Intergovernmental Oceanographic Commission
Reports of Governing and Major Subsidiary Bodies

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

Seventeenth Session
Seoul, Republic of Korea, 4-7 October 1999

UNESCO

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1. OPENING AND ARRANGEMENTS FOR THE SESSION

1 The Chairman, Mr. H. Gorziglia, opened the Seventeenth Session of the IOC International Co-ordination Group for the Tsunami Warning System in the Pacific at 10:00 on 4 October 1999. The Session was held at the new headquarters of the Korea Meteorological Administration in Seoul, Republic of Korea.

2 Mr. H. Gorziglia started his welcome address by expressing thanks to the Government of the Republic of Korea for the kind invitation to host the Session. He extended thanks to the governments of the countries who sent their representatives to the last session of the ICG/ITSU in the last millennium. He expressed belief that the participation of internationally reputed experts in the field of early warning known for their keen interest in tsunami mitigation will be a main factor for the meetings success.

3 Mr. Gorziglia expressed concern that in spite of the fact of the high priority given to the programme by the IOC Member States, it has not found a reflection in national disaster mitigation plans and in increased financial support for the programme implementation. The fact that only 50% of the ICG/ITSU Member States sent their representatives to the Seventeenth Session is an alarming signal. He called on Member States not to wait for a tsunami disaster to happen but rather take necessary prevention measures in advance of the event. The commitment of Member States to support and follow-up the ICG/ITSU decisions is required. He invited the participants of the Session to study the progress achieved, identify drawbacks and failures of the system and formulate recommendations to the IOC governing bodies which may help in saving human lives and protecting property.

4 Dr. Moon Sung Euii, KMA Administrator, extended to all participants his warm welcome to Seoul and to the KMA Headquarters. He expressed belief that the discussions and recommendations of this meeting will introduce new ideas and measures in tsunami disaster prevention, which will be noted by governments, governing bodies of international organizations and decision makers, funded and implemented. Dr. Moon emphasized the need to promote international and regional co-operation in improving effectiveness of tsunami warnings.

5 He noted that a tsunami threat exists for the Republic of Korea because of the high potential of large earthquakes in the surrounding seas. He presented as an example, tsunami disasters of 1983 and 1993, caused by the earthquakes near northwestern Japan which struck the eastern coast of the country. These tsunamis showed a clear need in reinforcing the national seismic network and installing a real-time tsunami monitoring system at Ulleung Island. Further actions for improving the national warning facilities are planned. The national system will gain its capacity only when supported by the competent international bodies like ITSU. Dr. Moon expressed the hope that the Session in Seoul will be a landmark of ITSU activities in the Twentieth Century and contribute to the promotion of the tsunami programme in the years beyond 2000. He wished the Session to be productive, and the participants, a comfortable and memorable stay in Seoul.

6 Dr. I. Oliounine, the Deputy Executive Secretary IOC, invited participants to join him for a minute of silence in the memory of Prof. Mohammed El Sabh from Canada, who passed away at the beginning of this year, and who was closely associated with the ICG/ITSU for many years.

7 He then conveyed to the meeting, the greetings and best wishes from Prof. P. Bernal, the IOC Executive Secretary.

8 Dr. Oliounine introduced a quick glimpse into the past activities of the Group and stressed that IOC took the lead role in tsunami warning, thanks to its universal character and its objectives. He expressed satisfaction that after 40 years, the achievements of the ICG/ITSU were widely noted and received worldwide recognition. However, the objective to provide timely accurate and reliable tsunami warning services, regardless of near- or far-shore events to all the tsunami-prone areas in the Pacific still requires much work and attention. The ultimate success of the tsunami programme will depend on being able to

make disaster reduction a public value. He invited the participants to critically assess the current state of science and technology used in disasters preparedness, identify ways for motivating an increasing broad range of people to work together in tsunami mitigation and make suggestions for future operational programmes to ensure continued progress.

9 Dr. Oliounine echoed Dr. Moon's view that the full, effective and long-term implementation of the tsunami programme requires strong and committed partnership between Member States, international community and the private sector. The synergetic collaboration among all partners should be established. Regions should become active players, initiating projects under the leadership of experienced international teams.

10 In conclusion, Dr. Oliounine invited the Session to take a long-term view in the discussions and to formulate recommendations, which could be translated into practical benefits for all Member States. He wished the participants every success with the meeting and hoped they enjoyed the hospitality of the host country.

11 The Chairman thanked the speakers and invited the Representative of the Local Organizing Committee to provide information on local arrangements. Mr. Kim Sang-jo informed the Group of the logistical support, accommodation facilities and the cultural programme. On behalf of the Group, the Chairman thanked the local organizers for the arrangements made.

12 The Chairman then invited the Group to adopt the Provisional Agenda. It was adopted as presented in Annex I.

13 The Group decided not to nominate a Rapporteur for the Session and requested all Key Speakers for different agenda items to provide support to the Technical Secretary in developing the draft Summary Report.

14 The Technical Secretary introduced the List of Documents and the Provisional Timetable of the Session. **The Group adopted** the working procedures and **decided** to make the necessary modifications to the Timetable with the progress of the Session. **It was further decided** to create an intersessional drafting group to work on the future programme and budget recommendation. The Delegate of the USA, Mr. R. Hagemeyer, was appointed as Chairman of this Group. **It was agreed** to have other intersessional groups established, if the need arises.

15 The List of Documents with the modifications made is given in Annex IV. The List of Participants and List of Acronyms are given in Annex III and XIII respectively.

16 **The Group expressed regret** that New Zealand, the Philippines, the Peoples Democratic Republic of Korea and some other countries, and international bodies and programmes like SOPAC, IOCARIBE and WDC-A, Tsunami were not able to attend the Session due to various reasons.

2. PROGRESS IN THE PROGRAMME IMPLEMENTATION

2.1 REPORT OF THE CHAIRMAN

17 The Chairman provided a short briefing on the progress achieved by the Group during the intersessional period 1997-1999, focusing on his personal contributions (Document IOC/ITSU-XVII/6). He stressed that more detailed discussions of the programme implementation will be held under relevant agenda items.

18 The Chairman reported on his input to the Thirty-First Session of the IOC Executive Council held in Paris in November 1998. This Session had in its agenda, the adoption of the ITSU-XVI Summary

Report and recommendations contained therein. In his presentation at the Executive Council he reiterated the importance of the IOC Tsunami programme as the only one within IOC fully dedicated to saving lives, property and livelihood. He emphasized that the lack of funds provided by IOC Member States to the Trust Fund and the low priority given to the programme within the IOC budget, hampered a full scope programme implementation. The Chairman expressed concern that it was frustrating to see the programme gaining attention only after a disaster occurred. The result of the Executive Council Session was the approval of the Summary Report and the recommendations, request to increase efforts in providing technical advice and training to developing countries and satisfaction with the progress achieved by the Group.

19 The Chairman paid special tribute to the PTWC Director for the finalization of the Tsunami Master Plan and to the IOC for its publication. The Master Plan for the Tsunami Warning System in the Pacific was designed as a long-term guide for improvement of the Tsunami Warning System based on the analysis of its existing components. In addressing the current operational limitations of the present system, the Master Plan specifically recognizes a number of areas requiring improvement. The Chairman then expressed concern with the low response of Member States to his letters and calls for action and requested Member States to be more co-operative.

20 He invited Member States to give modest contributions to the IOC Trust Fund for the tsunami programme activities and requested national contacts to take the necessary steps.

21 **The Group congratulated** its Chairman for the continuous attention to the programme needs and accepted his report on intersessional activities. **The Group supported** the importance of the Master Plan for the up-coming sessional discussions and **recommended** to use it as the basis for the formulation of long-term implementation activities. **The Group requested** the Technical Secretary to include the Action Sheet presented as Annex V to the ITSU Officers Meeting report (IOC/INF-1115) as Annex V to this Summary Report, taking into account information contained in the Chairman's report and resulting from later discussions at the session.

2.2 NATIONAL REPORTS

22 By the IOC Circular Letter N$^{o.}$ 1596 of 8 February 1999, the ICG/ITSU Member States were invited to submit national reports on tsunami-related activities. It was recommended, among other things, to include in the National Reports information on new communication technology development and mitigation, on the efforts made in establishing or improving national and regional tsunami warning systems and on contributions to national days for Natural Disaster Reduction. Fifteen National Reports were received and compiled in Document ICG/ITSU-XVII/7 and made available to the Group. Additional comments on national activities were provided by several Member States. Special emphasis was given to the support provided to the ITSU programme through financial and in-kind contributions.

23 The Delegate of Australia reported on the progress made in the development of an improved Australian Tsunami Warning System through the co-operation of four national agencies. He also described Australia's IDNDR activities, which resulted in an improved national assessment of tsunami risk. The Delegate explained that there was a big upsurge in public interest in tsunamis in Australia, following the disastrous Aitape tsunami of July 1998. There is now a problem in educating the media of the operation of the Tsunami Warning System and in managing the smallest magnitude tsunami impact events. The Delegate emphasized the importance of the operation of ITSU for Australia's Pacific Ocean coast and stressed the need for the development of an international tsunami warning system for the Indian Ocean rim. This requirement was recently identified at an IOC meeting on developing an Indian Ocean GOOS, in Perth 16-17 September 1999. This view was elaborated in detail under Agenda Item 5.

24 The Delegate of Canada reported that at the Eighteenth Session of the IOC Assembly, Canada expressed support for the activities of ITSU and its importance as a programme in IDNDR. To demonstrate the importance Canada places on this international commitment, funding was provided in

1997 to upgrade Canada's tsunami warning stations. Since that time, the development and testing of the new system has continued. In early 1999, the tsunami warning system was determined to be a Y2K critical application. A detailed contingency analysis identified the need for additional upgrades to Canadian tsunami warning procedures and infrastructures.

25 The Delegate of Canada announced that the station upgrades and the improvements to the national acquisition and processing system have been completed. The new stations provide the capability for both sending and acquiring water level information and tsunami alarms in real-time by either telephone or MSAT-1 geostationary satellite. He also noted the importance of making contributions to the IOC Trust Fund in support of the ITSU programme and specifically the TIME Project. He expressed readiness to continue efforts to acquire contributions to the IOC Trust Fund and the ITSU programme and urged other Member States to do the same.

26 The Delegate of France reported that during the IDNDR Seminar organized in Paris in June 1998 by the French Government, LDG presented a poster entitled '*Risque Tsunami Instabilitié'* which was distributed in the form of a brochure. The project on Rapid Determination of Focal Mechanisms developed in CPPT was accomplished. Results show that for all large earthquakes, the parameters obtained, such as seismic moment, depth and focal mechanism are very accurate. It is planned that the staff of CPPT will automate the procedure during the next intersessional period and send the results to PTWC. It is expected that the procedure will shorten the delay in getting results to 60 minutes. He also informed that the French version of the Tsunami '*The Great Waves'* brochure was published by France with the support of the French Ministry of Foreign Affairs. Copies were distributed to the participants of ITSU-XVII.

27 The Delegate of Indonesia mentioned that the main problem with Indonesia is that the country lies right on the boundary of three major tectonic plates: the Pacific, the Eurasian and the Indo-Australian. Consequently, the earthquake sources are located very close to the coast lines. This means that chances to issue tsunami early warnings are in the order of minutes, mostly less than 10 minutes. Therefore, the country's priority for tsunami warnings was given as the following:

- Evaluating the tsunami-prone areas based on the historical data;
- Educating people who live in the vicinity of shorelines to get better understanding of tsunami preparedness.

28 He informed of the actions taken by the local government during an earthquake of 28 November 1998 at co-ordinates 1.97S-124.92E, at the local depth of 33kms and of the magnitude 6,5 (Ms). The local government evacuated people from Mangole island in an anticipation to the tsunami attack. However, no tsunami wave was generated.

29 The Delegate of Republic of Korea highlighted the recent status of improvement of the KMA's tsunami warning system, which is to be composed of 31 seismic stations, a TREMORS system and a real-time monitoring system of sea state. He reported that there was a tsunami watch issued for the southern coast at the time of the Taiwan tsunami on 3 May 1998. He indicated that a national warning system could not work properly without information and data from neighbouring countries (Japan) and PTWC.

30 He also noted that KMA invited Prof. F. Imamura to provide technical guidance on the tsunami simulation model developed under the TIME project, and Dr. F. Schindele to train staff on TREMORS installation and operation.

31 Consequently, he emphasized that regional and international co-operation is very essential to effective tsunami warning.

32 The Delegate of Russia provided some modifications to the national report noting that at present time there are 3 seismological stations and 40 tidal stations in operation. The tide gauge and seismological stations which were destroyed during the 1994 Shikotan earthquake have not yet been restored.

33 During 1997-1998 and the first half of 1999, 46 earthquakes with the magnitude above 6.0 were registered in the Pacific Ocean by the seismic stations of Yuzhno-Sakhalinsk. Warnings about a tsunami threat were issued in 2 cases.

34 On 5 December 1997, after an earthquake in Kronotsky Bay, near the coast of Kamchatka (M=7.5), seismic stations in Petropavlovsk and Severo-Kurilsk announced a tsunami threat for the Kamchatka and Severo-Kurilsk regions independently from each other. Although coastal stations had not registered any tsunami, visual inspection from helicopter in the Kronotsky Bay revealed tsunami waves from 0,5 to 1,0 m.

35 On 8 March 1999, a warning about the tsunami threat in Severo-Kurilsk was issued (M=7.2). The coastal station had not registered any tsunami.

36 During the intersessional period, Russian TW centres exchanged messages with the centres in Hawaii, Tokyo, Hong Kong, Palmer (with the latter - from August 1998). The average travel time for messages to Petropavlovsk Kamchatskii (P-K) and to Yuzhno-Sakhalinsk (Y-S) from TWCs in the Pacific region are as follows:

From TWC	**to P-K**	**to Y-S**
Hawaii	24 min.	9 min.
Palmer	10 min.	7 min.
Hong Kong	14 min.	2 min.
Tokyo	19 min.	2 min.

37 At the beginning of 1998, an e-mail connection was established that has allowed improving ways of communication with foreign centres. The Sakhalin TWC was included in the electronic despatch lists of the tsunami information in Honolulu and Palmer. At present in Kholmsk port (Sakhalin), work is being carried out on the installation of tide gauges with the transmission of information in a real-time mode to the tsunami centre. It will become possible to forecast time of arrival and height of the maximum wave, to determine an expected flooding zone, to estimate the duration of a dangerous period and to issue '*all clear'* in good time. The real-time information from the tide gauges will allow solving a number of problems in numerical modeling of tsunami.

38 The installation of automated tide gauges and testing of the equipment in Kamchatka and Kuril Islands within the Kuril-Kamchatka project implemented by Russia, USA, Japan and IOC will be implemented by the end of 1999. The equipment has been supplied and in May 1999, two Russian experts from Petropavlovsk-Kamchatka and Yuzhno-Sakhalinsk attended, within the Visiting Experts Programme, a training course at PTWC.

39 **The Group noted** national reports and additional information provided by Member States and **commended** the progress achieved. **The Group acknowledged** with thanks, contributions of all partners involved in the Kuril-Kamchatka project and the financial support provided by IOC to speed up the finalization of the project and **expressed** strong hope that the project will be completed as planned by the end of 1999, noting that any further delay will leave the coastal population in the northern Pacific, especially in the Russian Federation, unprotected against the tsunami danger.

40 **The Group requested** all Member States to provide abbreviated report summaries to ITIC by 1 December preferably in electronic form for the publication in the 1999 issue of the *Tsunami Newsletter*.

41 **The Group requested** the Technical Secretary to inform relevant Member States accordingly.

2.3 ITIC DIRECTOR'S REPORT

42 The ITIC Director presented a summary of key activities carried out by ITIC during the intersessional period, noting that a detailed report is given in Document IOC/ITSU-XVII/8.

43 Due to different reasons, not all responsibilities assigned to ITIC by ITSU-XVI were fully implemented. Two experts from the Yuzhno-Sakhalinsk and Petropavlovsk-Kamchatskii Tsunami Warning Centres of Russia were participants of the ITIC's Visiting Experts Programme at the Pacific Tsunami Warning Center. The programme was directed toward their training in the installation and maintenance of new water level stations in the Kuril-Kamchatka area. The ITIC Director noted that, while he has not yet completely finished his review of the Visiting Experts Programme, his findings thus indicate that the programme should place greater emphasis on giving the experts detailed training in the functions and operations of regional or local tsunami warning systems.

