research and training. The research conducted by PIDP has identified ways in which the countries of the Pacific region can improve their ability to prepare for and cope with natural disasters, including tsunamis. One major factor is coordination among all those who can assist with the identification of threats and disaster events, the mitigation of disasters through training and infrastructure

development, and the provision of relief and rehabilitation assistance that will reduce the threat of natural disasters. In conclusion he expressed the opinion that this meeting will contribute to the efforts of PIDP.

7 Speaking on behalf of the Chairman and Secretary of IOC, the Assistant Secretary IOC, Dr. I. Oliounine, expressed his gratitude to the host organization, National Oceanic and Atmospheric Administration (NOAA), United States for the excellent meeting arrangements and particularly, the assistance which had been provided by National Weather Service Pacific Region in organizing the session. He stated that as a result of various intergovernmental fora new challenges have been placed on the IOC which require international cooperation. He emphasized that the success of internationally agreed upon operational systems, like the tsunami warning system in the Pacific, depends on the support of participating member scientists. The IOC, through its ICG/ITSU, provides a focal point for coordination of national efforts in establishing efficient tsunami warning systems. Dr. Oliounine concluded by joining the previous speakers in wishing all participants the Aloha Spirit in conducting the session.

8 Mr. G. Dohler thanked all speakers for their interesting information, valuable advices and kind and encouraging words. The list of participants is Annex III to this Report.

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

9 The Agenda was adopted with minor changes as given in Annex 1.

2.2 DESIGNATION OF THE RAPPORTEUR

10 Mr. R. Landis (USA) was proposed to be a rapporteur. This proposal was seconded by several Member States and Mr. R. Landis was designated as a rapporteur.

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

11 The IOC Assistant Secretary introduced the proposed time schedule, identified changes in the list of documents and informed the Committee on administrative arrangements.

12 The Committee agreed that drafting groups could be formed to deal with particular items during the Session, if there was a need.

13 The representative of the local Organizing Committee, Dr. G. Pararas-Carayannis, Director of ITIC, informed the Group on local arrangements.

3. INTERSESSIONAL ACTIVITIES

3.1 REPORTS OF THE CHAIRMAN OF THE GROUP AND THE DIRECTOR OF ITIC ON INTERSESSIONAL ACTIVITIES

- 14 The Chairman in his report (DOC. IOC/ITSU-IX/6) highlighted the main activities of the Group during the intersessional period. The IOC at its 12th Assembly approved the Summary Report of the Eighth Session of the group (Suva, Fiji, April 1982) and efforts were concentrated on the implementation of recommendations and decisions of that session.
- 15 The major requirements for new initiatives which had emerged during the intersessional period were:
- contacts with UNDP and other agencies for supporting the IOC Project in the Investigation of Tsunami Hazards in the Pacific;
 - compilation of appropriate data and information which could be used in the development of the Master Plan for International Tsunami Warning Operations;
 - preparation of Travel Time Charts and establishment of tsunami warning procedures;
 - training activities;
 - continued development of the successful tsunami warning system.
- 16 The Chairman informed the Group on his activities as the Associate Director at ITIC from July 1, 1982 to June 30, 1983. He emphasized the usefulness of consultative meetings during the intersessional periods between ICG/ITSU officers (Chairman, Vice-Chairman, Director of ITIC) and the staff of the Secretariat IOC in the way it was conducted in August 1983.
- 17 The Chairman reported on his participation at the Tsunami Symposium during the IUGG General Assembly in Hamburg and on his contacts with the IUGG Tsunami Commission officers.
- 18 The Group accepted the report of the Chairman, expressed its appreciation of the activities accomplished by him during the intersessional period and concurred with the importance of intersessional ITSU consultative meetings. The Group recommended to continue the practice of arranging these meetings and requested the Secretary IOC to take this recommendation into account when the budget for 1986-87 is developed.
- 19 The Director of ITIC, Dr. G. Pararas-Carayannis, introduced status report (DOC. IOC/ITSU-IX/7) on the activities of the International Tsunami Information Center during 1982-1983.
- 20 He noted that in the last two years the Center worked closely with the Pacific Tsunami Warning Center (PTWC) on such matters as communication tests, automation, regionalization of tsunami watch and warning messages, computer software development, communication problems

of the Tsunami Warning System (TWS) and contingency planning. ITIC monitored tide stations in the TWS to establish resource capability, and assisted PTWC in redrafting tsunami watch and warning procedures and informing participants of the changes. New participants in the TWS were provided with tsunami travel time data. Arrangements for a number of communication tests were made.

- 21 The Director of ITIC informed the participants of the work of the Center in monitoring research and reviewing the state of the art for the purpose of finding ways of improving the TWS. A thorough review of automation in the Pacific Tsunami Warning System was provided with emphasis on the on-line processing of seismic data at the Pacific Tsunami Warning Center, on the tide gauge instrumentation and on satellite telemetry.
- 22 All above-mentioned activities resulted in reducing the response time of tsunami investigations, and in rapid dissemination of tsunami information.
- 23 He commented on many seismic events of the last two years with emphasis on the destructive tsunami resulting from the 26 May 1983 earthquake in the Sea of Japan. The Director informed the Group that a contribution was made to the Master Plan for the Tsunami Warning System and that coordination was carried out with Member States of the IOC from the region and with international organizations. Assistance was provided to IOC in developing guidelines for the selection of experts for the Visiting Experts Programme.
- 24 ITIC continued to send out inquiries by following up every major earthquake investigated by PTWC, asking for tsunami data and information. An event file is maintained by ITIC and summaries of these events are published in the "Tsunami Reports" Series, in the Tsunami Newsletter and in the Director's Biannual Report. Additionally, ITIC provides tsunami summaries to the IOC and to the Smithsonian Institute. Educational materials, manuals and brochures were made available to Member States free of charge.
- 25 The Director of ITIC expressed satisfaction on the actual accomplishments of the Intersessional period that have resulted in the mitigation of the tsunami hazard in the Pacific.
- 26 Though the Group appreciated the efforts made by the Director of ITIC during the intersessional period some improvements of his report have been suggested. It was recommended that the Report be reviewed jointly by the Director of ITIC and the IOC Secretariat. The Group stressed the importance of timely submission of the Report of the Director of ITIC to the IOC Secretariat and ITSU national contacts (at least two months in advance of the Session).
- 27 The Group reiterated the need for increased financial support to ITIC and Recommendation ITSU-IX.1 was adopted.