44 During the intersessional period, the *1997 Annual Tsunami Newsletter* was published containing summaries of National Reports submitted to ITSU-XVI and information on all the tsunamigenic, and potentially tsunamigenic, events of 1997. The 1998 Annual Tsunami Newsletter is being compiled and its publication is anticipated shortly after ITSU-XVII. Also during the intersessional period, ITIC produced a new ITIC brochure and an electronic version of the artwork for the children's booklet, '*Tsunami Warning!'* the text in a user's native language may be added to the electronic artwork to produce the children's booklet for educational purposes in the user's country. An English version of a newly formatted French publication of '*Tsunami, the Great Waves'* was published by ITIC. Copies were distributed to the participants at ITSU-XVII.

45 The library items and other resource materials at ITIC have been organized into an annotated list of holdings. ITIC is now embarking on an effort to make this information available in a most efficient manner on its Web page. The ultimate goal is making as much of the material as possible directly available from the Web site. For the researchers needing materials not available on the Web site, ITIC provides desk space and certain office facilities for their use when they visit ITIC. The ITIC Director mentioned that there were more than 10 visits to ITIC and cited the extended visit in early 1998 by the late Muhammad El Sabh as an example of such a use of the ITIC facilities for research.

46 **The Group accepted** the report of the ITIC Director and encouraged him to continue his efforts to upgrade the products and programmes of ITIC. **The Group further encouraged** Member States to use the ITIC facilities for research by implementing extended visits to the Centre.

47 The ITIC Associate Director, Mr. Rodrigo Nunez from Chile reported on the implementation of his responsibilities in the development of the ITIC Web site and assisting the ITIC Director in carrying out his duties. He remarked that the practice of making the Associate Director to work at home showed its benefits and should be continued. The Head of the Chilean Delegation reiterated the readiness of his country to continue providing the services of Mr. Nunez.

48 **The Group thanked** the Chilean Delegation for the kind offer and agreed that the practice should be continued. **It was recommended** having an increase in a number of the Associate Director visits to ITIC for project discussions. The Group thought that it would be appropriate to have the first such visit to ITIC shortly after ITSU-XVII and the next in conjunction with the ITSU Officer-s Meeting in January 2001. It was **further recommended** that the plan of actions be developed, adjusted to meet the programme needs more effectively.

49 The idea of having a team of Associate Directors working on specific projects and providing assistance to the ITIC Director in the implementation of his duties was supported. **The Group agreed** that appointed Associate Directors should be task-oriented. Tasks will be identified by the ITIC Director based on the plan of his intersessional responsibilities. When the need for assistance and the task identified, the Executive Secretary IOC will be requested to invite Member States to make proposals for the Associate Directors. The Group decided to modify the Terms of Reference of the Associate Directors as presented in Annex VI.

3. IMPLEMENTATION OF ITSU-XVI RECOMMENDATIONS

3.1 TIME (TSUNAMI INUNDATION MODELING EXPERIMENT) PROJECT

50 The TIME Project Leader, Dr. Imamura from Japan reported on the TIME Project implementation (IOC/ITSU-XVII/20).

51 During the intersessional period, the Disaster Control Research Center (DCRC), Tohoku University, Japan has been acting as the TIME centre responsible for the transfer of numerical technique of tsunami simulation to the countries, which face or will face tsunami hazards.

52 Fifteen institutions of 12 countries obtained the computer programmes developed by DCRC and the TIME Manuals published by IOC in 1997 through the mail or training at DCRC. The TIME Manual was despatched by IOC to more than 1,000 addresses. As of 1999, the TUNAMI code was provided to 19 institutions of 15 countries. TIME training courses were arranged with the assistance of the DCRC personal in Chile and Mexico. At the end of 1999, beginning of 2000, a new course is planned in Costa Rica with financial support from Japan.

53 The Phase-I of the TIME Project was completed in 1997; however, demands for the tsunami numerical modeling technology is still very high. Implementation of Phase-II of the TIME project approved by ITSU-XVI requires financial support.

54 **The Group reinforced** the Recommendation ITSU-XVI.I on the TIME Project, **agreed** on the plan of action for the TIME Phase-II and **specified** TIME products and services as presented in Annex VII.

55 **The Group expressed** thanks to Japan for continuing support to the project and to the USA and IOC for financial support in implementing Phase-I.

56 **The Group noted** the need for extra funding to support the second phase of the project and **urged** Member States and the Executive Secretary IOC to provide the required funds at the level given in above-mentioned Annex.

3.2 REGIONAL SEMINARS ON DIGITAL BATHYMETRY DATABASE

57 Dr. V. Gusiakov, the Chairman of the IUGG Tsunami Commission informed the Group on the progress in the implementation of the Recommendation ITSU-XVI.2 "*Regional Seminars on Digital Bathymetry Database*". It is a joint ICG/ITSU and IUGG/TC initiative to make digital bathymetric data available for tsunami research and mitigation.

58 For tsunami analyses, there is a need for integrated bathymetric data, not only for the entire ocean, but for particular tsunamigenic regions and even particular harbours and bays as well. Accurate and high resolution bathymetric data are important for numerical simulations and also for other types of tsunami research and applications. For example, bathymetric data are needed for deploying tsunami instruments, development of tsunami inundation mapping, assessment for submarine and/or supermarine landslides,

hindcasting earthquake source mechanisms by solving the inverse problem. Furthermore, during a real tsunami event, real-time tsunami-effect assessment and predictions could be made based on graphical presentations of bathymetric and topographic data. No matter how sophisticated the prediction models are, if the data of bathymetry and coastal topography are insufficient, model predictions are unreliable and may yield misleading information.

59 Dr. V. Gusiakov reported to the Group on the results of two bathymetry workshops held in 1998-1999 in response to Recommendation ITSU-XVI.2. The first International Workshop on Bathymetry and Coastal-Topography Data Management was held 20-21 March 1998, at the Water-Front Activity Center, University of Washington. There were 29 participants with almost 40 papers presented. The focus of the Workshop was on the analysis of quality of existing digital bathymetry arrays, availability of shallow water gridded data and their compatibility with digital elevation model for coastal areas.

60 The Workshop concluded that all bathymetric data needed for numerical simulations can be clearly divided into three space levels: Pacific-wide, regional and local. At the Pacific-wide level, 5-min. resolution data in most cases are sufficient for all kinds of trans-Pacific computations of tsunami propagation. At the second (regional) level, 1-min. data are necessary for regional computation of tsunami generation and propagation. The local level may require data from 500 m to 5 m resolution.

61 As far as deep-water bathymetric data are concerned, the data were improved significantly in the last few years through close international co-operative efforts, especially by the British Oceanographic Data Center (BODC), Japan Oceanographic Data Center (JODC), National Geophysical Data Center (NGDC) and TOPEX (otherwise known as the Sandwell-Smith bathymetry). However, the problem remains for shallow-water bathymetric data (on continental shelves).

62 The Workshop recommended that the owners of bathymetric or coastal topography data should be encouraged to share their data with the larger scientific community. As the first step in this direction, the idea of having several dedicated web sites has been proposed. One of the most interesting sites is being maintained by Robert Kamphaus of PMEL/NOAA:

(http://newport.pmel.noaa.gov/~kamphaus/time/data.html).

63 This site contains the list of data resources compiled at the Center for Tsunami Inundation Mapping Efforts, a component of the PMEL Tsunami Mitigation Programme. Eventually, it is planned that the majority of these datasets, if not already available via ftp, will be included on an ftp site for download.

64 The second Workshop on Bathymetric and Coastal-Topographic Data Management was held on 28 July 1999 in Birmingham, United Kingdom, in conjunction with the IUGG International Tsunami Symposium and with financial support provided by IOC. The presentations and discussions focused on continental slope and shelf data, collected with the help of a narrow multi-beam echo sounder (e.g., SeaBeam). The participants discussed how this type of data, widely used by the research and industrial communities (oceanography, meteorology, navigation, marine geology, oil and gas exploration), be managed and made accessible for tsunami research.

65 In Birmingham, the importance of bathymetry for the tsunami waves evaluation was re-emphasized. The need for detailed bathymetric data, from continental shelves and continental slopes, especially for complex features of submarine canyons and rugged features where a sea-beam type echo sounder can be difficult to substitute was demonstrated.

66 **The Group commended** Dr. Gusiakov for his report and **acknowledged** with satisfaction the implemented activity. **The Group decided** that the initiative was timely and useful and **suggested** that the joint actions of the ICG/ITSU and IUGG/TC on the development of new bathymetry arrays and on organizing meetings where experts from different programmes and scientific areas will have the opportunity to exchange information, be continued.

3.3 PROGRESS IN THE DEVELOPMENT OF THE CD-ROM '*TSUNAMIS IN THE PACIFIC, 47 BC - 2000 AD'*

67 **The Group considered** the report on the implementation of the Project '*CD-ROM Tsunamis in the Pacific, 684-2000'* (Recommendation ITSU-XVI.3) presented by Dr. V. Gusiakov, Project Co-ordinator.

68 The final purpose of this project was to improve the situation by cataloging historical tsunamis in the Pacific by means of organizing them in the form of the database containing all the meaningful historical tsunami data along with additional reference information related to the tsunami problem. This database summarizes the long-term efforts of several research groups and individuals in collecting, refining and digitizing the tsunami-related data. The considerable support provided to the Novosibirsk Tsunami Laboratory within the project implementation by IOC, ITIC (Honolulu, Hawaii) and the NGDC (Boulder, Colorado) was specially acknowledged and appreciated. The current version of the database contains the parametric source and run-up data for the 1495 historical events that occurred in the Pacific from 47 BC to 1999. This represents the most complete parametric tsunami dataset covering the whole Pacific and the full historical period of observations. The data are provided with a specially developed graphic shells (the GIS-type mapping subsystem) for easy data retrieval, manipulation and handling.

69 **The Group noted** with satisfaction that Recommendation ITSU-XVI.3 has been fully implemented. The beta version of the CD-ROM *'Historical Tsunami Database in the Pacific, 47 BC - 1999 AD'* was demonstrated to the Group and copies of the CD-ROM were distributed among the participants. The manual is also available to accompany the CD-ROM.

70 **The Group agreed** that the progress achieved in the development of the comprehensive Historical Tsunami Database in the Pacific (HTDB/PAC) was very encouraging and suggested that this activity should be continued in order to finalize the project in the first half of 2001. Information on the future plans for the HTDB/PAC Project finalization is presented under Agenda Item 8 of the Summary Report.

4. PROGRAMME MATTERS IN LIGHT OF THE INTERSESSIONAL ACTIVITIES

4.1 COMMUNICATION PLAN

71 The Director PTWC presented a summary of contents of the first revision to the Twelfth Edition of the Communication Plan for the Tsunami Warning System in the Pacific. The revision was made available to the Group and was recently mailed to the distribution list. Replacement pages contain updates to mailing addresses, telephone numbers and other contact information for key offices of the TWSP. They also contain modifications to reflect the M=7.0 to M=7.5 change in the warning magnitude threshold for Alaska-Aleutian earthquakes that was approved by the Group at ITSU-XVI.

72 The report on the Summary of Results of Monthly Communication Tests (Document IOC-ITSU-XVII/11) was also discussed. Offices that participated in the tests generally reported that they are receiving the messages within 5 to 10 minutes of when they were issued. However, many Member States do not have any offices that participate. Consequently, the monthly tests are not comprehensively testing the communications system used to issue warnings.

73 **The Group encouraged** all Member States to participate in the monthly tests. **The Group required** the PTWC Director to widely advertise the results of the tests. For this purpose the usage of the ITIC Newsletter was recommended to consider.

74 A wider discussion of PTWC communication tests and bulletins dissemination followed. As a result of these discussions **the Group agreed** on the following:

i. PTWC should disseminate the results of its monthly tests to motivate more active participation;
ii. PTWC should investigate the possibility of issuing a Spanish version of all bulletins;
iii. ITIC should solicit feedback from Member States regarding actions taken in response to warnings.

4.2 WARNING AND WATCHES

75 The ITIC Director presented to the Group background information on the origins of the current format used by the Pacific Tsunami Warning Center in its messages disseminated to the Member States and others following the occurrence of earthquakes exceeding magnitude 6.5. In accordance with Resolution ITSU-VIII.3, the PTWC implemented the dissemination of a single message containing a tsunami warning for persons located in the region that is within three hours tsunami travel time of when the message is issued and a tsunami watch for those who are located outside of the warning region but within six hours tsunami travel time. The implementation of this procedure greatly increased the number of warnings issued. Since the establishment of the Tsunami Warning System in the Pacific, only two warnings had been issued (one in 1966 and one in 1986), in the 22 years prior to the 1989 implementation. In the 10 years since the implementation, there have been at least 15 dissemination of Regional Warning/Watch messages by the PTWC. While all but a few of the earthquakes that resulted in the dissemination of the messages, actually generated tsunamis, it is debatable whether or not some of the tsunamis were of sufficient size and destructiveness to avoid having the associated warnings be termed "*false*."

76 The ITIC Director also presented arguments for the establishment of a definite area of responsibility for the Tsunami Warning System in the Pacific. In the eastern Pacific (North, Central, and South America), the boundary of the System, is relatively easy to define. The northern and western boundaries become more complex due to the presence of substantial marginal basins containing earthquake activity that has generated quite destructive tsunamis historically. The ITIC Director pointed out that destructive tsunamis coming from elsewhere in the Pacific tend to lose their destructiveness on entering the marginal basins and that destructive tsunamis within the marginal basins have never been destructive beyond the basin in which they occurred. He therefore proposed that the area of responsibility for the issuance of Regional Warning/Watches exclude the marginal basins in the western and northern Pacific.

77 The presentation evoked much discussion by the Group. Topics included the sharing of responsibilities between the Pacific Tsunami Warning Center and the Regional or National Warning Centers within the Tsunami Warning System in the Pacific, responsibilities of the emergency managers receiving the messages, and a variety of related issues. The topics of non-warnings, such as the cases in Nicaragua in 1992 and Peru in 1996, were also discussed. This brought on discussion of the need for Regional or National Centers to establish distinct warning criteria suitable for their area and to help neighbouring areas that may not have organized regional warning systems. Also, the topic of message cancellation was discussed. It was suggested that the term cancellation be dropped in favour of simply issuing a '*final*' warning/watch supplement.

78 **The Group recommended** the establishment of an *ad hoc* intersessional study group consisting of representatives from Australia, France, Japan, and the Director of the PTWC, under the Chairmanship of the ITIC Director, to address the issues related to Regional Warning/Watch message content and to the definition of the area of responsibility of the Tsunami Warning System in the Pacific.

79 **The Group approved** Recommendation ITSU-XVII.1 containing the Terms of Reference of the *ad hoc* Working Group and **requested** the Chairman to report the progress in the formulation of a warning and watches proposal to the ITSU Officers meeting and to present the final results to ITSU-XVIII.

4.3 IMPLEMENTATION OF NEW TECHNOLOGIES

The Emergency Managers Weather Information Network (EMWIN)

80 The Representative of the USA briefed the Group on the current status and future plans for the EMWIN system in the Pacific. He noted that through the auspices of the European Union's project for the improvement of the tropical cyclone warning service and the assistance of the South Pacific Regional Environmental Programme, EMWIN receivers were now operational at the Meteorological Services and National Disaster Offices of about 22 island nations. While currently EMWIN reception is limited to those locations within the footprint of the US GOES-WEST satellite, this is scheduled to change. Arrangements have just been completed to begin, sometime in mid-2000, broadcasting the EMWIN data on a satellite operated by the University of Hawaii. The satellite, called PEACESAT, for Pan Pacific Educational and Communications Experiment by Satellite, is located at 175 degrees West and thus will provide coverage well into the Asia continent.

81 **The Group expressed its appreciation** to the USA for this effort and **encouraged** the further development in the use of EMWIN to meet the communications needs for information about all types of natural disasters.