3.2 DISCUSSION OF NATIONAL INPUTS TO THE IMPROVEMENT OF THE ITSU NETWORK IN THE PACIFIC

- 28 The Group was presented with national reports of participating countries on intersessional activities. Eight Members of the ICG/ITSU submitted reports prior to the Session and these reports were included in DOC.IOC/ITSU-IX/8 (Canada, Chile, Colombia, Fiji, Japan, New Zealand, Hong Kong, USA). In addition the delegates of China and the USSR presented verbal reports at the Session.
- 29 Some major items mentioned in the reports are summarized below:
- 30 The Delegate of Canada indicated his country as an active participant in tsunami-related activities. Its Pacific coast tide and seismic stations are interrogated both by PTWC and ATWC.
- 31 Warnings for north Pacific tsunamis are now being received from the Center in Palmer, Alaska. Two civil defense exercises were held in 1983 to test evacuation procedures of coastal communities, and more tests are planned. Canada is continuing to coordinate the Historical Study of Tsunamis.
- 32 The delegate of Chile reported that his country has concentrated its efforts on training of personnel on tsunamis, educational material preparation and improvement of a telecommunication network.
- 33 The seismic network will be improved as a result of a coordinated effort between national agencies of the USA and Chile (now at the funding stage).
- 34 The Delegate of China spoke on some of the results of the study of historical information on tsunamis. In more than 2000 years from 47 BC to 1976, about 10 tsunami events occurred inshore and offshore of China. He also mentioned that a programme to develop a national Tsunami Warning System based on the established storm surge warning system has been worked out. Present emphasis are being made on training of personnel and updating of equipment for Tsunami warning and research.
- 35 By the written report Colombia reported to the Group about the establishment of the Colombian Oceanographic Commission and the National Committee for the Study of Tsunamis. Colombia has two standard tide-recording gauges in the Pacific and all tidal information is collected and stored. There are plans to incorporate this data into the World Telecommunications System through the HIMAT exchange as an alternative to the GOES Satellite or the NASA Satellite. There is a well-integrated seismological network equipped with the SRO system. A project is being prepared to establish modern stations in the Pacific in areas of high seismic activity. An urgent need was expressed for educating the general public in tsunami awareness, watch and warning, in training to install, operate and maintain modern seismological and tidal stations.
- 36 By the written report Fiji reported on monitoring earthquake activity by a network of 13 seismic stations data from which are telemetered into the central observatory in Suva. A seismograph station in Nandi provides P-arrivals to the PTWC, Hawaii. The Communication

Centre at Nandi also relays seismic information and alerts from PTWC to other S.W. Pacific countries. The only tsunami warning tide gauge operating in Fiji is in Suva Harbour wharf. No tsunami was recorded on the gauge from April 1982 - April 1983.

- 37 Regional communications were improved and warnings will be broadcast by several regional broadcast stations with backup radio communications to the Central Fiji Broadcasting Commission station at Suva.
- 38 Research on the historical record of Fiji island tsunamis was carried out which indicated that the tsunami risks result primarily from earthquakes within the Fiji region.
- 39 The Delegate of United Kingdom (Hong Kong) reported that there are eight tide gauges in Hong Kong and three are telemetered to the Royal Observatory Headquarters. Two worn-out mechanical tide gauges will soon be replaced by piezo-resistive ones with real time telemetry capability.
- 40 The Delegate of Japan described tsunami warning services in his country. JMA is responsible for issuing tsunami forecasts and warnings after the occurrence of an earthquake in a sea area. For the tsunami caused by an earthquake in a near submarine area, a nearby local centre is responsible for issuance of warnings. There are six local centres. Twenty minutes after the occurrence of an earthquake is the time limit for a tsunami warning of a local center.
- 41 Automated Data Editing and Switching System (ADESS) was considerably improved. All local centers but one have a local ADESS (L-ADESS). Tsunami warnings are automatically transmitted from the local center to relevant organizations.
- 42 A Permanent Ocean Bottom Seismograph Observation System (OBSOS) off the southern coast of the Tokai district has been operating very satisfactorily. A tsunami meter with a quartz pressure gauge attached to the terminal apparatus is found to be a very efficient instrument. JMA is planning to set up another OBSOS off the south-eastern coast of the Boso peninsula by 1986.
- 43 The Delegate of New Zealand reported that during the intersessional period no tsunamis were recorded although two large submarine earthquakes occurred relatively close to the shores of the country.
- 44 New Zealand Oceanographic Institute has applied existing numerical models to a number of harbors in order to determine the normal mode oscillation and to compare these with those periods determined by spectral analysis of oscillations in response to the 1960 Chilean Tsunami.
- 45 The education programme aimed at natural hazards generally, but mainly earthquakes, has produced a video tape, posters and pamphlets. Copies of all these were sent to ITIC and a limited number of copies are available for ITSU members.

- 46 A recent study in New Zealand aimed at alerting the public found two methods not previously in use for this purpose:
- the 'MUSAK' system of piped music into large buildings, elevators, etc. This can be interrupted with a preset tape or a live broadcast telling the public an emergency is imminent.
 - the electricity distribution networks have a 'ripple control' system to turn on or off water heaters, etc. Spare channels may be used to trigger alarms throughout the community, or area by area.
- 47 The Delegate of the USA noted the realignment of the National Weather Service internal management that has resulted in a closer coupling of tsunami program management and field operations. He described improvements to the service including: physical plants at PTWC, ATWC; the expansion of seismic data availability at PTWC which provides that center with fourteen channels of real time seismic data from sites extending from the Eastern U.S. to the Aleutian Islands; and addition to USA tide gauging activities..
- 48 He reviewed improvements in computer equipment and processing, noting that both Centers are now processing seismic data in real time, picking "p's" and determining epicenter locations and magnitudes automatically.
- 49 The recent research activities were summarized with a special emphasis on the new THRUST (Tsunami Hazard Reduction Utilizing System Technology) Program. He noted that the Communication Plan for the Tsunami Warning System had been updated (the 10th edition has been printed and distributed).
- 50 The Delegate of the USSR provided information on earthquakes and tsunami investigations which have been carried out including estimations of tsunamis which arise as a result of under-marine landslides or under-marine volcano eruptions. Scientific research included the investigation of the problem of tsunamis spreading in the ocean, of tsunami behavior on the shelf and of waves run up on the sea shore. All results of studies were, or are being published.
- 51 To improve communication between national and international tsunami warning services, a communication link Tokyo-Khabarovsk was organized. During 1983 a number of messages broadcasted through communication channels was practically doubled as compared with 1982. Three local centers issued tsunami warnings and three seismic stations are included in the Tsunami Warning System. Arrangements are being made to involve two new seismic stations in the system, continuous observations on the changes of sea level (after the tsunami threat is declared) were organized in a number of locations along coastal areas of the Pacific, Sea of Okhotsk and Sea of Japan. Data were transmitted through wire or radio channels to the local centers.
- 52 Studies continued to further develop software for automatic processing of seismic records in real time. To determine time loss on the tsunami messages transmission using different kinds of communication channels, tests have been carried out for different coastal zones of the Pacific.

- 53 The Group noted with interest information provided and thanked the Chairman and the Secretariat IOC for efforts made for early submission of national reports. The Group stressed the importance of the usefulness of national reports. It was proposed that the Chairman of the Group invite members of ITSU who have not submitted national reports prior to the Ninth Session to submit reports to the Director of ITIC with a copy to the Secretariat IOC before 1 June 1984, with a view to publish a complete set of national reports in the Tsunami Newsletter before the next session of the Group. If required, any changes, amendments or modifications to national reports which were considered at the session could also be accepted before above-mentioned deadline.

3.3 REVIEW OF THE EFFECTS OF 26 MAY 1983 TSUNAMI IN THE SEA OF JAPAN

- 54 The most important natural event related to the International Tsunami Warning System in the Pacific was the disastrous tsunami caused by the Japan Sea Earthquake on 26 May 1983.
- 55 Only in Japan the total number of casualties was about one hundred people and the total amount of damage came up to 800 million American dollars. In the USSR small fishing boats were strongly damaged or sunk by the tsunami, ships had their mooring lines broken off, stacks of boxes and barrels on beaches were washed away.
- 56 The Delegates from Japan and the Soviet Union informed the Group on the actions taken by their respective national authorities to warn people on the disaster and on the measures taken to decrease the volume of losses. Preliminary results of records' analyses were reported. The Group was given an opportunity to see the film produced in Japan on the tsunami of 26 May 1983 and its effects.
- 57 The Group received with interest the information provided and noted the importance of the film as one shown for educational, training and research purposes. The Group thanked the Delegate of Japan for the opportunity provided.

4. IMPLEMENTATION OF ACTIONS IDENTIFIED BY THE EIGHTH SESSION OF ITSU

4.1 DEVELOPMENT OF A MASTER PLAN FOR INTERNATIONAL TSUNAMI WARNING OPERATIONS

- 58 The Chairman of the Group reported on the status of implementation of Resolution ITSU-VIII.1 which recommended inter alia development of a Master Plan for the International Tsunami Warning System. Document IOC/ITSU-IX/9 entitled Compilation of Data and Information for the Preparation of a Master Plan was thoroughly discussed. A number of specific items were addressed in the paper such as tsunami instrumentation, assessment of natural hazards requiring warning, further improvement of the Tsunami Warning System, etc.
- 59 In response to the request of the Group, a lecture on the THRUST pilot study to be established on the basis of a bilateral USA-Chile agreement was delivered by the members of Chilean and US delegations, Mr. E. Lorca and Dr. E. Bernard. The goal of THRUST is to demonstrate that Regional Systems can be assembled, using existing technology, and integrated into established disaster warning and relief infrastructures in developing nations.

60 The purpose of THRUST is not to build and maintain a warning system for the threatened nation. Instead, the goals are to stress that such a system can be built, to work with the host government to integrate the technical system into its disaster control structure, and to train in-country personnel in the operation and maintenance of the system.

61 The Group welcomed the efforts made by the Chairman and appreciated the support provided by the Director of ITIC and Mr. S. Wigen (Canada) in the preparation of this concise paper. The Group realized that some changes and amendments in the text would be necessary: priorities should be identified; training of personnel should become an important element of the plan; ways to improve technology and instrumentation should be studied and included in the report; national activities and plans related to preparedness should be included in a final version of the Master Plan. The Group concluded that the early preparation of the Plan was desirable and could result in significant improvements of the current capabilities of the TWS. The Group recommended that a draft plan be available in advance of the Tenth Session of ITSU so as to have an opportunity to comment on it before discussions at the Tenth Session of ITSU will take place. Resolution ITSU-IX.1 was adopted.

4.2 ADDITIONAL TRAVEL TIME CHARTS

62 By Resolution ITSU-VIII.2 the need of Member States for additional tsunami travel time charts was expressed.

63 The Director of ITIC reported that he had been unable to find any NOAA agency that was prepared to produce these charts with the amount of money (10,000 American dollars as of the end of February, 1984,) available from IOC. The specific additional travel charts have not been identified. The expenditures to carry out this project were estimated at 25,000-30,000 American dollars. The Group realized that IOC support was to be regarded as a supplement and not the sole source of funding.