Ocean Bottom Tsunami Detectors

82 Work continued during the intersessional period under the US National Tsunami Hazard Mitigation programme in the development and installation of satellite reporting ocean bottom pressure sensors for the detection of tsunamis. A variety of problems, both technical and natural were overcome and a final version of the system was deployed offshore of Monterey, California some months ago and has been producing excellent data since its installation. The original system of one surface buoy with a satellite transmitter was modified to include a second buoy with its transmitter operating on a different frequency. With two independent paths for the data, 100% data reception has been achieved. With this successful deployment of Monterey, the installation of two additional sensors off the Alaskan coast is underway. The Group recalled that the US Representative was requested at ITSU-XVI to prepare an implementation plan with cost estimates for installation of this system in other areas. The US Representative noted that the revisions that were being made to the system during the intersessional period did not make this possible.

83 **The Group noted the progress** in the system development with great interest and **urged** the US Representative to, by the next Session, provide for the consideration of the Member States, the requested implementation plan and cost estimate.

Seismic Data Exchange and Analysis System (EARTHWORM)

84 The Director, PTWC reported on a new seismic data exchange and analysis system called EARTHWORM that was developed by the US Geological Survey and is now being installed at PTWC, as part of a co-operative programme between the USGS and NOAA. This system will permit PTWC to receive high-quality digital broadband seismic data in real-time from the US National Seismic Network, as well as from an increasing number of broadband seismic stations around the Pacific region outside the US. These data will permit more accurate earthquake hypocenter estimates, as well as better estimates of earthquake magnitude and other characteristics indicative of tsunamigenic potential. The net result to the TWSP will be more timely and accurate warning messages.

New Automated System of Signal Detection

85 A single station, automatic seismic P-wave detection and reporting system development has proceeded slowly over the last several years mainly because it was relegated to lower priority level behind other more pressing issues at the PTWC. The ITIC Director reported that the system is now at a stage where the next action will be the field deployment of a system in Pago Pago, American Samoa.

86 The system consists of a short period seismometer, a programmable digitizer, signal processor, message generator, and a satellite data collection platform. The digitized signal contains about 23bits per sample thus precluding the need for a separate seismic amplifier. The detection sub-system uses a modified version of an algorithm developed some time ago. An encoded message of the picked P-wave arrival time is generated by the processor and passed on to the DCP. The entire system is time-synchronized with GPS. When the message is received by the DCP, it is transmitted to the GOES satellite on a non-scheduled basis within a minute of reception.

87 The system has been operating for nearly all of the intersessional period in the PTWC seismic vault. A comparison of automatic picks by the system and manual picks by a geophysicist show that the system can pick P-phases within 0.5 seconds precision, which is adequate for teleseism location purposes

88 The ultimate objective is to deploy these systems to sites in remote areas of the Pacific where no seismic data is currently available. The systems could readily be deployed at water level sites if the seismometer can be properly placed. A network of these systems can provide the PTWC, or any Member State with a large aperture seismic network for more rapid location of large, distant earthquakes. The ITIC Director has strongly supported the development of the system.

89 **The Group acknowledged** the importance of the information provided under Agenda Item 4.3 and **supported** the need to have an item on new technology development in the agendas of coming sessions in order to have an opportunity of gaining knowledge on the latest technological and software developments which can be helpful for improving the tsunami warning system effectiveness.

5. PROGRESS IN THE ESTABLISHMENT OF THE REGIONAL TSUNAMI WARNING SYSTEMS IN THE PACIFIC REGIONS AND OTHER AREAS

Intra-Americas Sea

90 As the Chairman of the IOCARIBE Tsunami Steering Group of Experts was unable to attend the ICG/ITSU-XVII, the ITIC Director presented materials provided by the Chairman to the Group.

91 The Tsunami Steering Group of Experts noted that tsunami events have been recorded in the Intra-Americas Sea since the 16th Century. In addition, the Caribbean tectonic plate is marked by active subarial and submarine volcanoes and by numerous earthquakes. In the last 150 years, there have been as many as 1,922 tsunami-related fatalities in the region. Local tsunami events, if detected by an operational regional system could be forewarned by minutes to more than an hour.

92 Preventing a major tsunami disaster in the region was the focus of the workshops in the Virgin Islands (1996), Puerto Rico (1997) and Costa Rica (1999). Each attendee at the 1997 tsunami workshop for emergency management was charged with informing his or her head-of-state about the tsunami threat.

93 Taking into account the views and recommendations of the workshops participants, the IOCARIBE Tsunami Steering Group of Experts developed a Project Proposal for the IAS region. The proposal was adopted by the Sixth Session of IOCARIBE and approved by the Twentieth Session of the IOC Assembly in July 1999.

94 The ICG/ITSU was informed that in response to the decision of ITSU-XVI, the countries of IAS named national contacts to deal with the tsunami warning issue. They will assist the Chairman of the IOCARIBE Tsunami Steering Group of Experts with resolving the tsunami problem in the region. A list of national contacts is given in Annex VIII.

95 The presentation of the IAS project raised an extensive exchange of views and opinions.

96 The Delegate of Colombia expressed concern about the strategy adopted for the implementation of an IAS tsunami preparedness programme. From his point of view, the proposition of a regional tsunami warning system in itself implies the existence of a basin-wide threat and promotes a public perception which might be far beyond reality in many, if not most, of the segments of the IAS area. There is abundant historical testimony for very local tsunamis and also some evidence of larger events, mainly on the outer side of the sea, but for countries like Colombia, neither historic data nor modeling results support the idea of a regional source hazard; three of its major cities are on the Caribbean coast and the project could create an undue potential of disruption.

97 He recommended that the IAS regional project should start with a further thorough assessment of hazard, making use of the up-to-date and readily available techniques, such as tsunami wave propagation modeling.

98 The Chairman of the IUGG Tsunami Commission pointed out the great potential danger for landslide tsunamis in the region due to great deposits of sediments. The first studies on the tsunami waves propagation have been carried out in the region and tsunami travel time charts were developed on the basis of bilateral agreements between scientific institutions of Costa Rica and the Russian Federation.

99 The Delegate of France emphasized the need for strengthening educational and awareness components of the project and called on more scientific studies before the creation of an expensive system commences.

100 The Delegate of Nicaragua stressed the need for the establishment of a regional tsunami warning system on the basis of existing networks of national seismic and tidal station networks. The communication plan for the region should be developed where the responsibilities of different national and regional authorities be identified. Existing regional international bodies like CEPREDENAC (Centre for Reduction of Natural Disaster in Central America) should be involved in the project.

101 The Delegate of the USA expressed concern that the project tries to imitate the tsunami warning system in the Pacific with the PTWC at the top of the pyramid of tsunami warning centres. However, the PTWC is teleseismic event-oriented and it is not logical to use the PTWC approach for IOCARIBE. He recommended that the plan should incorporate the expertise gained by the worldwide tsunami community.

102 **The Group recognized** that a tsunami risk exists in the region. However, the approach to the problem presented in the project proposal was not considered as an effective one. **It was recommended** to make a thorough revision of the project, taking into account the latest scientific findings and technological developments. **The Group reiterated** the importance of having a joint meeting of experts from the Pacific and IAS which will critically review the project and propose changes, keeping as the basis the needs for a wide regional education and awareness campaign and the need for close co-ordination between countries in the region. **The Group recommended** inviting a CEPREDENAC Representative to take part in the meeting.

103 **The Group noted** that the extensive distribution of the pamphlet '*Caribbean Tsunami Awareness*' throughout the region is an excellent start for the IAS project proposal and **expressed readiness** to provide the region with available educational and awareness material.

104 **The Group reiterated the willingness** to work closely with the IOCARIBE Tsunami Steering Group of Experts in resolving the problem and to provide the necessary advice and assistance.

South-West Pacific Tsunami Warning System Project

105 The Technical Secretary advised the Group as to the history of the Group's efforts in establishing the SouthWest Pacific Tsunami Warning System Project and requested that the Group give serious consideration to the need of the continuation of efforts.

106 After an extensive discussion it was noted that the conditions which had existed at the start of the project formulation had changed markedly, including the establishment of national and multi-national co-operative efforts in seismology.

107 **The Group decided** that the effort to establish this Project should not be continued. **The Group emphasized**, however, that the ICG/ITSU and its Member States from the region are willing, and prepared, to offer technical assistance to those Member States desiring to establish a National Tsunami Warning Service.

Tsunami Programme in Europe

108 The Delegate of France made a short presentation on the tsunami programmes in Europe named *Genesis* and *Impact of Tsunamis on European Coasts* (GITEC and GITEC TWO) funded by the EU. He informed the Group that GITEC TWO ended at the end of 1998. The first Tsunami Catalogue for Europe, as well as improvements in the simulation modeling have been considered as the most important results of the project. As a contribution to the International Year of the Ocean, LDG organized in Paris in May 1998, a joint IOC-EC International Conference on Tsunamis, attended by more than 40 scientists and persons in charge of warning centres. The proceedings were published in June 1999.

109 The Delegate of France mentioned that the tsunami warning centre built by France and Portugal has been in operation since 1998 and is maintained continuously.

Far East Tsunami Warning Centre

110 The Delegate of Japan recalled the discussions held at ITSU-XVI regarding the establishment of the Far East Centre. In response to ITSU-XVI recommendations, Japan Meteorological Agency conducted a survey of 6 Member States of the Western Pacific on the interest and possibility to provide seismic and tidal observational data to JMA for facilitating early tsunami warning.

111 The survey showed the interest of the Member States and their readiness to collaborate with Japan on this important initiative. The Member States requested Japan to include in tsunami forecasts

information on the location and the magnitude of the earthquake, the estimated times of the first tsunami arrival and the forecast of estimated tsunami heights.

112 JMA began to operate its new tsunami forecasting system in April 1999. This system has the capability to make forecasts of tsunamis caused by the earthquakes for surrounding coastal areas. In 2000, it will be able to issue a tsunami forecast and after minor modifications of the system transmit it automatically to the Member States concerned.

113 **The Group expressed deep appreciation** to Japan for its efforts in providing for the surrounding coastal areas, the estimated tsunami height and times of the first wave arrival caused by the earthquake in the sea between the Asian continent, Korean peninsula and Japan. The tsunami forecast would be transmitted through Global Telecommunications System (GTS) to the Member States concerned, in accordance with the ITSU Communication Plan. **The Group advised** that the possibility of using the Internet should also be considered.

114 **The Group recommended** that information on tsunamis provided by Japan should be transmitted to responsible national authorities directly.

115 **The Group endorsed** Japan's proposal and **adopted,** in principle, the procedure to issue the tsunami forecast as given in Annex IX. **The Group urged** the Member States concerned to ensure that a transmitted tsunami forecast be relayed to Member States securely and rapidly, in accordance with the ITSU Communication Plan. **The Group requested** the IOC Executive Secretary to inform the Governments of China and the Democratic People's Republic of Korea of the developments and invite them to join the system.

116 **The Group further urged** Japan to continue considering the possibility of expanding the centre's functions to the coastal areas in and around the Yellow Sea, the East China Sea and the Western North Pacific. **The Group supported** the need for a regional workshop with the participation of all countries concerned to discuss actions to be taken for the smooth running of the system.

Indian Ocean

117 The Delegate of Australia sought advice from the Group on the best way to develop an integrated tsunami warning system for the Indian Ocean. This is of particular concern to Australia which has an area of high tsunami risk on its north-west (Indian Ocean) coast and is especially vulnerable to distant tsunamis, such as those generated in the vicinity of Indonesia. The IOC has recently established an Indian Ocean Office in Perth (Western Australia) which might be able to assist with international co-ordination.

118 The Delegate of Indonesia supported the need for a co-ordinated Indian Ocean tsunami warning system and pointed out that Indonesia is very vulnerable to local tsunamis on its Indian Ocean coasts. In its capacity as the ASEAN Earthquake Information Centre (AEIC), Indonesia provides quick epicenter determination (preliminary version) of significant earthquakes (magnitude greater than or equal to 5) to the ASEAN member countries. This can be extended to countries in the vicinity of Southeast Asia in an anticipation for tsunami warning systems in the Southwest Pacific and Indian Ocean.

119 **The Group re-affirmed** that a major tsunamigenic region exists in the Indian Ocean area in the vicinity of Indonesia and **recommended** that Australia and Indonesia co-ordinate their activities in the development of a Indian Ocean warning system during the intersessional period. This could be facilitated with the joint involvement of Australian and Indonesian experts in the ITSU Visiting Experts Programme. The Delegates of Australia and Indonesia were invited to consider nominating candidates for the 2000 Visiting Experts Programme and inform the IOC Executive Secretary and the ITIC Director accordingly.

120 **It was agreed** that Australia would report on the progress at ITSU-XVIII.

6. WAYS TO INCREASE PREPAREDNESS FOR AWARENESS OF THE TSUNAMI DANGER

6.1 IYO AND EXPO '98

121 The Technical Secretary introduced this agenda item and described the activities implemented by the Member States during the International Year of the Ocean. The activities oriented on increasing awareness of the needs for the ocean protection were wide-ranging from various sources, sectors and nations. They included organization of scientific meetings, training courses and cruises; publication of educational materials; development of the IYO Web site, visited by more than 600,000 requests; organization of press conferences, briefings and radio programmes and many other initiatives.

122 He paid special attention to the contribution of the Group and individual tsunami experts to the IYO and congratulated the Group with the valuable input of the IYO objectives. He specially thanked Member States for their participation in Expo '98 and provision of the tsunami warning system materials to the exhibition. The UN Pavilion where the tsunami programme was located was visited by millions of visitors and the programme received unique publicity.

123 The Technical Secretary then informed the Group of the decisions of the Twentieth Session of the IOC Assembly relevant to the follow-up actions to the 1998 IYO and called on the Group to consider activities, which may be included in the list of potential actions.

124 **The Group agreed** that the attention to the World Ocean should not cease to exist after the IYO is over. **The Group encouraged** the development of the tsunami press kit discussed under Agenda Item 6.5 and an educational CD-ROM discussed under Agenda Item 6.3 as possible contributions. **The Group welcomed** the efforts of IOC in developing educational materials and **expressed** the hope that they will be published and made available to school children.

6.2 TSUNAMI GLOSSARY

125 The ICG/ITSU Vice-Chairman presented the Revised Version of the Tsunami Glossary. This Glossary contains 6 different lists of definitions on: Tsunami Classification; Tsunami Measurements and Survey; Acronyms and ITSU Organizations; Tide, Mareograph, Sea-level; General Tsunami Terms, Wave measurements. The work is still needed for incorporating graphical material and photographs into the text.

126 **The Group accepted** the new version of the Glossary.

127 **The Group requested**, as a matter of priority, to publish the Glossary in the ITIC Web site by the end of November 1999 and **urged** the ITIC Director and Associate Director to take the necessary steps jointly with the Delegate of France.

128 **The Group also welcomed** the idea of publishing the Glossary in the form of a multi-coloured, high quality booklet. The Delegate of Nicaragua expressed readiness to publish the booklet with some financial assistance from IOC.

129 **The Group agreed** that the Director ITIC and the Delegate of France provide Nicaragua with the necessary graphic materials and photographs before April 2000, in order to make the publication in English and Spanish before January 2001. The Spanish translation of the Glossary will be made by Nicaragua with the assistance of Chile. The French and Russian versions will be done by IOC.

6.3 TRAINING AND EDUCATION

130 The ITIC Director presented his report on the implementation of the Tsunami Visiting Experts Programme and introduced his views on possible ways of improving this programme. He is considering placing greater emphasis on practical training in the operations of regional or local tsunami warning systems that are much more responsive to the needs of the populace during the tsunami events. He also proposed shortening the course to 10 working days and suggested that it might be more useful to conduct the training at the facilities of existing regional warning systems, other than those in Hawaii, so that the experts may gain first hand experience about such systems closer to their own home areas. The ITIC Director will also continue efforts in completing the evaluation of the programme by implementing a survey of past trainees on their experiences.

131 **The Group agreed** in principle with this suggestion, however, it **recommended** to continue organizing the courses under the ITIC auspices in Hawaii at least during the next intersessional period and plan training of four experts in 2000-2001. **The Group also decided** that a more flexible training programme based on the needs of individual trainees is formulated each time when the trainees have been selected and their needs identified.