64 The need for new or additional charts was again reviewed by the Group.

65 The Group agreed that its Member States should identify their specific needs for tsunami travel times, and adopted Resolution ITSU-IX.2 to implement their production.

4.3 ESTABLISHMENT OF TSUNAMI WARNING PROCEDURES

66 The Chairman invited the Delegate of the United States of America to comment on the Tsunami Warning Procedures as adopted by ITSU-VIII (RES. ITSU-VIII.3). The Delegate of the U.S.A. explained that because of several problems, including the potentially high number of false alarms due to the misinterpretation of regional tsunami warnings, the recommended procedures were only partially implemented beginning on March 1, 1984. The Delegate of the U.S.A. further indicated that he had so informed the National Contacts of ITSU prior to the implementation and it was considered acceptable.

67 The Group felt that the procedures adopted by Resolution ITSU-VIII.3 were still a viable objective, but realized that full implementation could not take place until improvements were made in the data system used to confirm tsunami wave generation and in the establishment of additional Regional Centers

68 Several delegates expressed the importance of feedback information after a query for tide or seismic data was received . The Director of PTWC indicated that such information should be included in tsunami information bulletins.

69 The Group addressed the possibility of modifying the procedures with respect to the issuing of tsunami watches and warnings for inland seas. Several points made by the Group during this discussion including the fact that PTWC does not have the capability to issue warnings for inland seas and that the issuance of such warnings should be accomplished on a regional basis. The Group agreed that no changes needed to be made in the existing procedures and that once PTWC determined that a tsunamigenic earthquake would not effect the Pacific Basin, then National and Regional Centers would have the responsibility to issue the appropriate warnings.

5. FUTURE ACTIVITIES OF THE GROUP

5.1 COMMUNICATION PLAN FOR THE TSUNAMI WARNING SYSTEM

70 The Director of the Pacific Tsunami Warning Center, Mr. G. Burton, reported on the recent publication by the National Weather Service of the Tenth Edition of the Communication Plan for the Tsunami Warning System and summarized the changes incorporated relative to the previous edition. The Delegate of the USA emphasized that the present plan is an internal planning guide for the operations of the U.S. Tsunami Centers in Hawaii and Alaska and that efforts have been made to include information on tsunami communication aspects from all Member States of the ICG/ITSU. It was suggested that the formulation of an International Communication Plan would have definite benefit, principally, providing an officially recognized international mechanism whereby the Member States could formally participate in the activities and implementation of the Plan.

71 The Chairman of ITSU suggested that in spite of the fact that this is an internal document of, and the Group supported the USA, it could serve as a model for the development of an internationally agreed ITSU Communication Plan. It was stressed that as an operational document, the Communication Plan should be accurate in content, timely, and comprehensive in the inclusion of active participants. It was recognized that the PTWC is currently functioning as the Communications focal point for ITSU. To improve its performance of this function, the Members of ITSU are encouraged to advise on changes to or expansion of The Plan with a view to improving its usefulness. Several delegates expressed concern over possible confusion being generated by the publication of two communication plans.

72 The Group agreed that the U.S. Communication Plan should be distributed to all ITSU National Contacts incorporating all changes proposed by delegates at the Session. The Group adopted Resolution ITSU-IX.3.

5.2 REVIEW OF RECOMMENDATIONS AND RESOLUTIONS FROM THE IUGG TSUNAMI COMMISSION MEETING (HAMBURG, AUGUST 1983)

73 The Director of ITIC introduced this agenda item (DOC.IOC/INF-565) and provided general information on the findings of the Eighteenth General Assembly of the International Union of Geodesy and Geophysics (August 1983). The Tsunami Commission was informed on the decision of ITSU-VIII to have ICG/ITSU meetings, where possible, jointly with the Tsunami Commission sessions to encourage exchange and interaction between members of the two groups.

74 Dr. E. Bernard, the representative of the IUGG Tsunami Commission, commented that the Commission will be willing to meet the requirements for scientific advice from the ICG/ITSU on a case-to-case basis and that the Commission is ready to cooperate closely with the ICG/ITSU on scientific issues and research. Copies of the Proceedings of the 1983 Tsunami Symposium were distributed at the Session.

75 The Group welcomed the information provided and agreed that permanent contacts with and exchange of information between the Group and the IUGG Tsunami Commission should be continued.

6. PROPOSALS TO ENHANCE TRAINING AND EDUCATION OF TSUNAMI SPECIALISTS FROM DEVELOPING MEMBER STATES OF THE REGION AND REGIONAL COOPERATION

6.1 ORGANIZATION OF WORKSHOPS ON THE TECHNICAL ASPECTS OF TSUNAMI ANALYSES, PREDICTION AND COMMUNICATION

76 The Assistant Secretary IOC referred the participants to the decision of the First ITSU Intersessional Consultative Meeting (August 1983, Paris) to organize the workshop on the above-mentioned subjects for experts from developing countries. A workshop was considered as a very important mechanism to train people from developing countries. It was agreed that such workshops should be held whenever possible in conjunction with the meetings of ICG/ITSU and of the Tsunami Commission. It was proposed to have a workshop in August, 1985, in Sidney, B.C., Canada. The Director of ITIC was charged to draft a plan for a Workshop. Appropriate candidates would be designated by the Secretary IOC in consultation with the Chairman of the Group for such training.

77 The Director of ITIC informed the Session of the status of the preparation of the plan and invited the group to provide guidance to him on that matter.

78 After considering all pro and contra the Group concurred with the idea to have the Workshop jointly with the next session of the ICG/ITSU. It was recommended that the plan for the workshop should be more oriented on training in operational procedures than in theory. The Group recognized the need for urgent completion of the plan and urged the Director of ITIC to complete the preparation of the draft in one month. The plan should then be approved by the Chairman and the Secretary IOC and attached to the IOC Circular letter inviting ITSU

Member States to nominate candidates. The Group requested the Secretary IOC to allocate funds for 5-10 participants and 2-3 lecturers to participate at the Workshop and to make all necessary arrangements for the success of the training.