132 The round table survey organized by the Chairman showed that national training courses are being implemented in about half of the countries participating at the Session. However, very little information is available to the ICG/ITSU members and the IOC Secretariat about the content and programme of these courses.

133 **The Group urged** Member States to include information on national training activities in national reports for the next session and arrange an exchange of views during the session on national experiences.

134 **The Group considered** the need for educational materials and **discussed** the problems related to the usage of the tsunami and earthquake textbooks published by Chile in Spanish and later translated into English and Russian. The textbooks gained a worldwide recognition as valuable educational material. Unfortunately, very little is known on the results of the use of the books in schools. What is known is that there is not a single country where the books were included in the schools curricula. However, the demand for the textbooks as supporting educational material is very high. In some countries the books are used as a model for the production of national textbooks. Today IOC and Chile, the main textbooks producers and stock possessors, are out of stock. **It was recommended** to put the textbooks on the ITIC Web site and **consider** the feasibility of having the textbooks on CD-ROMs. The Delegate of Chile volunteered to publish the textbooks on the Web site, provided the IOC Secretariat would make the books available to Chile in electronic form. The Delegate of the USA volunteered to download them onto a Master CD-ROM and make copies for all Member States. Taking into account the CD-ROM capacity and the volume of the textbooks, the inclusion of other tsunami educational materials in the CD-ROM will be considered.

6.4 TSUNAMI NEWSLETTER

135 The ITIC Director presented to the Group, a proposal to restructure the ITIC information systems. The current information systems employed by the ITIC are the Tsunami Bulletin Board (TBB), the ITIC Web site, and the *'Tsunami Newsletter'*. The ITIC Director proposed a new publication, an annual almanac or yearbook that will contain historical information on ITSU and on major tsunami events that have occurred during the existence of ITSU. It will also contain detailed information on all tsunami events that have occurred during the past year, as well as information on the activities of the Pacific Tsunami Warning Center and the other Regional or National Tsunami Warning Centers that make up the Tsunami Warning System in the Pacific.

136 The '*Tsunami Newsletter*' will become a page of the ITIC Web site. The page will contain summary information on the latest tsunami and cite references to other web sites or sources where more detailed information may be found regarding the event. It will also contain lists of earthquakes for which some tsunami generation may be possible. Readers of these lists will be encouraged to report to the ITIC Director the actual occurrence of tsunamis associated with the events in the lists. Another section of the page will provide notice of forthcoming meetings related to tsunamis. The page will also contain information related to other activities of ITSU and an up-to-date list of ITSU National Contacts. In addition, a 4-page hard copy version of the '*Tsunami Newsletter*' will be published bi-monthly. It will essentially contain all the information that has accumulated on the Web page version over the two-month period since the publication of the previous hard copy newsletter. The structure and function of the TBB will not be changed.

137 **The Group agreed** with the restructuring proposed by the ITIC and **recommended** that the restructuring be implemented. The ITSU National Contacts were requested to provide the necessary information to the ITIC Director for inclusion in the new information systems regularly and without delay.

6.5 ITSU AND THE MASS MEDIA

138 The Chairman invited the Group to consider interaction between the programme and the mass media and to discuss ways of establishing closer links, taking into account the critical role of the mass media in increasing the awareness of the ITSU programme.

139 **The Group considered** a number of options and discussed the experience gained by Member States in their contacts with the mass media.

140 **The Group agreed** on the need to have high quality advertising materials. As the first step in this direction, it **decided** to initiate the publication of a tsunami press kit in order to provide consistent and reliable information to the mass media, in order to avoid confusing people by providing erroneous information.

141 **The Group requested** the ITIC Director to take the lead in developing a press kit with a video section. To assist him in implementing this task, a working group was established with experts from Canada and Chile. **It was agreed** that the draft of the kit is ready for the 2001 ITSU Officers meeting and the final version is available for approval at ITSU-XVIII.

7. EXISTING PARTNERSHIPS AND OPPORTUNITIES FOR NEW ONES

7.1 CO-OPERATION WITH THE IUGG TSUNAMI COMMISSION AND CONCLUSIONS OF THE JOINT TSUNAMI WORKSHOP, SEOUL, 30 SEPTEMBER - 1 OCTOBER 1999

142 The Chairman of the IUGG Tsunami Commission introduced this item by making reference to the IUGG Tsunami Commission activities report for 1995-1999. Many of the activities have been implemented jointly with the ICG/ITSU, including TIME and HTDB projects. Many meetings and publications were arranged and produced with the IOC financial support. However, there is still a place for improving further the co-operation, e.g., in co-ordinating the field surveys or in exchange of information and providing data.

143 He then gave a detailed description of on-going projects and called on the Group to continue and extend bonds of co-operation with the IUGG Tsunami Commission which acts as a scientific Advisory Body to the ICG/ITSU.

144 He informed the Group of the results of the Seoul Workshop, which was the first joint workshop in a series of workshops, which will deal with the plans for further development of the tsunami programme in the years after 2000 and will implement ideas presented in the *ITSU Master Plan*. He invited the Group to support the organization of the Moscow Workshop of 2000 dedicated to a long-term tsunami risk assessment and of 2001 dedicated to tsunami mitigation and counter measures, planned in conjunction with ITSU-XVIII.

145 **The Group expressed** satisfaction with the results of co-operation with the IUGG Tsunami Commission and **decided** to take an active part in the organization and implementation of the proposed joint workshops in Moscow and in 2001. **The Group invited** the Chairman of the IUGG Tsunami Commission to consider arranging the Moscow workshop immediately after the IOC Executive Council session of 2000.

146 The Vice-Chairman of the ICG/ITSU in his capacity of the Co-Chairman of the Seoul Workshop presented to the Group, recommendations of the Workshop (Annex X) and invited the Group to consider ways for their joint implementation.

147 **The Group noted** that some of the recommendations have already been discussed under different ITSU-XVII agenda items and the ways for their implementation have been identified. Working groups have been established to deal with recommendations 1,2,5 and 6. Recommendation 4 is partly covered by the TIME Second Phase proposal. To implement Recommendation 3, the Executive Secretary IOC will be invited to issue a letter informing Member States of the products developed within the HTDB project and inviting them to contact the Pacific Headquarters of the US National Weather Service for available software and consider developing similar software for their areas of interest.

7.2 ICG/ITSU AND IDNDR

148 The Final Forum of the International Decade of Natural Disaster Reduction was held in Geneva in July 1999. The PTWC Director, reported on the presentation he gave in Geneva to the Sub-Forum on Science and Technology regarding progress made in tsunami mitigation during the decade through the efforts of ITSU and its Member States. Key areas for future work in tsunami mitigation were also identified. The presentation will be published as a part of the proceedings of the Sub-Forum.

149 The Forum adopted the Geneva Mandate on disaster reduction to guarantee a safer world for future generations. It also produced a strategy for future action entitled *A Safer World in the 21st Century: Risk and Disaster Reduction*, which will serve as a frame of reference at the international, regional, national, and local levels in all disciplines.

150 Noting the Geneva Mandate on disaster reduction, **the Group resolved** to contribute to the associated implementation plan for a Safer World in the 21st Century as follows:

151 Over the period 2000-2010, co-ordinate the development and implementation of a global tsunami warning system which meets the goals and objectives of the programme *'A Safer World in the 21st Century: Risk and Disaster Reduction'* and particularly:

i. Develop global observation and communication networks and associated standards;
ii. Co-ordinate regional tsunami warning systems and the Pacific-wide Tsunami Warning System within an overall framework of global operations;

iii. Further stimulate research and development into tsunami generation and real-time tsunami warning systems;

iv. Develop standards for the content of tsunami warning messages for international exchange;

v. Co-ordinate global awareness and preparedness for tsunami threats and associated education and training activities; and

vi. Co-ordinate and co-operate with other international groups operating under the Geneva mandate.

7.3 WDC-A, SEG DEVELOPMENT RELATED TO TSUNAMIS

152 Due to the absence of a representative from the World Data Centre-A, Solid Earth Geophysics (WDC-A, SEG), and the ITIC Director made a brief presentation of his knowledge of current activities of the WDC-A related to tsunamis. The WDC-A is in the process of compiling a new catalogue of the United States tsunamis. It is anticipated that the catalogue will contain data to the year 2000. Information from the recently published catalogues for Alaska and the United States West Coast will be incorporated into the new catalogue. The ITIC Director also briefed the Group on a study made by Mr. Allen Hittleman of the WDC-A on inaccuracies and biases in the geophysical databases of the WDC-A.

153 The ITIC Director informed the Group about the availability through e-mail of both the weekly and the monthly preliminary determination of epicenters. There are about 47 parameters possible for each event including information on the occurrence of tsunamis. The ITIC Director stressed the importance of reporting the occurrence of even small, non-destructive tsunamis for this database and other databases such as the HTDB.

154 **The Group thanked** the ITIC Director for his presentation and **agreed** with his comments on the need for the Member States to report to the international community on all sizes of tsunamis in their areas.

7.4 NEW OPPORTUNITIES WITH SOPAC

155 The Director PTWC reported on the increased interest of the South Pacific Applied Geoscience Commission (SOPAC) in the tsunami hazard as a result of the 1998 Papua New Guinea tsunami. SOPAC is an intergovernmental body representing 17 Member States in the South Pacific region, and it has certain hazard assessment and disaster reduction responsibilities. Taking into account the fact that many of the SOPAC Member States do not belong to ITSU, and have interest in mitigating the tsunami hazard, **the Group recommended** the Directors of the PTWC and ITIC, and the Executive Secretary IOC to take the necessary actions to invite SOPAC Member States to become members of the ICG/ITSU. **It was recognized** by the Group that increased co-operation and co-ordination of tsunami-related activities between ITSU and SOPAC would benefit the South Pacific region. **The Group noted with regret** that although SOPAC was invited to send a representative to ITSU-XVII, they were unable to attend due to a conflicting event.

8. NATIONAL PROPOSALS FOR FUTURE PROJECTS AND OTHER BUSINESS

156 Under this agenda item, the Group considered two proposals made by the HTDB Project Co-ordinator. The texts of both proposals are presented in Annex XI to the Summary Report. Both projects are directed to the improvement of the situation with catalogization of historical tsunamis in the Pacific. They will provide better access to the historical data by means of organizing them in the form of a database containing all the meaningful historical tsunami data and an additional reference information related to the tsunami problem.

157 The first proposal '*Basic Pacific Tsunami Catalogue and Database*' foresees the development by the year of 2001 the comprehensive parametric tsunami catalogue covering the whole Pacific and the full historical period of observations (47 BC up to 2000 AD). This catalogue will summarize the long-term efforts of several research groups and individuals in collecting, refining and digitizing the tsunami-related data. It will be provided with a specially developed DOS-based and Windows-based

graphic shells (the GIS-type mapping subsystem) for easy data manipulation and handling. Finally, both main components of the database [historical catalogue and a graphic shell] will be put on a CD-ROM '*Tsunamis in the Pacific, 47 BC - 2000 AD'* This CD-ROM can be widely distributed among the potential users through the IOC and WDC systems.

158 **The Group stressed** that the success of the project will depend on the input from regional co-ordinators having the direct access to the primary sources of historical data and information related to the particular region. The list of regional co-ordinators for 9 of 10 tsunamigenic regions in the Pacific is enclosed as Annex XII.

159 The second proposal entitled "*Web-version of the Historical Tsunami Database*" is connected with the first one and provides a better access to the historical dataset already collected under the HTDB Project through the Internet channels. The proposal foresees establishing a mirror Web-site (presumably at the ITIC, Honolulu) to be connected with the Novosibirsk Tsunami Laboratory (NTL) tsunami server (http://tsun.sscc.ru/htdbpac) run under Windows NT 4.0 and containing the Web-version of the historical tsunami database built on the basis of MS SQL Server. The establishment of a mirror site in Honolulu will increase the accessibility of the database for potential users and will enhance the ITIC ability to provide the recipients with historical tsunami data and information.

160 **The Group agreed** on a high value of both projects and **adopted** Recommendation ITSU-XVII.2.

161 Under 'Other Business' (Agenda item 8), the Delegate of Chile presented information on the plans to commemorate the 40^{th} anniversary of the May 1960 earthquake and tsunami by arranging a special workshop or symposium within the framework of the national bi-annual scientific meeting on Earth Sciences. On 22 May 1960, a great earthquake occurred in the south of Chile (M=9.5) producing destructive tsunami waves that impacted almost every port within the Pacific Ocean. Great losses of lives and property were reported from several countries besides Chile.

162 It is planned to invite internationally renowned tsunami experts to lecture on the subject. He called on the Group to consider providing support to implementing the scientific meeting. **The Group decided** to take it into consideration while formulating programme and budget for 2000-2001.

9. ELECTIONS OF THE CHAIRMAN AND VICE-CHAIRMAN OF THE ICG/ITSU

163 The Technical Secretary briefly reviewed the rules and practical arrangements for the election of the Officers of the main subsidiary bodies as they are presented in the *IOC Manual, Part I*, March 1989. Mr. F. Schindele from France was the sole candidate for the position of Chairman and Dr. C. McCreery from the USA, for the position of Vice-Chairman. The Group took into account the role of France and the USA in promoting the IOC Tsunami Programme's objectives and in strengthening the Pacific Tsunami Warning System, as well as the personal and professional qualities of the individuals whose efforts in supporting the programme and devotion to the ideas of the international co-operation were well known. Mr. F. Schindele and Dr. C. McCreery were unanimously elected as Chairman and Vice-Chairman of the Group. Mr. Schindele and Dr. McCreery thanked the Group for its decision. They stressed that the success of the programme in the future will depend, to a large degree, on the partnership between the Member States and international organizations. More attention should be given to regional projects and awareness efforts, closer links of co-operation should be established with different user groups. The IOC/ITSU Programme should focus on providing effective services and useful products to the user community.

10. PROGRAMME AND BUDGET FOR 2000 - 2001

164 The Technical Secretary referred to the decisions of the Twentieth Session of the IOC Assembly (29 June - 9 July 1999, Paris, France) relevant to the IOC Programme and Budget for 2000-2001. Mr. R. Hagemeyer, speaking as Chairman of the *Ad hoc* Sessional Group on the Programme and Budget, informed the Plenary of the results of the deliberations of the Group. He presented the programme which took into account the decisions of the Group adopted at the Session and provided an estimate of the necessary funding.

165 The Technical Secretary described that the total amount of resources requested for the programme implementation goes far beyond the expected funding from IOC. He emphasized that in order to successfully implement the programme, there will be the need for extra budgetary funding. He called on the delegates to take all the actions necessary to provide financial support to the programme through the IOC Trust Fund arrangements. **The Group urged** the ITSU National Co-ordinators to inform their national authorities of the ITSU-XVII decisions and to continue their efforts in obtaining additional support for the programme.

166 **The Group adopted** Recommendation ITSU-XVII.3.

11. DATE AND PLACE FOR ITSU-XVIII

167 **The Group considered** the kind offers of Colombia and New Zealand to host the next session of the ICG/ITSU and the Joint ICG/ITSU-IUGG Workshop in conjunction with the session. **The Group thanked** Mr. A.E. Ayala Melendez, the Representative of the Embassy of Colombia in the Republic of Korea for his interesting and insightful information about Colombia and Cartagena, and for his invitation to have ITSU-XVIII in his country. After discussion, taking into account the development of regional tsunami centres in Central America, plans for the Regional Tsunami Warning System in the Inter-America Seas, **the Group decided** to accept the offer of Colombia to have ITSU-XVIII and the Workshop in Cartagena in the Fall of 2001.

168 The Group was of the opinion that this decision will raise the interest to the programme in the region and will help to bring many participants to the tsunami meetings. **The Group thanked** New Zealand for the country's offer to host ITSU-XVIII and was of the opinion that New Zealand is welcome to extend the offer to host ITSU-XIX in 2003 in New Zealand if there is still an interest to provide facilities for the ICG/ITSU session. **The Group requested** its Chairman to bring this decision to the attention of the ITSU National Co-ordinator of New Zealand. **The Group recommended** having the next ITSU Officers meeting in Honolulu, Hawaii in January 2001.