6.2 VISITING EXPERTS TRAINING PROGRAMME

- 79 The Assistant Secretary IOC and the Director of ITIC outlined progress made in implementing Recommendation ITSU-VIII.1, the terms under which the IOC supports this Programme and plans for its enhancement. In 1984 two trainees from Chile and China will take the course and this practice will be continued in 1985.
- 80 The representatives from Canada, Japan and New Zealand provided information on training activities carried out in their countries relevant to tsunami research and warning.
- 81 Canada is ready to study the possibility of providing training facilities for two-three experts at the Institute of Oceanography in Sidney where there is good expertise in tsunami research.
- 82 In Japan there is an International Institute of Seismology and earthquake Engineering (IISSE) which has a one-year course of international training in Seismology and Earthquake Engineering. The seismology course includes lectures on tsunamis.
- 83 The New Zealand Government is able to fund the sending of one or two New Zealand experts (scientists and/or civil defense specialists) to other Pacific nations to assist in their tsunami warning projects - on request, through diplomatic channels. Also, if any Pacific country wishes to send a person to the New Zealand Civil Defence School, New Zealand will meet all internal costs, including short attachments to oceanographic or seismology institutions.
- 84 In May 1983, the U.S. National Science Foundation (NSF) sponsored a US-Japan Tsunami Workshop in which ten U.S. scientists and 16 Japanese scientists participated. The purpose was to promote interchange of ideas and research in progress between U.S. and Japanese scientists and engineers working in the field of tsunamis.
- 85 In December 1983, the NSF funded Professor R.O. Reid of Texas A&M University to conduct a scientific exchange program between his university and Tohoku University of Japan. The first exchange of scientists will emphasize numerical modelling techniques used in both countries. Dr. Goto of Tohoku University will visit Texas A&M in 1984.
- 86 The Group thanked the Director of ITIC and the U.S. delegation for the facilities provided at ITIC and PTWC for the visiting experts training programme. The Group noted with appreciation information on facilities available in other countries and recommended to use the Tsunami Newsletter for the announcements of existing training courses.

6.3 MISSION TO WESTERN PACIFIC NATIONS AND UNDP TSUNAMI PROJECT

- 87 The Chairman presented his report on the mission to the Western Pacific to investigate present state of tsunami preparedness and how this could be improved by education, training and establishment of regional warning systems. The mission was implemented in January 1984 with the participation of Mr. G. Dohler (Canada), Dr. K. Kitazawa (IOC) and Dr. H. Watanabe (Japan). He noted with appreciation the support given to the Mission through the IOC by accommodating regular funds and the grant made to the IOC Trust Fund by Japan to implement this mission. He outlined some aspects of the tidal and seismic technology now in operation in the countries visited: Philippines, Indonesia, and Papua-New Guinea. The Group expressed satisfaction with results of the mission and accepted recommendations contained therein.
- 88 The Group expressed regret that although these States all gave wholehearted cooperation to the Mission, none was able to participate in the ITSU-IX meeting.
- 89 It was recognized by the Group that national programs would become an integral part and necessity for a regional warning system.
- 90 The Group recognized also that the technology, educational programs, and warning procedures would need to be developed by Member States over a period of years, and that initiative must come from the States concerned, with the support of ITSU and ITIC.
- 91 Discussion then centered on other regions of the Pacific where warning systems may be warranted, including the islands of the southwest Pacific, Central, and South America. To maintain momentum in the proposal, the Group endorsed a second mission to be arranged in 1985 to the Islands of the South West Pacific. The Secretary noted the specific request of Colombia that a group of tsunami technical experts be sent to Colombia to advise national authorities on the preparation of the tsunami warning plan and make recommendations on the selection of stations, equipment and communication systems. It was recognized that this may be possible in conjunction with a future mission to Central America. The representative from Chile presented the regional warning system requirements along the coastline of his country. The possibility of a centre serving Chile and Peru was identified by the Group.

7. REVIEW OF THE ITEMS OF REFERENCE AND RELATIONSHIP OF ITSU, ITIC AND PTWC

- 92 The Chairman informed the Group that several organizational changes within IOC and the USA had occurred since the adoption of Resolution IOC-IV-6 and that the Group might wish to look at the present terms of reference of ITSU and ITIC and their relationship to PTWC to see if any changes were needed. It was pointed out that Resolution IOC-23 updated the terms of reference of ITIC. The Group felt that this resolution adequately reflects the actual functions of the center.
- 93 In order to avoid any possible confusion in the future the Group agreed with the suggestion that the Secretariat IOC in collaboration with the Chairman, the Vice Chairman and the Director of ITIC review all past resolutions and recommendations and recommend to ITSU-X any possible actions needed in respect to their validity.

8. POST OF ASSOCIATE DIRECTOR OF ITIC - STATUS AND PLANS

94 The Assistant Secretary IOC informed the Group that Mr. G. Dohler (Canada) was seconded by his country as Associate Director of the ITIC from July 1, 1982 for one year. Additional financial support was provided by the IOC. During his stay in Honolulu Mr. Dohler worked on several problems involving the tsunami programme specifically compiling materials for a draft of the Master Plan on the Tsunami Warning System, and planning for a tsunami oriented mission to Western Pacific Countries. Nominations for Associate Director have not been made since July 1983 and the post presently remains vacant.

95 Former Associate Directors of ITIC present at the session shared their experience on the work at ITIC with the participants of the Session. They were of a general opinion that actions should be done to fill the post because of the volume of work to be done by ITIC.

96 The Group expressed its sincere thanks to the Government of the USA for sponsoring ITIC. The fact of the significant increase in space allocated to ITIC was noted accordingly.

97 The Group realized that the Associate Director may be effective when he stays at ITIC for a relatively long period (not less than a year) and deals with implementation of specific predetermined tasks.

98 There was an opinion expressed that the post of the Associate Director if occupied by a representative from developing countries of the regions, may provide a good training mechanism.

9. COOPERATION WITH OTHER INTERNATIONAL BODIES INVOLVED IN TSUNAMI MATTERS

99 The representatives of international bodies involved in tsunami research or in research which might be of interest to the Group were invited to express their views on the ways of cooperation between the Group and their respective bodies.

100 Mr. J. F. Lander, Representative of the World Data Center-A for Solid Earth Geophysics, described those aspects of the Center that related to tsunamis. Catalogues have been issued detailing the tsunami materials that are available to the research community, tsunami data was digitized, and the large collection of damage and disaster photographs prepared. Most requests are received from users for material from this last collection.

101 He noted that WDC-A is compiling a new map of tsunami generation zones, and copies will be supplied to National Contacts. The Chairman expressed appreciation of the Group for the work of WDC-A, and its support of tsunami research.

102 Dr. E. Bernard, Director, NOAA/Pacific Marine Environmental Laboratory and Representative of the IUGG Tsunami Commission, reported on the present status of the Commission. He described the Commission's organizational affiliation with the two IUGG bodies of International Association of Seismology and Physics of the Earth's Interior and the

International Association of Physical Sciences of the Oceans. He reported that the Commission would entertain requests from ITSU on scientific aspects of tsunamis, through the Secretary of the Commission.

103 Professor K. Wyrтки of the University of Hawaii, coordinator of the IGOSS Sea Level Pilot Project (ISLPP), described the main objectives of the Project as they are presented in DOC.IOC/ITSU-IX/14. They include the study of the possibility of arranging real time transmission of sea level data through IGOSS channels in the Pacific. Monthly mean sea level averages should be provided to users within one month period.

104 He further gave a presentation to the Group on the US mean sea level program that is functioning on the islands of the Pacific. Examples of the correlation of monthly mean sea level data from these stations were submitted showing the abnormally high and low levels over large areas associated with the recent El Nino. Five of the stations now transmit data routinely via satellite, and three more are scheduled for appropriate conversion this year.

105 Professor Wyrтки described a new Global Sea Level Network Project prepared at the IOC. Its scope will include a network of tide stations in all major oceans monitoring the spectrum of sea level changes on all time scales from few minutes (tsunamis) up to 100 years. More than 100 new stations are anticipated in addition to those in the network now in operation. The Group showed its interest with many questions dealing with operational aspects of the program. The Group reiterated its readiness to participate actively in the implementation of ISLPP and in the Global Project.

106 The Director of ITIC informed the Group on the links established with UNDRO during the intersessional period. Coordination was made on tsunami emergency planning and disaster response, introducing UNDRO into the stream of tsunami information and communications.

107 The Group expressed hope that mutually beneficial cooperation with UNDRO will continue and that a representative of that organization would participate in future sessions of the Group.

9.1 TSUNAMI SOCIETY, ITS STATUS AND WAYS OF COOPERATION WITH THE GROUP

108 Dr. G. Pararas-Carayannis, at the request of the Group, gave a brief outline of the Society. He reported that it was formed about three years ago, and now has approximately 100 members. So far it has published one issue of its journal of the science of natural hazards, and one monograph. In response to questions he noted that papers have been received and reviewed by the editor, Dr. Murty, for one or two more issues of the journal, but additional funds over membership dues are needed for their publication.

10. ELECTION OF THE CHAIRMAN AND VICE-CHAIRMAN OF THE GROUP

109 The Assistant Secretary IOC explained the procedures for the election of the officers of the Group and introduced the Guidelines for Subsidiary Bodies of IOC, adopted by the Eleventh Session of the IOC Assembly. Since according to the established procedures the present

Chairman and Vice-Chairman would have to resign at the end of this session, the Group was invited to elect a new Chairman and Vice-Chairman. Mr. N. Ridgway (New Zealand) was proposed to become a new Chairman of the Group and Dr. N. Yamakawa (Japan) a new Vice-Chairman. The candidates were seconded by a necessary number of delegates and Mr. Norman M. Ridgway and Dr. Norio Yamakawa were elected unanimously as a new Chairman and a new Vice-Chairman, respectively.

- 110 The Group expressed deep satisfaction and appreciation with the work carried out by its former Chairman during his long stay at the Head of the Group and requested him to continue his duties till the official closure of the session.

11. PROPOSALS FOR 1984-85 DRAFT PROGRAMME

- 111 The subject was introduced by the Assistant Secretary IOC, who stressed the need to define actions and to make recommendations for the activities of the Group in 1985 and in 1986-87. He placed particular emphasis on the importance of providing guidance to the Secretary IOC and the Chairman of ITSU regarding the next biannual period, namely 1986-1987.

- 112 Taking into account decisions of the 22 session of the Unesco General Conference pursuant to the IOC budget and activities and discussions being held at this session the Group identified the activities for 1985 and 1986-1987 which are considered of vital importance for carrying out responsibilities assigned to the Group and requested the Secretary IOC to allocate necessary funds for their successful implementation. Recommendation ITSU-IX.2 was adopted.

12. DATE AND PLACE OF NEXT SESSION

- 113 As it was proposed by ITSU-VIII and adopted by the Twelfth Session of the IOC Assembly, the Tenth Session of the Group will be held in Victoria, B.C., Canada, the end of July and the beginning of August in conjunction with the 1985 IUGG Tsunami Symposium and the Workshop. The sequence of these meetings will allow maximum interaction between those engaged in tsunami operations and research.

- 114 The Group requested its Chairman to contact Members of the ICG/ITSU with the view to investigate possibilities of hosting the Eleventh Session of the Group and it was agreed to have this session in 1987.

13. ADOPTION OF THE SUMMARY REPORT, RESOLUTIONS AND RECOMMENDATIONS

- 115 The Group adopted the Summary Report, Resolutions and Recommendations and requested the Chairman to endorse the final edited version to be prepared by the IOC Secretariat.