12. ADOPTION OF THE SUMMARY REPORT

169 **The Group adopted** the Summary Report and recommendations as they are presented in Annex II. **The Group requested** its Chairman to endorse the final, edited version to be prepared by the IOC Secretariat jointly with the ITSU Officers. **The Group also requested** the Chairman to present the Summary Report and recommendations to the Thirty-third Session of the IOC Executive Council, planned for May-June 2000, for approval.

13. CLOSURE

170 The Chairman thanked the participants for the generous efforts of co-operation that had made the Session so successful and further extended his thanks to the local organizers for the excellent facilities provided. Mr. H. Gorziglia thanked the Group for its kindness and assured them that he will always remember the assistance and understanding he received from the ITSU Officers.

171 **The Group wished** Mr. Gorziglia every success in his future work and stressed that much of the success achieved by the Group was due to Mr. Gorziglia and the Technical Secretary's energy, knowledge and devotion. The Group will remember them for their kindness, friendliness and good humour. Following this, Mr. Gorziglia and Dr. I. Oliounine, the Technical Secretary, were presented, on behalf of the Group, with tokens of their esteem. Dr. Oliounine, in his capacity as the IOC Deputy Executive Secretary, presented Mr. Gorziglia, on behalf of the IOC Executive Secretary, with the ***IOC Certificate of Acknowledgment*** for his outstanding contribution to the ITSU Programme. The Director PTWC, Dr. C. McCreery, on behalf of the Group, presented Dr. Oliounine with the ***Certificate of Appreciation*** for his 20 years of service to the Tsunami Programme.

172 In reply, Dr. Oliounine thanked all the participants for their friendly co-operation and assistance he had encountered during all these 20 years. The secret of the ITSU success was a mix of a few ingredients he said, the quality and dedication of experts, an open and friendly exchange of views that promoted collaboration and effective leadership of the ICG/ITSU Officers. Dr. Oliounine stressed that he was encouraged by the progress that the ICG/ITSU was making in meeting the challenge of saving lives and property. He was confident that through the joint efforts of the ITSU Officers, National Co-ordinators and the IOC Secretariat, the Tsunami Programme would continue to strengthen. He was looking forward to maintaining links with the many friends he had made through ITSU.

173 The delegates expressed thanks to Dr. Oliounine for his hard work, leadership and friendliness he had set.

174 The Chairman closed the Session on 7 October 1999 at 12:00.

ANNEX I

AGENDA

1. OPENING AND ARRANGEMENTS FOR THE SESSION

2. PROGRESS IN THE PROGRAMME IMPLEMENTATION
- 2.1 REPORT OF THE CHAIRMAN
- 2.2 NATIONAL REPORTS
- 2.3 ITIC DIRECTOR'S REPORT

3. IMPLEMENTATION OF ITSU-XVI RECOMMENDATIONS
- 3.1 TIME (TSUNAMI INUNDATION MODELLING EXPERIMENT) PROJECT
- 3.2 REGIONAL SEMINARS ON DIGITAL BATHYMETRY DATABASE
- 3.3 PROGRESS IN THE DEVELOPMENT OF THE CD-ROM '*TSUNAMIS IN THE PACIFIC, 47 BC - 2000 AD'*

4. PROGRAMME MATTERS IN LIGHT OF THE INTERSESSIONAL ACTIVITIES
- 4.1 COMMUNICATION PLAN
- 4.2 WARNING AND WATCHES
- 4.3 IMPLEMENTATION OF NEW TECHNOLOGIES

5. PROGRESS IN THE ESTABLISHMENT OF THE REGIONAL TSUNAMI WARNING SYSTEMS IN THE PACIFIC REGIONS AND OTHER AREAS

6. WAYS TO INCREASE PREPAREDNESS FOR AWARENESS OF THE TSUNAMI DANGER
- 6.1 IYO AND EXPO '98
- 6.2 TSUNAMI GLOSSARY
- 6.3 TRAINING AND EDUCATION
- 6.4 TSUNAMI NEWSLETTER
- 6.5 ITSU AND THE MASS MEDIA

7. EXISTING PARTNERSHIPS AND OPPORTUNITIES FOR NEW ONES
- 7.1 CO-OPERATION WITH THE IUGG TSUNAMI COMMISSION AND CONCLUSIONS OF THE JOINT TSUNAMI WORKSHOP, SEOUL, 30 SEPTEMBER-1 OCTOBER 1999
- 7.2 ICG/ITSU AND IDNDR
- 7.3 WDC-A, SEG DEVELOPMENT RELATED TO TSUNAMIS
- 7.4 NEW OPPORTUNITIES WITH SOPAC

8. NATIONAL PROPOSALS FOR FUTURE PROJECTS AND OTHER BUSINESS

9. ELECTIONS OF THE CHAIRMAN AND VICE-CHAIRMAN OF THE ICG/ITSU

10. PROGRAMME AND BUDGET FOR 2000 - 2001

11. DATE AND PLACE FOR ITSU-XVIII

12. ADOPTION OF THE SUMMARY REPORT

13. CLOSURE

ANNEX II

LIST OF RECOMMENDATIONS

Recommendation ITSU-XVII.1

WARNING CENTER BULLETINS

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

Recognizing the need to continue to seek methods for improving the timeliness, accuracy, and effectiveness of bulletins issued by the PTWC and other local and regional tsunami warning centers,

Being aware of recent scientific and technological advances applicable to the problem of tsunami warning,

Considering the recommendations of the ITIC Director contained in *A Watch and Warning Clarifications* (IOC/ITSU-XVII/12),

Considering the recommendations of the Workshop on Tsunami Warning Beyond 2000: Theory, Practice, and Plans contained in *A Summary of Results and Recommendations of the Seoul Workshop* (IOC/ITSU-XVII/18),

Recommends the formation of an *Ad Hoc* Working Group chaired by the Director, ITIC, and composed of appropriate experts chosen in consultation with the ITSU Officers, to make recommendations regarding the language of bulletins and the area of responsibility of the PTWC, with the Terms of Reference as provided in the Annex to this Recommendation;

Further recommends the formation of a second *Ad Hoc* Working Group chaired by Director, PTWC, and composed of appropriate experts chosen in consultation with the ITSU Officers, to make recommendations regarding procedures and criteria for issuing warnings, watches and cancellations, and regarding more precise tsunami forecasting.

Annex to Recommendation ITSU-XVII.1

Ad hoc Working Group to Clarify the Language of the ITSU Regional Warning/Watch Message and the Area of Responsibility of the Tsunami Warning System in the Pacific

TERMS OF REFERENCE

The Working Group shall:

$ Review the current language used in the initial, supplemental, and cancellation Regional Warning/Watch (RWW) messages disseminated by the Pacific Tsunami Warning Center (PTWC) to Member States of the Tsunami Warning System in the Pacific (ITSU) and others.

$ Recommend to the Member States at ICG/ITSU-XVIII changes in the language of the RWW messages that will clarify the meaning of the messages for emergency managers and others who are involved in making decisions on appropriate action to be taken during periods of tsunami threat in their areas of responsibility.

$ Review current practices used by the PTWC to determine the type of message dissemination- RWW or Tsunami Information Bulletin (TIB)- or no dissemination based on the epicenter location.

$ Recommend to the Member States at ICG/ITSU-XVIII a definition of the Area of Responsibility (AOR) for ITSU within which the PTWC is expected to disseminate appropriate messages regarding tsunami threat from earthquake sources.

$ Further recommend to the Member States at ICG/ITSU-XVIII regions within the ITSU AOR where the PTWC will issue only TIB messages because earthquakes in these areas are never expected pose the threat of a Pacific-Wide tsunami regardless of their magnitudes.

Recommendation ITSU-XVII.2

CD-ROM AND WEB VERSION OF THE BASIC PACIFIC TSUNAMI CATALOGUE AND DATABASE

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

Being informed on the current status and plans for further development of the Historical Tsunami Database in the Pacific (HTDB),

Acknowledging with thanks the efforts of the Novosibirsk Tsunami Laboratory in collecting parametric historical tsunami data and maintaining the HTDB,

Recognizing the importance of a comprehensive historical tsunami catalogue for the Pacific, which would be beneficial for a wide scope of application, and to different user groups,

Noting the value of the catalogue and the database for educational purposes,

Being aware of the value of the Web-version of the HTDB for providing the remote access to the database for wider community,

Recommends accepting the proposals for the implementation during the next intersessional period;

Requests the Executive Secretary IOC to secure the necessary funds for the development of a CD-ROM '*Tsunamis in the Pacific, 47 BC - 2000 AD'* by the middle of 2001 and for the installation of the Web-version of the database in the second quarter of 2000;

Recognizing further that the success of the whole project strongly depends on the level of completeness and the quality of historical data scattered in numerous publications and reports, quite often unavailable outside of an area of the origin,

Encourages the ITSU National Contacts and **urges** the Officers of the ICG/ITSU to provide necessary assistance to the HTDB Project Co-ordinator in collecting and refining historical data within the area of their responsibility.

Recommendation ITSU-XVII.3

PROGRAMME OF WORK AND BUDGET FOR 2000-2001

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

Recalling the view of the IOC Governing Bodies on the IOC Tsunami Programme as a Programme of high priority, which is targeted at saving human lives and reducing the impact of natural disasters and, which was a significant IOC contribution to the objectives of the IDNDR,

Recalling further the discussion during the Session regarding the activities and priorities agreed upon by the Group,

Recognizing that the sustainable development of this important IOC programme cannot be achieved without adequate resources,

Noting with thanks the support to the programme by the IOC through the regular programme budget and the in-kind contributions by the Member States,

Being informed of the IOC Programme and Budget for 2000-2001 adopted by the Twentieth Session of the IOC Assembly,

Emphasizing the need for all Member States of the Pacific to share the operational costs of the tsunami warning system and of the resources required for the implementation of the agreed upon actions in 2000-2001,

Adopts the ICG/ITSU Work Programme for 2000-2001:

i. Provision of increased assistance to the International Tsunami Information Centre (ITIC) for the continuing activities in the following areas:

   - The Visiting Experts Programme (4 trainees) and other training activities which will help Member States of the region to increase their capacity in preventing or diminishing the effects of tsunamis, giving priority to developing States.

   - Preparation and publication of the ITIC Annual Report, six Newsletters, the maintenance and continued development of the Web page and the development of the tsunami press kit.

   Budget: 2000 - US$25,000; 2001 - US$25,000.

ii. Provision of support to the activities of the Associate Director, ITIC including one trip each year to the ITIC.
Budget: 2000 - US$2,000; 2001 - US$2,000

iii. Provision of funds for the organization of meetings of the Group (ITSU-XVIII) in the second half of 2001 in Colombia and the ITSU Officers Meeting in January 2001 in Honolulu, and of the support to the co-ordination meeting within the Caribbean region.
Budget: 2000 - US$8,000; 2001 - US$22,000

iv. Provision of support to two workshops planned for Moscow and Colombia.
Budget: 2000 - US$15,000; 2001 - US$5,000

v. Provision of funds to support the invitation of key speakers for the workshop to be held in Chile marking the 40th anniversary of the 1960 tsunami.
Budget: 2000- US$5,000

vi. Provision of support to the development of the TIME Project - Phase Two
Budget: 2000 - US$20,000; 2001 - US$20,000

vii. Provision of funds for the participation of ITSU Officers/Experts at the meetings of other organizations dealing with relevant problems and of ICG/ITSU Chairman at the meetings of other bodies.
Budget: 2000 - US$3,000; 2001 - US$3,000

viii. Provision of funds to support the creation of the Web server version of the Historical Tsunami Data Base for the Pacific.
Budget: 2000 - US$3,000

ix. Provision of funds to further the work on the Basic Pacific Tsunami Catalogue and Data Bases.
Budget: 2000 - US$10,000.

x. Support to the publication of the tsunami glossary.
Budget: 2000 - US$1,000

Invites all Member States to support the programme by contributions to the IOC Trust Fund and in-kind, through national and regional efforts; and requests the ITSU National Contacts to make national authorities aware of the programme and of the potential benefits of disaster reduction by recognizing the risks, making commitments and allocating resources;

Requests the Executive Secretary IOC to take all necessary measures for providing support to the programme by allocating the necessary funds and staff;

Expresses a strong hope that all activities mentioned in the programme for 2000-2001 above, will receive the necessary funding.

Budget Summary

Item	**2000**	**2001**
	US$	**US$**
i.	25,000	25,000
ii.	2,000	2,000
iii.	8,000	22,000
iv.	15,000	5,000
v.	5,000	
vi.	20,000	20,000
vii.	3,000	3,000
viii.	3,000	
ix.	10,000	
x.	1,000	
TOTALS	92,000	77,000

ANNEX III

LIST OF PARTICIPANTS

I. MEMBER STATES

AUSTRALIA

Mr. A.B. Neal
Assistant Director (Services)
Bureau of Meteorology
G.P.O Box 1289 K
Melbourne, Vic. 3001
Tel: <61> (3) 9669 4087
Fax: <61> (3) 9669 4695
E-mail: b.neal@bom.gov.au

CANADA

Mr. F. Stephenson
Manager, Geomatics Engineering
Canadian Hydrographic Service
Institute of Ocean Sciences
P.O. Box 6000
Sidney, BC V8L 4B2
Tel: <1> (250) 363 6350
Fax: <1> (250) 363 6323
E-mail: stephensonf@dfo_mpo.gc.ca

CHILE

Capt. H.M. Gorziglia (*Chairman*)
6, Norte 1081
Vina del Mar
Tel: <56> (32) 26 65 06
Fax: <56> (32) 26 65 42
E-mail: hgorziglia@shoa.cl

Capt. R. Mac-Kay
Director, Servicio Hidrografico y
Oceanografico de la Armada (SHOA)
Errazuriz 232 Playa Ancha
Valparaiso
Tel: <56> (32) 26 65 02
Fax: <56> (32) 26 65 42
E-mail: shoa@shoa.cl
http://www.shoa.cl/

Dr. R.H. Nunez
Head, Dept. of Oceanography
Servicio Hidrografico y Oceanografico de la
Armada
Errazuriz 232 Playa Ancha
Valparaiso
Tel: <56> (32) 26 66 70
Fax: <56> (32) 26 65 42
E-mail: rnunez@shoa.cl
http://www.shoa.cl/oceano/bios/nunez.html

COLOMBIA

Prof. H. Meyer
Observatorio Sismologico del Suroccidente –
OSSO
Universidad del Valle, Campus Melendez
A. Aereo 25360
Cali
Tel: <57> (2) 339 7222/330 1661
Fax: <57> (2) 331 3418
E-mail: hjm@tsunami.univalle.edu.co
E-mail: hjm_osso@usa.net

Mr. A.E. Ayala Melendez
First Secretary & Consul
Embassy of Colombia
13th Floor, Kyobo Building
1, Chongro 1ka, Chongro-ku
Seoul
REPUBLIC OF KOREA
Tel: <82> (2) 720 1369/61
Fax: <82> (2) 725 6959
E-mail: alvaroa_98@yahoo.com

FRANCE

Dr. F. Schindele (*Vice-Chairman*)
Assistant Director
Département Analyse et Surveillance de
l'Environnement
Laboratoire de Géophysique, B.P. 12
91680 Bruyères-le-Châtel
Tel: <33> (1) 69 26 50 63
Fax: <33> (1) 69 26 70 23
E-mail: schindel@ldg.bruyeres.cea.fr

INDONESIA

Mr. Ibnu Purwana
Head, Geophysics Division
Meteorology & Geophysical Agency
P.O. Box 3540
Jakarta 10720
Tel: <62> (21) 424 64 74
Fax: <62> (21) 424 67 03
E-mail: ibnu@bmg.go.id

JAPAN

Dr. Itsuo Furuya
Director, Earthquake & Tsunami Observations Division
Seismological & Volcanological Dept.
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
Tokyo 100-8122
Tel: <81> (3) 3212 8341
Fax: <81> (3) 3215 2963
E-mail: ifuruya@met.kishov.gp.jp

Dr. Eng. F. Imamura
Associate Professor
Tokyo University
Aoba-ku
Sendai 980 8579
Tel: <81> (22) 217 7513
Fax: <81> (22) 217 7514
E-mail: fimamura@tsunami2.civil.tohoku.ac.jp