14. CLOSURE OF THE SESSION

- 116 The Chairman thanked the participants for their generous efforts of cooperation which had made the session so successful and further extended his thanks to the Government of the USA for hosting the Session and the facilities provided.

117 The Group expressed its high regard to the Chairman for the
conduct of the Session and to the Secretariat and the local Organizing
Committee for the hard work and kind hospitality.

118 The Session was closed at 13:00 on 17 March 1984.

ANNEX I

AGENDA

1. OPENING OF THE SESSION
2. ADMINISTRATIVE ARRANGEMENTS
 - 2.1 ADOPTION OF THE AGENDA
 - 2.2 DESIGNATION OF THE RAPPORTEUR
 - 2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION
3. INTERSESSIONAL ACTIVITIES
 - 3.1 REPORTS OF THE CHAIRMAN OF THE GROUP AND THE DIRECTOR OF ITIC ON INTERSESSIONAL ACTIVITIES (IOC/ITSU-IX/6; IOC/ITSU-IX/7)
 - 3.2 DISCUSSION OF NATIONAL INPUTS TO THE IMPROVEMENT OF THE ITSU NETWORK IN THE PACIFIC (IOC/ITSU-IX/8)
 - 3.3 REVIEW OF THE EFFECTS OF 26 MAY 1983 TSUNAMI IN THE SEA OF JAPAN (IOC/ITSU-IX/8)
4. IMPLEMENTATION OF ACTIONS IDENTIFIED BY THE EIGHTH SESSION OF ITSU
 - 4.1 DEVELOPMENT OF A MASTER PLAN FOR INTERNATIONAL TSUNAMI WARNING OPERATIONS (REF. RES: ITSU-VIII.1)
 - 4.2 ADDITIONAL TRAVEL TIME CHARTS (REF. RES: ITSU-VIII.2)
 - 4.3 ESTABLISHMENT OF TSUNAMI WARNING PROCEDURES (REF. RES: ITSU-VIII.3)
5. FUTURE ACTIVITIES OF THE GROUP
 - 5.1 COMMUNICATION PLAN FOR THE TSUNAMI WARNING SYSTEM
 - 5.2 REVIEW OF RECOMMENDATIONS AND RESOLUTIONS FROM THE IUGG TSUNAMI COMMISSION MEETING (HAMBURG, AUGUST 1983)
6. PROPOSALS TO ENHANCE TRAINING AND EDUCATION OF TSUNAMI SPECIALISTS OF DEVELOPING MEMBER STATES OF THE REGION AND REGIONAL COOPERATION
 - 6.1 ORGANIZATION OF WORKSHOPS ON THE TECHNICAL ASPECTS OF TSUNAMI ANALYSES, PREDICTION AND COMMUNICATION
 - 6.2 VISITING EXPERTS TRAINING PROGRAMME
 - 6.3 MISSION TO WESTERN PACIFIC NATIONS AND UNDP TSUNAMI PROJECT

7. REVIEW OF THE TERMS OF REFERENCE AND RELATIONSHIP OF ITSU, ITIC AND PTWC (REF: RES: IOC IV-6 AND IOC WAVE REPORTING PROCEDURES FOR TIDE OBSERVERS IN THE TSUNAMI WARNING SYSTEM, UNESCO 1975)
8. POST OF ASSOCIATE DIRECTOR OF ITIC - STATUS AND PLANS
9. COOPERATION WITH OTHER INTERNATIONAL BODIES INVOLVED IN TSUNAMI MATTERS (IOC/ITSU-IX/12, IOC/ITSU-IX/13)
 - 9.1 TSUNAMI SOCIETY, ITS STATUS AND WAYS OF COOPERATION WITH THE GROUP
10. ELECTION OF THE CHAIRMAN AND VICE-CHAIRMAN OF THE GROUP
11. PROPOSALS FOR 1984-85 DRAFT PROGRAMME
12. DATE AND PLACE OF NEXT SESSION
13. ADOPTION OF THE SUMMARY REPORT, RESOLUTIONS AND RECOMMENDATIONS
14. CLOSURE OF THE SESSION

ANNEX II

RESOLUTIONS AND RECOMMENDATIONS
ADOPTED BY THE NINTH SESSION OF THE ICG/ITSU

RESOLUTION ITSU-IX.1

MASTER PLAN FOR INTERNATIONAL
TSUNAMI WARNING OPERATIONS

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

Recalling Resolution ITSU-VIII.1 which recommended the development of a Master Plan for the International Tsunami Warning System,

Appreciating the efforts made by the Chairman of the Group in consultations with ITSU experts for the preparation of a paper, "Tsunamis, where... next?" which compiles data and information important and necessary for the Master Plan,

Considering this paper as a sound basis for the future Master Plan,

Urges the Secretary IOC in consultation with the Chairman of the Group to engage an expert for formalizing the Master Plan taking into account comments and proposals made at the Ninth Session of IOC/ITSU.

Recommends that the final version of the Master Plan should be prepared in close cooperation with the Director of ITIC, the Chairman of the Group and the Secretariat IOC.

Recommends further to complete the preparation of the draft of the Master Plan in advance of the Tenth Session and send it to ITSU National Contacts for comments with a view to adopt the Master Plan at the Tenth Session (August, 1985).

RESOLUTION ITSU-IX.2

PREPARATION OF ADDITIONAL TSUNAMI
TRAVEL TIME CHARTS

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

Recognizing the value of tsunami travel charts and the need for these as expressed by Member States at the ITSU-VIII session,

Considering the difficulties that have been expressed in producing these charts,

Appreciating the effort made by the Secretary IOC in providing financial support for the development and production of these charts,

Urges the Chairman of the ICG/ITSU to request ITSU National Contacts to inform him by October 1, 1984, of their requirements for new Travel Time Charts,

Requests ITSU National Contacts to investigate and advise the Secretary IOC and the Chairman of the ICG/ITSU of the possibility of developing and producing these charts within their respective countries with IOC support,

Recommends the Secretary IOC in consultation with the Chairman of ITSU to consider proposals and to take necessary measures to commence production of the required charts.