Dr. Y. Tsuji
Associate Professor
Earthquake Research Institute
University of Tokyo
1-1-1 Yayoi Bunkyo-ku
Tokyo 113-0032
Tel: <81> (3) 5841 5724
Fax: <81> (3) 5689 7265
E-mail: tsuji@eriou-tokyo.ac.jp

KOREA, REPUBLIC OF

Mr. Chun-woo LEE
Deputy Director-General for Observation
Korea Meteorological Administration
460-18, Shindaebang-dong, Tongjak-gu
Seoul 156-720
Tel: <82> (2) 836 2385
Fax: <82> (2) 836 2386
E-mail: cwlee@kma.go.kr

Mr. Sang-Jo KIM
ITSU National Contact
Director, Aeronautical Meteorological Division
Korea Meteorological Administration
460-18, Shindaebang-dong, Tongjak-gu
Seoul 156-720
Tel: <82> (2) 842 3673
Fax: <82> (2) 842 3674
E-mail: kimsj@kma.go.kr

Mr. Young-soon CHO
Director, Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-dong, Tongjak-gu
Seoul 156-720
Tel: <82> (2) 843 4228
Fax: <82> (2) 841 7664
E-mail: choys@kma.go.kr

Mr. Je-gon YOU
Assistant-Director
Disaster Prevention & Preparedness Bureau
Ministry of Government Administration & Home Affairs
77, Sejongno Chongno-gu
Seoul 110 050
Tel: <82> (2) 3703 5217
Fax: <82> (2) 3703 5566
E-mail:y1000@mogaha.go.kr

NICARAGUA

Dr. W. Strauch
Research Director for Geophysics
INETER, Geofisica
Managua
Tel: <505> 249 27 61
Fax: <505> 249 10 82
E-mail: wil@ibw.com.ni

PERU

Capt. A. Saettone
Jefe Tecnico
Direccion de Hidrografia y Navegacion
Marina de Guerra del Perú
Av. Gamarra No. 500 Chucuito-Callao
Tel: <55> (1) 429 89 25
Fax: <51> (1) 465 29 95/429 75 64
E-mail: asaettone@hidronav.marina.mil.pe

RUSSIAN FEDERATION

Dr. T. Ivelskaya
Director, Sakhalin Tsunami Warning Centre
78, Zapadnaya St.
Yuzhno-Sakhalinsk 693000
Tel: <7> (4242) 72 28 20
Fax: <7> (4242) 72 13 07
E-mail: twc@sakhmail.sakhalin.ru

USA

Mr. R. Hagemeyer
Regional Director, Pacific Region
National Weather Service (NWS)
National Oceanic & Atmospheric Administration (NOAA)
737, Bishop St., Suite 2200
Honolulu, Hawaii 96813-3213
USA
Tel: <1> (808) 532 6416
Fax: <1> (808) 532 5569
E-mail: richard.hagemeyer@noaa.gov

Dr. C. McCreery
Geophysicist-in-Charge
Director, Pacific Tsunami Warning Center (PTWC)
91-270 Fort Weaver Rd.
Ewa Beach, HI 96706-2928
USA
Tel: <l> (808) 689 8207x301
Fax: <1> (808) 689 4543
E-mail: charles.mccreery@noaa.gov

II. ORGANIZATIONS

INTERNATIONAL TSUNAMI INFORMATION CENTRE (ITIC)

Mr. M. Blackford
Director, International Tsunami Information Center (ITIC)
737 Bishop St., Suite 2200
Honolulu, HI 96813-3213
USA
Tel: <1> (808) 532 6423
Fax: <1> (808) 532 5576
E-mail: michael.blackford@noaa.gov

IUGG TSUNAMI COMMISSION

Dr. V. Gusiakov
Head, Tsunami Laboratory
Institute of Computational Mathematics & Mathematical Geophysics
Lavrentieva Pr. 6
Novosibirsk 630090
Russian Federation
Tel: <7> (3832) 34 20 70
Fax: <7> (3832) 32 42 59
E-mail: gvk@omzg.sscc.ru

WORLD METEOROLOGICAL ORGANIZATION (WMO)

Dr. Hyo-Sang CHUNG
Acting Director-General
Meteorological Research Institute
Korea Meteorological Administration
460-18, Shindaebang-dong, Tongjak-gu
Seoul 156-720
REPUBLIC OF KOREA
Tel: <82> (2) 849 0665
Fax: <82> (2) 849 0668
E-mail: hschung@metri.re.kr

III. OBSERVERS

Mr. Kwang-ho PARK
Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: khpark@kma.go.kr

Mr. Yong-Gyu RYOO
Researcher, Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: ryooyg@kma.go.kr

Dr. Samkeun PARK
Senior Seismologist
Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: sam@kma.go.kr

Mr. Sehsub HAN
Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: hanss@kma.go.kr

Mr. Sobeom JIN
Senior Researcher
Structural System & Site Evaluation Dept.
Korea Institute of Nuclear Safety
P.O. Box 114, Yusong
Jaejon 305 600
REPUBLIC OF KOREA
Tel: <82> (42) 868 0265
Fax: <82> (42) 861 2535
E-mail: k257jsb@pinpoint.kins.re.kr

Mr. Ik-Soon CHANG
Senior Meteorologist
Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: ischang@kma.go.kr

Mr. Ho-Man LEE
Researcher, Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: leehm@kma.go.kr

Mr. Sang-Boo CHEONG
Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: jeongsb@kma.go.kr

Mr. Kyung-Hi LEE
Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: kyunghi@kma.go.kr

Mr. Sung-Hoon CHEONG
Earthquake Division
Korea Meteorological Administration
460-18, Shindaebang-pong, Tongjak-gu
Seoul 156 920
REPUBLIC OF KOREA
Tel: <82> (2) 841 7663
Fax: <82> (2) 841 7664
E-mail: shjung@kma.go.kr

IV. IOC SECRETARIAT

Dr. I. Oliounine
Deputy Executive Secretary IOC
1, rue Miollis
Paris 75015
FRANCE
Tel: <33> (1) 45 68 39 63
Fax: <33> (1) 45 68 58 12
E-mail: i.oliounine@unesco.org

Mr. A. Vannier
Assistant to Deputy Executive Secretary IOC
1, rue Miollis
Paris 75015
FRANCE
Tel: <33> (1) 45 68 40 09
Fax: <33> (1) 45 68 58 12
E-mail: a.vannier@unesco.org

ANNEX IV

LIST OF DOCUMENTS[2]

Document Code	Title
WORKING DOCUMENTS	
IOC/ITSU-XVII/1	Agenda
IOC/ITSU-XVII/1	Timetable
IOC/ITSU-XVII/2	Annotated Agenda
IOC/ITSU-XVII/3	Summary Report
IOC/ITSU-XVII/4	List of Documents
IOC/ITSU-XVII/5	List of Participants
IOC/ITSU-XVII/6	Report of the Chairman of ICG/ITSU on Intersessional Activities
IOC/ITSU-XVII/7	National Reports on Tsunami-Related Activities
IOC/ITSU-XVII/8	Report of the ITIC Director
IOC/ITSU-XVII/9	Digital Bathymetry for Tsunami Modeling
IOC/ITSU-XVII/10	'A *Tsunamis in the Pacific, 47 BC - 1999 AD'* Basic Pacific Tsunami Catalogue & Database
IOC/ITSU-XVII/11	Summary of Results of Monthly Communication Tests
IOC/ITSU-XVII/12	Warnings & Watches Clarifications
IOC/ITSU-XVII/13	CANCELLED
IOC/ITSU-XVII/14	Intra-Americas Sea Tsunami System: Education, Warning, Management & Research
IOC/ITSU-XVII/15	Results of the Far East Tsunami Warning Centre Survey
IOC/ITSU-XVII/16	Tsunami Glossary
IOC/ITSU-XVII/17	Restructuring of the ITIC Periodical Publications & Tsunamigenic Event Information Dissemination
IOC/ITSU-XVII/18	Summary of Results & Recommendations of Seoul Workshop
IOC/ITSU-XVII/19	Basic Pacific Tsunami Catalogue & Database: Project Proposal for the Development of the Multi-media CD-ROM '*Tsunamis in the Pacific, 47 BC - 2000 AD'*
IOC/ITSU-XVII/19 Add.1	Web-Version of the Historical Tsunami Database for the Pacific
IOC/ITSU-XVII/20	Progress Report on the TIME Project

2.This list is for reference only. No stocks of these documents are maintained, except for the Summary Report.

ANNEX V

ACTION SHEET BASED ON THE DECISIONS OF ITSU-XVI

Agenda Item	Major Subject	Paras., Res/Rec	Actions	Responsible	Status of Implementation
2.2	**National Tsunami Activities**	22	Send letter of thanks to Member States (MS) who submitted reports but were not able to participate at session.	Chairman ICG/ITSU	Done 15 Nov.'97
		22	Provide abbreviated texts of national reports to ITIC for publication by 1 Dec.'97.	ICG/ITSU Nat. Contacts	Done
		22	Publish texts in ITIC Newsletter (1st half '98).	Director ITIC	Done. 1998 Newsletter
2.4	**TIME Project - Present & Future**	29 Rec. ITSU-XVI.1	Continue support to Training Component of TIME by allocating funds for 1998-99. Training Course in Chile, Apr.'98	Chairman; Tech. Sec.	Done. TC in Chile, Apr.'98. TC in Costa Rica '99
		31-32 Rec. ITSU-XVI.1	Provide support to 2nd phase of TIME through Trust Fund arrangements.	ICG/ITSU MS; Chairman; Tech. Sec.	Letter from Chairman to provide TF support (10.12.98/08.02. 99) No funds received.
2.5	**ETDB**	37 Rec. ITSU-XVI.3	Further development of ETDB Project (Transfer from MS-DOS to Windows 95, new version of mapping subsystem, extension of dataset to entire Pacific, etc.).	Novosibirsk Computing Centre (contact: V. Gusiakov)	Done
		37 Rec. ITSU-XVI.3	Sign contract with Novosibirsk Computing Centre for the development of ETDB.	Tech. Sec.	Done
		38	Provide ETDB development team with regional tsunami data.	ICG/ITSU Nat. Contacts; Director ITIC	Done. Nomination of regional contacts

		39	Develop CD-ROM version of Historical Tsunami Database & provide for demonstration at ITSU-XVII, Fall '99.	Novosibirsk Computing Centre (V. Gusiakov)	Done
2.6	**New Technologies**	40	Develop formal project with detailed budget of international tsunami mitigation plan for submission to ITSU-XVII, Fall '99.	US Nat. Contact; Directors ITIC & PTWC; Chairman & Vice-Chairman ICG/ITSU	Not implemented
		42	Continue routine communication tests	Director PTWC; US Nat. Contact; ICG/ITSU MS	Continuously, once a month
		43	Explore reasons & improve communications between PTWC & SOA of China for delivery of tsunami watches & warnings.	Tech. Sec.; Chairman ICG/ITSU	Done, partly
		45	Prepare national reports on experience in new communication technology development & utilization for submission to ITSU-XVII.	ICG/ITSU Nat. Contacts; Director PTWC	Done
		45	Provide available technical data on EMWIN system to ITSU-XVI participants.	US Nat. Contact	Done
		47	Inform all institutions concerned with change in warning threshold & modify communication plan accordingly.	Director PTWC	Done, Fall'99
		51	Request national oceanographic & hydrographic authorities to check mareograms for minor recordings after each earthquake equal to or greater than magnitude of 6 degrees.	ICG/ITSU Nat. Contacts	Include in invitation letter. Request to include results of the implementation

		54	Inform regional & local observatories on four criteria approach for issuing watch & warnings.	Director PTWC; Vice-Chairman ICG/ITSU	Done, Fall'99
		54	Identify procedure for implementation of Recommendation of transmitting to PTWC arrival time of pP or the focal depth determined by regional network.	Director PTWC; Vice-Chairman ICG/ITSU	Not implemented
3	**ITIC Activities**	58	Identify areas of common interest with the Pacific Tsunami Museum for facilitating co-operation.	Director ITIC	Done
		58	Contribute to activities of Museum.	ICG/ITSU MS	In progress
		62	Continue efforts in increasing membership of ICG/ITSU	Chairman; Director ITIC; Tech. Sec.	Continuous
		65	- Standardize & improve content of Tsunami Newsletter; - Establish ITSU/ITIC Web site; (Spanish version may be available) - Improve collection & accessibility to ITIC library materials.	Director ITIC	- In progress. - Done - In progress
		65	Establish & carry out strategies to better collect information & water level records of all tsunami events.	Director ITIC; WDC-A for SEG	
		65	Assist in development & support of virtual centres for tsunami & tsunami-related data needed by scientific community.	Director ITIC; Chairman IUGG Tsunami Commission	In progress

		67	Send corrections & additions to Field Guide for Post-Tsunami Surveys by 15 Nov.'97	ICG/ITSU Nat. Contacts	Done
		67	Incorporate additions & modifications to Guide & make it ready for publication in English & Spanish.	Mr. S. Farreras; Director ITIC; Nat. Contact Chile	Done
		67	Implement publication of Guide in 4 languages: (E,F,S,R).	Tech. Sec. IOC	Done
		69	Arrange visit of Associate Director to ITIC for briefing & formulation of working plans.	Tech. Sec. IOC; Nat. Contacts: USA & Chile; Director ITIC	Done
4	**Regional TWS in Pacific**	75	Keep Chairman & Secretariat informed of efforts in establishment or improvement of national & regional tsunami warning systems.	ICG/ITSU Nat. Contacts	Done
		77	Implement questionnaire survey within countries interested in establishment of Far East Tsunami Centre, to identify problems, needs & requirements for regional centre.	Nat. Co-ord. Japan; Director ITIC; Chairman ICG/ITSU	Done
		81	Arrange meeting of parties involved in implementation of K/K Project before end of '97.	Tech. Sec.; Nat. Contacts Russia, Japan, USA	Done, Dec.'97, Moscow
		81	Arrange training of experts within K/K Project objectives.	Director ITIC; Tech. Sec.; Nat. Contacts: Russia, USA	Done

		81	Finalize K/K Project implementation by autumn '98	All partners concerned	In progress. Planned for Fall'99
5.1	**Co-operation with IUGG Tsunami Com-mission**	87 Rec. ITSU-XVI.2	Organize set of regional seminars on digital bathymetry as identified in Recommendation.	Chairman ICG/ITSU; Chairman IUGG Tsunami Commission; Tech. Sec.	Mar.'98, Wash., Seattle Jul.'99, Birmingham
5.2	**ICG/ITSU & IDNDR**	90	Extend links of co-operation with IDNDR & identify actions which will contribute to final stage of IDNDR.	Chairman & Vice-Chairman ICG/ITSU	Done
		90	Take steps to improve co-operation with IDNDR Secretariat.	Tech. Sec.	Done
		91	Contribute to international days for Natural Disaster Reduction & inform Exec. Sec. IOC of actions taken.	ICG/ITSU MS	No information provided
5.3	**Tsunami Prog. in Europe**	94	Identify actions for co-operative activities of ICG/ITSU & European group & bring them to attention of ITSU Officers Mtg.	Vice-Chairman; Co-ord. GITEC, Prof. Tinti	'98 Tsunami Conference, May, Paris
5.4	**IOCARIBE**	102	Organize meeting of key people in development of tsunami warning programmes from Pacific, Mediterranean & Caribbean regions.	Chairman, Vice-Chairman ICG/ITSU; Tech. Sec.	Not implemented
		104	(i) Send letter to IOC contacts in region with request to inform officials of high possibility of regional tsunami hazard; (ii) Provide them with information about ICG/ITSU; (iii) Request to name Nat. Contacts to deal with tsunami warning issue.	Chairman ICG/ITSU; Head, IOC Regional Office for IOCARIBE; Tech. Sec.	Done 20.07.98. CL N$^{o.}$1579

6.1	**Tsunami Glossary**	107	Send lists of definitions to all MS & selected IUGG experts in order to get comments & prepare final draft for adoption during ITSU-XVII.	Vice-Chairman ICG/ITSU; Nat. Contact Japan; Tech. Sec.	Done
		108	Follow progress of IASPEI in developing reference books & report views to ITSU-XVII.	Vice-Chairman ICG/ITSU	In progress
6.2	**Training & Education**	110	Conduct survey of former ITIC Visiting Experts Programme participants regarding their recent activities to evaluate effectiveness of Visiting Experts Programme.	Director ITIC	Not implemented
		110	Provide ITIC Director with questionnaires which were used by IOC in conducting the same type of survey within other programmes.	Tech. Sec.	Not implemented
		116	Finalize arrangements for translation & publication of earthquake & tsunami textbooks in Russian.	Nat. Contact Russia; Tech. Sec.	Done
6.3	**Publication of advertising materials**	119-120	Finalize preparation of new version of A Tsunami - Great Waves booklet as contribution to IYO in accordance with timetable presented in para.120	Vice-Chairman ICG/ITSU; Director ITIC	Done, in French
		121	Organize publication of booklet in E, S.	Nat. Contacts: USA, France, Chile	E: published F: published S: translated, publication foreseen
		122	Explore possibility of translation & publication of booklet in Russian.	Tech. Sec; Nat. Contact Russia	In progress
		123	Implement adjustment of graphical content of childrens cartoon book A *Tsunami Warning*, make portable graphics/text separation, apply Spanish text.	Nat. Contact USA	Done, ‘98

		123	Make master copies of artwork & text of cartoon book available to MS upon request.	Director ITIC	Done. Reported to ITSU-XVII
		124	Consider ways of publishing Spanish version of cartoon book.	Chairman ICG/ITSU; Tech. Sec.	In progress
		124	Inform MS of availability of portable form of publication by end of '97.	Director ITIC	Not implemented
		127	Finalize tsunami text & cutout of oceans & coastal zone hazards poster & send comments to producers by Nov.'97.	Tech. Sec.	Done
		129	Provide sponsorship for printing copies of poster in English & other languages.	ICG/ITSU MS	Done
		130	Implement production of at least 1,000 copies of poster in Spanish.	Nat. Contact Chile; Chairman ICG/ITSU	Under development
		131	Look for commitments of other countries in contributing to translation of poster into other than English languages & to ensure its wide distribution.	Tech. Sec.	Partly. Distribution done.
7.	**ICG/ITSU & 1998 IYO**	135	Organize presence of the tsunami programme in national pavilions & UN pavilion of Expo '98.	ICG/ITSU Nat. Contacts; Tech. Sec.	Done
		136	Formulate proposals for presenting tsunami programme at Expo '98 pavilion by 1 Dec.'97.	ICG/ITSU Vice-Chairman; Tech. Sec.	Done
		136	Provide Vice-Chairman with information on space available in UN Pavilion for tsunami programme demonstration by 15 Nov.'97.	Tech. Sec.	Done
8.	**ITSU Master Plan**	138	Provide comments, corrections & additional input to Plan by 1 Dec. '97	ICG/ITSU Nat. Contacts	Done

		138	Incorporate comments into final form by 1 Apr.'98.	Director ITIC	Done
		138	Forward Master Plan to IOC for publication & distribution. Publication was implemented by IOC	Director ITIC; Tech. Sec.	Done. Aug.'99
9.	**National proposals for future projects**	141	(i) See para. 39; (ii) Develop preliminary tsunami bulletin version, test it during 1998-99 & report results to ITSU-XVII.	Nat. Contact France; Vice-Chairman ICG/ITSU	Not implemented
		142	(i) Use modern communication facilities for despatch of documents, e.g., IOC ICG/ITSU WWW Homepage; (ii) Remind national contacts with Internet access to check site regularly.	Tech. Sec.	
10.	**Elections**	145	Send official IOC letter of acknowledgment to Dr. C. McCreery for his input to ITIC activities.	Tech. Sec.	Done
11.	**Programme & Budget 1998-99**	146	Continue & extend MS efforts in support of programme.	ICG/ITSU Nat. Contacts	Continuous
		146	Send letter to MS requesting to support programme in funds through Trust Fund arrangements & in-kind.	Tech Sec.	Done. See comments to para.31-32
		147	Consider ways of providing additional funds to support IDNDR-related activities, other than tsunami programme.	Exec. Sec. IOC	Done

		147 Rec. ITSU-XVI.4	Implement activities identified in work plan presented in Recommendation ITSU-XVI.4 in accordance with established priorities.	Chairman, Vice-Chairman ICG/ITSU; Tech. Sec.; ICG/ITSU MS	Implementation reported to ITSU-XVII. Continuous
12.	**ITSU-XVII**	148	Take necessary actions for organization of session & concluding required formalities not later than beginning of '99.	Tech. Sec.; Chairman ICG/ITSU	Done
		150	Explore possibility before end 1998 of having joint ICG/ITSU Workshop on Tsunami Mitigation in conjunction with ITSU-XVII.	Chairman ICG/ITSU; Chairman IUGG Tsunami Commission; Nat. Contact Rep. of Korea; Tech. Sec.	Done
		151	Organize & implement ITSU Officers Meeting in Jan. '99 under auspices of ITIC.	Chairman ICG/ITSU; Director ITIC; Tech. Sec.	Done
		151	Identify date & place of ITSU-XVIII prior to ITSU Officers Meeting planned for Jan.'99.	Chairman ICG/ITSU; Tech. Sec.	Done
13.	**Adoption of Summary Report**	152	Bring findings of ITSU-XVI to attention of 31st Session of IOC-EC, Nov.'98.	Chairman ICG/ITSU.	Done

ANNEX VI

TERMS OF REFERENCE OF THE ITIC ASSOCIATE DIRECTOR

The responsibilities of the Associate Director are based primarily on assisting the ITIC Director with the implementation of the ICG/ITSU activities assigned to ITIC. His assistance will make of those areas of expertise that will be most beneficial for the ICG/ITSU. It may take the form of helping the ITIC's publications, development and updating the Web page, electronic bulletin board or assistance in the implementation of regional projects.

The list of responsibilities is regularly modified in order to have it adjusted to new needs and demands based on the decisions of the ICG/ITSU sessions. The Director of ITIC, in consultation and in agreement with the Assistant Director provides the Chairman and the Executive Secretary IOC with the Work plan of the Associate Director on an annual basis. The Work plan outlines projects that the Associate Director should accomplish, has deadlines and reporting procedures. The Associate Director is reporting on the implementation of his Work plan to the IOC Officers and the ICG/ITSU.

The ITIC Associate Director need not be physically present in Honolulu and could actually perform the duties in his regular place of work (his own country) using the capabilities of electronic communication, such as the Internet, fax, tele-conferencing and with regular-spaced travel when personal working visits to ITIC are required. The Associate Director is entitled to at least two visits to ITIC during the intersessional period.

ANNEX VII

TIME - PLAN AND BUDGET

TIME Project - Phase Two

PLAN

$ Continue to transfer the technology for producing numerical model inundation maps through training and by disseminating manuals and source codes.

$ Improve the accuracy of runup estimates by calibrating model results with the results from hydraulic experiments and by using fine scale evaluation data to estimate coastal roughness.

$ Improve model accuracy by using a dynamic source and also by considering possible additional contributions to the source from submarine slumps and/or volcanic sources.

PRODUCTS

$ Improved standard methodology for producing more accurate tsunami hazard maps through more accurate initial conditions and runup computations.

$ Wider capacity for applying TIME technology to unmapped coastal areas significantly at risk from the tsunami hazard.

TWO-YEAR BUDGET (US Dollars)

Research Assistant Salary (US$9,000/year x 2 years)	US$18,000
Computer Usage Charges	US$10,000
Computer expendables used during training	US$ 5,000
Costs for hydraulic experiments	US$ 7,000
TOTAL Requested from the IOC	US$40,000

ANNEX VIII

LIST OF IAS NATIONAL CONTACTS

Response from the Caribbean Region to the IOC Circular Letter N$^{o.}$ 1579 of 20 July 1998 and a reminder of 22 March 1999 regarding the nomination of contact points to deal with the Tsunami Programme within the IAS Region, as of September 1999

ANTIGUA & BARBUDA
Mr. Philmore G. Mullin
Logistic Officer
National Office of Disaster Services
American Rd., St. Johns
Antigua W.1
P.O. Box 1399
Tel: <1> (268) 460 7075/462 4206/464 8456
Fax: <1> (268) 462 4742
E-mail: nods@candw.ag
(nominated by the letter of 6 April 1999 from a Division of the Ministry of Home Affairs, NODS)

BAHAMAS
Mr. Arthur Rolle
Deputy-Director
Dept. of Meteorology
(nominated by the letter of 20 May 1999 from the Ministry of Foreign Affairs)

DOMINICA
Mr. Cecil P. Shillingford
Assistant National Disaster Co-ordinator
Ministry of Communication, Works & Housing
Government Headquarters
Rosean
Tel: <1> (767) 448 2401, Ext: 3296/7777/7626
Fax: <1> (767) 448 2883
E-mail: mincomwh@cwdom.dm
(Nominated by the letter of 7 April 1999 from the Ministry of Communication, Works & Housing, Office of Disaster Management)

JAMAICA
Dr. Barbara Carby
Director-General
Office of Disaster Preparedness & Emergency Management
12, Camp Rd.
Kingston 4
Tel: <876> 928 5111-4
Fax: <876> 928 5503/8763
E-mail: odpem@cwjamaica.com
(Nominated by the letter of 12 April 1999 from the Office of Disaster Preparedness & Emergency Management)

ST. KITTS, W.I.
Mr. Carl Herbert
National Disaster Co-ordinator
National Emergency Management Agency (NEMA)
Administrative Office
Old Telephone Building
Central St., Bassterre
Fax: <1> (869) 466 5310
E-mail: nemaskb@caribsurf.com
(nominated by the message of 14 April 1999 from NEMA)

ST. LUCIA, W.I.
Mr. Timothy James
National Disaster Co-ordinator
P.O. Box 1517
Castries
Tel: <1> (758) 452 8802
Fax: <1> (758) 453 2152
E-mail: eoc@candw.lc
(Nominated by the letter of 13 April 1999 from the Office of the Disaster Preparedness & Prevention).

SAN VINCENT & THE GRENADINES
Mr. Maxwell Porter
Seismic Unit
c/o Forestry Division
Ministry of Agriculture & Labour
Kingston
Tel: <1> (784) 472 070/457 8594
Fax: <1> (784) 457 1688
(nominated by the letter of 23 April 1999 from the Ministry of Housing, Local Government, Youth Sports & Community Development)

TRINIDAD & TOBAGO (REPUBLIC OF)
Dr. John Shepherd (Main)
Senior Scientist
Seismic Research Unit
St. Augustine
c/o University of the West Indies
St. Augustine Campus
Tel: <868> 662 4659
Fax: <868> 662 9293

Lt. Col. D.L. Williams (First Alternate)
Director, National Emergency Management Agency
NBS Radio 610 Building
17-19 Abercromby St.
Port of Spain
Tel: <868> 623 1943/2078/8004
Fax: <868> 625 8926
E-mail: nematt@wow.net

Mr. Eli Henry (Second Alternate)
Director, Meteorological Services Division
Ministry of Public Utilities
Rawinsonde Building
Piarco International Airport
Golden Grove Rd.
Piarco
Tel: <868> 669 5465
Fax: <868> 669 4009
(Nominated by the letter of 20 April 1999 from the Ministry of National Security, National Emergency Management Agency)

VIRGIN ISLANDS (UK)
Mr. Elton Georges
Deputy-Governor
Ms. Sharleen DaBreo
Ag. National Disaster Co-ordinator
Office of Disaster Preparedness
3, Wailing Rd.
MacNamara, Tortola
Tel: <284> 494 4499
Fax: <284> 494 2024
http://www.bvigovernment.org
Intl. call sign: ZJL89
(Nominated by the message of 19 April 1999 from the Office of Disaster Preparedness)

ANNEX IX

PROCEDURE TO ISSUE THE TSUNAMI FORECAST FROM THE JAPAN METEOROLOGICAL AGENCY

1. INTRODUCTION

The Japan Meteorological Agency (JMA) issues tsunami forecasts in case of an earthquake with a magnitude equal to or larger than 7.0 occurring in the area shown in the figure attached hereto for the forecast areas as defined in the same figure.

2. FORECAST ISSUED BY JMA

JMA will issue the estimated tsunami heights for each of the forecast areas and estimated times of the first tsunami arrival at the locations defined below for the reference of the Member States in issuing their national tsunami forecasts/warnings.

3. ESTIMATED TSUNAMI HEIGHTS

JMA will categorize the estimated tsunami heights into the following 9 categories: “UNDER 0.5M” A0.5M” A1M” A2M” A3M” A4M” A6M” A8M” and “OVER 10M”. The minimum and maximum heights will be issued for reach forecast area. If the minimum and maximum heights are the same, only one value will be issued. If the estimated height is less than 0.1m for the entire tsunami forecast area, “NO TSUNAMI” will be issued.

4. FORECAST AREAS OF TSUNAMI HEIGHTS

The areas for which JMA will issue the estimated tsunami heights are defined as follows:

COASTS ON TATAR STRAIT
COASTS OF PRIMORJE
EASTERN COASTS OF KOREAN PENINSULA
SOUTHERN COASTS OF KOREAN PENINSULA
NORTHERN COASTS OF WEST JAPAN
WESTERN COASTS OF NORTH JAPAN

The attached figure shows the extent of the forecast areas.

5. ESTIMATED TIME OF TSUNAMI ARRIVAL

The unit of the estimated time of the first tsunami arrival is 10 minutes.

6. LOCATIONS WHERE THE ESTIMATED TIMES OF TSUNAMI ARRIVAL IS ISSUED

The estimated times of the first tsunami arrival are issued at the following 8 locations:

$ COASTS ON TATAR STRAIT
  KHOLMSK
  SOVETSKAYA GAVAN
$ COASTS OF PRIMORJE
  RUDNAYA PRISTAN
  NAKHODKA
  VLADIVOSTOK

$ EASTERN COASTS OF KOREAN PENINSULA
SOKSHO
ULLUNG DO
$ SOUTHERN COASTS OF KOREAN PENINSULA
PUSAN

If the tsunami is too weak to estimate the time of arrival, “NO TSUNAMI” will be issued.

7. TIME TO ISSUE THE TSUNAMI FORECAST

JMA will issue the JMA forecast as soon as it transmits the information on the epicenter to the Pacific Tsunami warning Centre (PTWC).

EXAMPLE OF MESSAGE - 1

WEPA40 RJTD 121322
TSUNAMI BULLETIN ISSUED BY JMA

ORIGIN TIME 1317Z 12 JUL
PRELIMINARY EPICENTER LAT42.8N. LONG139.2E.
SW OFF HOKKAIDO
FOCAL DEPTH 35KM. PREL MAG7.8

TSUNAMI IS EXPECTED ALONG THE FOLLOWING COASTS

ESTIMATED TSUNAMI HEIGHTS ARE:

COASTS ON TATAR STRAIT	FROM 0.5M TO 1M
COASTS OF PRIMORJE	FROM 1M TO 6M
EASTERN COASTS OF KOREAN PENINSULA	FROM 1M TO 2M
SOUTHERN COASTS OF KOREAN PENINSULA	0.5M
* WESTERN COASTS OF NORTH JAPAN	FROM 0.5M TO OVER 10M
* NORTHERN COASTS OF WEST JAPAN	FROM 0.5M TO 3M

ESTIMATED TIMES OF THE FIRST TSUNAMI ARRIVAL ARE:

COASTS ON TATAR STRAIT	
KHOLMSK	1420Z 12 JUL
SOVESTSKAYA GAVAN	1440Z 12 JUL
COASTS OF PRIMORJE	
RUDNAYA PRISTAN	1330Z 12 JUL
NAKHODKA	1330Z 12 JUL
VLADIVOSTOK	1400Z 12 JUL
EASTERN COASTS OF KOREAN PENINSULA	
SOKCHO	1440Z 12 JUL
ULLUNG DO	1430Z 12 JUL
SOUTHERN COASTS OF KOREAN PENINSULA	
PUSAN	1540Z 12 JUL

EXAMPLE OF MESSAGE - 2

WEPA40 RJTD 121322
TSUNAMI BULLETIN ISSUED BY JMA

ORIGIN TIME 1317Z 12 JUL
PRELIMINARY EPICENTER LAT38.4N. LONG139.2E.