RESOLUTION ITSU-IX.3

INTERNATIONAL COMMUNICATION PLAN
FOR THE TSUNAMI WARNING SYSTEM

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

Recognizing, with appreciation, the work of the United States in the preparation of the 10th Edition of the "Communications Plan for the Tsunami Warning System,"

Acknowledging that PTWC is the proper linkage for ITSU Member States to effect changes into the above-mentioned Communication Plan,

Recognizing further that there is sentiment for the creation of an International Communications Plan for the Tsunami Warning System, prepared under the aegis of ICG/ITSU, and using as a format document the US National Communications Plan,

Requests the Chairman of the ICG/ITSU through the Director, ITIC to query, in writing, all National Contacts of the Member States of ITSU to determine if they desire the preparation of an International Communications Plan.

Requests further that the Director, ITIC, complete the Survey at least six months prior to ITSU-X, and inform the Chairman of the results for action by the group.

RECOMMENDATION ITSU-IX.1

SUPPORT TO THE ACTIVITIES OF THE
INTERNATIONAL TSUNAMI INFORMATION CENTER

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

Recognizing the important function of the International Tsunami Information Center (ITIC) in coordinating research, education, training and publicity relating to tsunamis in the Pacific,

Noting that the activities of the ITIC are hampered by lack of funding,

Recommends that the Secretary IOC make appropriate additional funding available for day-to-day operation of the Centre,

Recommends further that Member States be requested to make trust funds and other funds available to IOC for the purpose of tsunami research, publicity, education and training.

RECOMMENDATION ITSU-IX.2

PROPOSED ACTIVITIES IN ORDER OF
PRIORITIES FOR 1985 (I) and 1986-1987 (II)

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

I

Being informed on the budget and programme of ITSU for 1984-1985,

Taking into account decisions of the Twenty-Second Session of the General Conference of Unesco and the outcome of the Ninth Session of the ICG/ITSU,

Recommends that the following activities should be implemented in 1985:

Support to the activities of the International Tsunami Information Center - staff support (to assist in the preparation of audio-visual materials, updating the library, cataloging the data), run-up surveys, printing

Support for the Director of ITIC and Chairman ITSU to carry-out post-tsunami surveys and to visit Member States to provide guidance on matters relevant to the tsunami watch and warning

Staff and ICG/ITSU officers and experts attendance at subject-related meetings and conferences of other organizations and advisory bodies

Consultant to be invited to finalize a Master Plan

Assistance should be provided for development and publication of Tsunami Travel-Time Charts

Mission to South West Pacific Islands be arranged for 2-3 participants to provide assistance in the further development of regional tsunami warning centers

Publication of the Proceedings of IUGG Tsunami Commission Meeting to be held in August 1985 in Canada

Organization of the Tenth Session of the ICG/ITSU (29 July - 1 August, 1985, Canada)

Support for the organization of the Workshop on the Technical Aspects of Tsunami Analyses, Prediction and Communication (jointly with ITSU-X in Canada, 2-4 August 1985)

Visiting expert programme (travel and early allowances for 3 trainees from the countries of the region)

Requests the Secretary IOC to allocate money for the above-mentioned activities in accordance with established priorities and existing procedures.

II

Recalling that biannual financial period of Unesco will expire before 1 January 1986,

Bearing in mind the necessity to provide guidance to the Secretary IOC on the Unesco next biannual programme (1986-1987) and budget in the fields relevant to the ICG/ITSU activities,

Recognizing that during 1984-1985 there may be requests for actions in new fields which were not covered by activities proposed below,

Recommends the Secretary IOC anticipate and secure appropriate funds to support the following minimum of activities needed for the successful implementation of the programme:

Continual support for the activities of the International Tsunami Information Center

Support missions to the countries of the region to provide assistance in the further development of regional tsunami warning centers and of a Pacific-wide Tsunami Warning System

Provide living allowance and travel for the Associate Director, ITIC

Make funds available for the visits of the Director and Associate Director, ITIC, and the Chairman of the ICG/ITSU to give guidance to Member States and to carry out surveys after the occurrence of tsunamis

Support the organization of an intersessional ITSU Consultative meeting in Paris for ICG/ITSU Officers and Members of the Secretariat IOC, if possible in conjunction with the session of the IOC Governing Bodies

Provide funds for staff, ICG/ITSU officers and experts attendance at subject-related meetings of other organizations and advisory bodies

Assist in organization of the Eleventh Session of the ICG/ITSU in one of the countries of the Pacific region

Continue assistance for the implementation of the visiting experts programme (4 trainees from the countries of the region).

ANNEX III

LIST OF PARTICIPANTS

I. PARTICIPANTS FROM MEMBER STATES

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ANNEX IV

LIST OF ABBREVIATIONS AND ACRONYMS

ADESS	Automated Data Editing and Switching System
AOS	Advanced Operating System
ATWC	Alaska Tsunami Warning Center
CCOP/SOPAC	Committee for Coordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas
HIMAT	The Colombian Institute for Hydrology, Meteorology, and Land Development
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific
IGOSS	Integrated Global Ocean Services System
IOC	Intergovernmental Oceanographic Commission
ISLPP	IGOSS Sea Level Pilot Project
ITIC	International Tsunami Information Center
IUGG	International Union of Geology and Geophysics Research
JIMAR	Joint Institute for Marine and Atmospheric Research
NOAA	National Oceanic and Atmospheric Administration
OBSOS	Ocean Bottom Seismograph Observation System
PIDP	Pacific Islands Development Programme
PTWC	Pacific Tsunami Warning Center
SRO	Seismic Research Observatory
THRUST	Tsunami Hazard Reduction Utilizing System Technology
TWS	Tsunami Warning System
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UH	University of Hawaii
WDC	World Data Center
WMO	World Meteorological Organization

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