NW OFF HONSHU
FOCAL DEPTH 35KM. PREL MAG7.0
THIS MESSAGE IS FOR YOUR INFORMATION ONLY
ESTIMATED TSUNAMI HEIGHTS ARE:

COASTS ON TATAR STRAIT	NO TSUNAMI
COASTS OF PRIMORJE	UNDER 0.5M
EASTERN COASTS OF KOREAN PENINSULA	UNDER 0.5M
SOUTHERN COASTS OF KOREAN PENINSULA	NO TSUNAMI
* WESTERN COASTS OF NORTH JAPAN	0.5M
* NORTHERN COASTS OF WEST JAPAN	UNDER 0.5M

ESTIMATED TIMES OF THE FIRST TSUNAMI ARRIVAL ARE:

COASTS ON TATAR STRAIT	
KHOLMSK	(NO TSUNAMI)
SOVETSKAYA GAVAN	(NO TSUNAMI)
COASTS OF PRIMORJE	
RUDNAYA PRISTAN	1430Z 12 JUL
NAKHODKA	1430Z 12 JUL
VLADIVOSTOK	1440Z 12 JUL
EASTERN COASTS OF KOREAN PENINSULA	
SOKCHO	1520Z 12 JUL
ULLUNG DO	1520Z 12 JUL
SOUTHERN COASTS OF KOREAN PENINSULA	
PUSAN	(NO TSUNAMI)

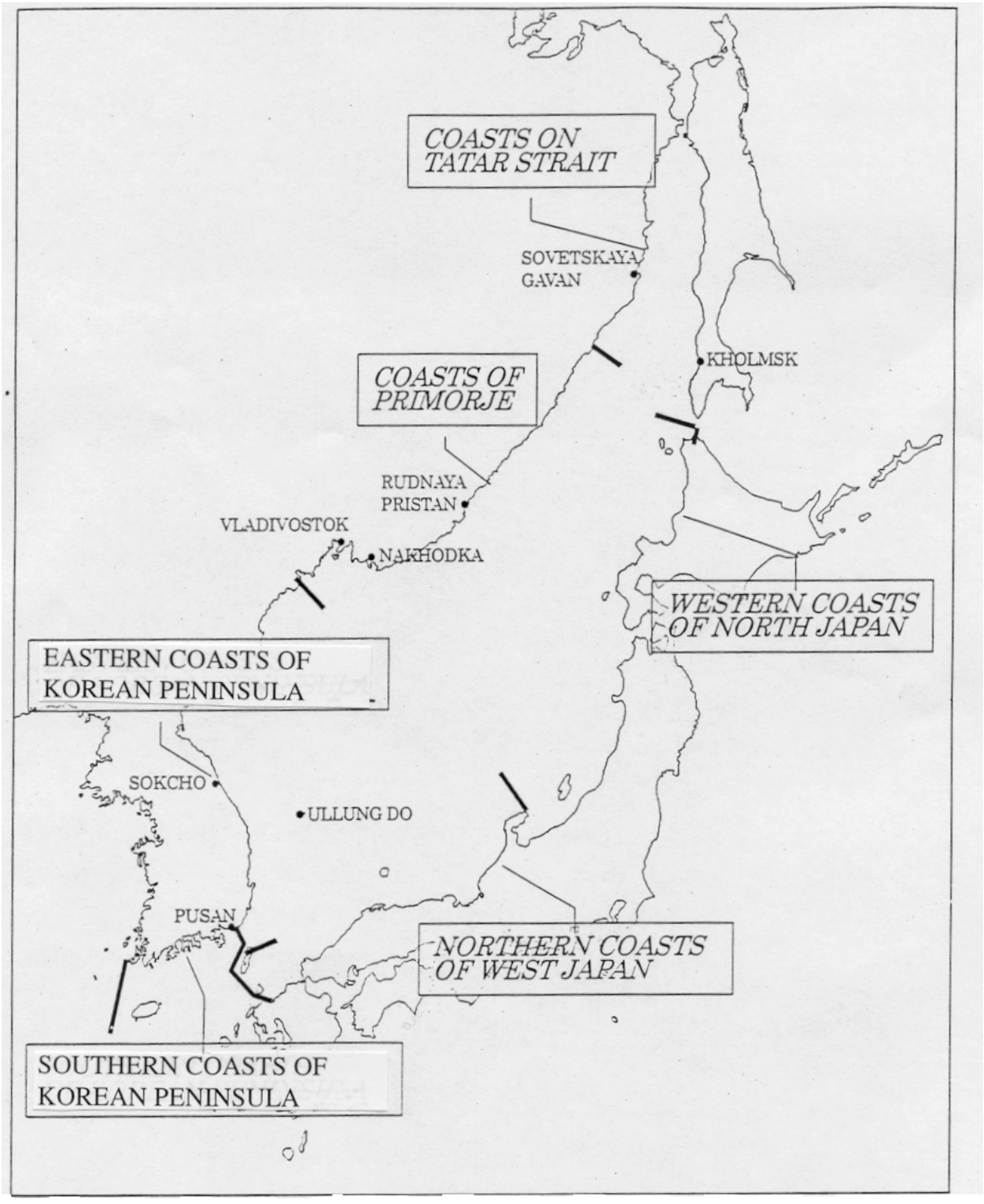

Figure 1: Forecast Areas of Tsunami Heights

ANNEX X

SUMMARY OF RESULTS AND RECOMMENDATIONS OF THE SEOUL WORKSHOP

RECOMMENDATIONS OF THE INTERNATIONAL WORKSHOP ON TSUNAMI WARNING BEYOND 2000: THEORY, PRACTICE AND PLANS SEOUL, SEPTEMBER 30 - OCTOBER 1, 1999

In response to ITSU-XVI recommendations the Workshop '***Tsunami Warning Beyond 2000: Theory, Practice and Plans'*** was organized in Korea from 30 September to 2 October 1999 in conjunction with the ITSU-XVII Session,. This is the first workshop of a series of three workshops planned jointly by the IUGG Tsunami Commission and the International Co-ordination Group of the Tsunami Warning System in the Pacific (ICG/ITSU), which will complement the plan for the further development of the tsunami programme in the years after 2000 (*ITSU Master Plan*, Second Edition, April 1999, IOC/INF-1124). The main purpose of the Workshop was to consider the current situation with warning system operations in the Pacific, to analyze the warning performance and to identify the ways for improvements of warning, accuracy and reliability.

Among the topics discussed during the workshop were:

1. Procedures and criteria for issuing initial warnings and watches
   - i. type and level of magnitude
   - ii. hypocenter depth
   - iii. epicenter location
   - iv. Source duration
   - v. Focal mechanism

2. Procedures and criteria used for warning cancellation
   - i. seismic parameters
   - ii. sea level readings and reports
   - iii. stepped cancellations

3. Tsunami forecasting
   - i. coasts to be warned
   - ii. expected tsunami heights
   - iii. slide/slump risk

Analysis of operations of the tsunami warning system in the Pacific made by the workshop participants indicates that there is the potential for significant improvement of warning effectiveness. Based on presented papers and taking into account the follow-up discussions, the Workshop proposed **the recommendations** presented below as an approach to realizing this improvement.

Recommendation 1

Within the foreseeable future, the tsunami warning criteria must be based on a combination of magnitude, location, depth and source duration. The focal mechanism is also important, but it is probably a secondary level parameter, and its application to warning still requires more research. The workshop **recommended** that specific threshold criteria based on the moment-magnitude, location, depth and source duration for particular tsunamigenic areas be developed.

Recommendation 2

Recognizing that the usefulness of the watch/warning messages issued by the PTWC can be improved by including quantification of expected tsunami height and by restricting the area of dissemination, the Workshop **recommended** that the ICG/ITSU studies ways of accomplishing this.

Recommendation 3

Realizing that one of the major problems emergency managers have to contend with is the difficulty of accessing historical tsunami data for the particular area of interest, the Workshop **recommended** that the ICG/ITSU encourage Member States to take advantage of the Historical Tsunami Database for the US Pacific Coast (HTDB/US) jointly developed by the Novosibirsk Tsunami Laboratory and the US National Weather Service, Pacific Headquarters to provide similar software to their Emergency Management officials. The Executive Secretary IOC was requested to inform the US about the development and invite them to contact the Pacific Headquarters for similar software. The Member States should be requested to look at their data and the HTDB Project and provide the Leader with modifications and additional data.

Recommendation 4

Recognizing that submarine slumping may be a leading factor in tsunami generation, the Workshop **recommended** that coastal regions with high seismicity, strong potential for offshore mass failure, and with vulnerable shorelines be identified. T-phases and other seismic records should be analyzed for evidence of mass failure following anomalous tsunamis. Following the success and ongoing implementation of TIME software by ITSU Member States, **it was also recommended** that software be developed that will provide initial conditions for tsunami generation by both coseismic displacement and mass failure, separately or in combination, that will be implemented on the existing TIME software.

Recommendation 5

Recognizing that there are at least several distinct classes of tsunamigenic earthquakes that have been identified, including normal subduction-zone thrust earthquakes, abnormal earthquakes such as "tsunami" or "slow" earthquakes (1896 Sanriku, 1946 Aleutians, 1992 Nicaragua, 1994 Java, 1996 Peru), large back-arc earthquakes (1983 Akita, 1992 Flores, and 1993 Okushiri), and large outer-rise earthquakes (1933 Sanriku, 1977 Sumba, and possibly 1998 Papua New Guinea), the Workshop **recommended** that operational methods of identifications of abnormal tsunamigenic events be developed and implemented into warning operations.

Recommendation 6

Finally, it was recommended that a standing Working Group led by the PTWC Director should be formed to formulate recommendations for upgrading the procedures and criteria used by PTWC to issue and cancel tsunami warnings in the Pacific Basin. The recommendations should be soundly based on scientific analysis and take into consideration: 1) recent scientific advances in the understanding of tsunami generation, propagation, and termination, 2) historical and numerical model data, and 3) operational capabilities and limitations. These Recommendations should be as specific as possible, with a well-defined path for implementation. The goal of this work is to make the warning system more effective by reducing areas warned unnecessarily while ensuring that informative warnings are issued in as timely a way as possible to areas that will be adversely effected by a tsunami impact.

ANNEX XI

HTDB-RELATED PROJECTS

A. Basic Pacific Tsunami Catalogue and Database
Project Proposal for the Development of the Multimedia CD-ROM
A Tsunamis in the Pacific, 47 BC - 2000 AD

1. Background

The efficiency of operational tsunami warning, as well as the accuracy of long-term tsunami prediction are heavily based on availability and quality of historical tsunami data. In the past, observational data on tsunamis have been compiled and published in the form of tsunami catalogues for the whole Pacific and for the same regions. Collection and refinement of the primary data scattered in numerous sources requires great efforts, and importance of the published catalogues for the tsunami research and mitigation cannot be overestimated.

However, most of the hard-copy tsunami catalogues have been compiled and published in the form of a descriptive plain text of different styles, formats and approaches used. The quantitative data in these catalogues are usually scattered over the text and are not easy to be retrieved and handled. Besides, published catalogues become obsolete rather quickly, as new events occur and additional information for the old historical events becomes available. All these reasons limit to some extent further application of the hard-copy tsunami catalogues in research and practice. The present-day information technology demands organization of data in the form of computerized databases, where data can be kept in a constantly updated and active form and be easily accessible. The information in the database should be easily retrieved in different ways and formats, transferred to other relational databases and used in different data processing and visualization systems.

Recent achievements in the development of Data Base Management Systems (DBMS) along with declining prices and growing capacity of new recording media (CD-ROM and DVD) provide an excellent opportunity to readily bring all observational tsunami data to any researcher who is seeking available information. It is highly desirable to convert all regional and Pacific-wide tsunami catalogues into a computer readable form and make them available to individual researchers along with problem-oriented retrieval and visualization software which can be easily used to handle and process this type of data. The direct access to a large volume of historical tsunami data in standardized formats along with convenient visualization and processing tools will open new possibilities for research related to many aspects of the tsunami problem.

2. Purpose of the Project

The proposed project is aimed to improve the situation with the catalogization of historical tsunamis in the Pacific by means of organizing catalogues in the form of a database containing all the meaningful historical tsunami data, along with an additional reference information related to the tsunami problem. The focus of this project will be on the tsunami data PARAMETRIZATION and their CONVERSION into the digital form rather than on further data COMPILATION. The work on the conversion of the available tsunami catalogues into the digital database started long ago but is still far from completion. A wealth of historical data exists, but these data are not properly organized, are not uniformly collected and they are not readily available. The project will summarize long-term efforts of several research groups and individuals in collecting, refining and digitizing tsunami-related data. Its final product (the database on CD-ROM and Web-site) will represent an updated, revised and homogenous set of observational data otherwise unavailable in digital domain.

3. Content of the Work

Initial data collection will be made in the form of a relational database using some commercially available DBMS software like dBASEIV or FoxBase. This database will be established and maintained at the Tsunami Laboratory of the Institute of Computational Mathematics and Mathematical Geophysics of the Siberian Division, Russian Academy of Sciences in Novosibirsk, Russia, and at the National Geophysical Data Center in Boulder, Colorado, USA, with possible mirror databases established at the International Tsunami Information Center in Honolulu, Hawaii, USA and/or other participating institutions. Three basic parts of a dataset will be a tsunami event catalogue, a tsunami run-up height catalogue and textual descriptions of tsunami manifestation.

After the collection of data is completed, the main content of the database will be exported in the form of several data files with standardized formats and input into a specially developed graphic shell (the GIS-type mapping subsystem) for easy data manipulation and handling. Finally, both main components of the database (historical data and a graphic shell) will be put on a CD-ROM that can be widely distributed among the potential users through the WDC system.

4. Product

The final product will be a full parametric catalogue of historical tsunamis in the Pacific and a CD-ROM "Tsunamis in the Pacific, 47 BC - 2000 AD". The CD-ROM will contain historical tsunami dataset imbedded inside the specialized graphic shell (a geographic mapping subsystem) for easy data retrieval, display and handling. The CD-ROM can be widely distributed among the potential users. Upgraded versions of the database will be published as the new CD-ROM releases thus serving as a comprehensive and periodically updated source of historical and reference data on tsunamis. In addition, the main content of the database (the event catalogue and the tsunami run-up catalogue) can be placed on one or more dedicated Web sites, where they will be readily available for the tsunami community and other users through the Internet.

Upon the accomplishment of the project, its final product (the database and its users release on CD-ROMs) will represent a complete set of historical tsunami data and information along with the supporting software, that will be widely used in real-time operations in Tsunami Warning Centers and for tsunami risk assessment and hazard mitigation in various research projects.

5. Project Duration

Two years (1 March 2000 - 30 August 2001)

6. Project Participants

Tsunami Laboratory, Institute of Computational Mathematics and Mathematical Geophysics (TL/ICMMG), Siberian Division, Russian Academy of Sciences, Novosibirsk, Russia.

International Tsunami Information Center (ITIC), Honolulu, Hawaii, USA.

National Geophysical Data Center (NGDC/NOAA), Boulder, Colorado, USA.

7. Requested Amount of Money

US$10,000 (for 2000).

B. Web-version of Historical Tsunami Database for the Pacific

1. Background

The efficiency of operational tsunami warning, as well as the accuracy of long-term tsunami prediction are heavily based on the availability and quality of historical tsunami data. A wealth of such data exists, but they are not properly organized, not uniformly collected and not readily available. Recent achievements in the development of Data Base Management Systems (DBMS) along with recent enhancements to Internet communications, sophisticated Hypertext browsers, and HTML (Hyper Text Markup Language) provide an excellent opportunity to readily bring all observational tsunami data to any researcher who is seeking available information. The direct access to large volumes of historical tsunami data in standardized formats, along with convenient visualization and processing tools will open new possibilities in the investigations related to many aspects of the tsunami problem.

The primary goal of the proposed project is to test the methodology of construction of the interacting web sites and to present historical tsunami data and information, to anyone who has a high-bandwidth Internet connection and a World Wide Web (WWW) browser to access this information. An additional important advantage is that the user interface is established and standardized by inexpensive and widely available commercial WWW browsers such as Netscape Navigator or Microsoft Explorer; digital images and videos are either directly or indirectly supported; and the development of a specific problem-oriented Web site is straightforward.

Although not currently available to the tsunami community in all ITSU Member States, the Internet computer network will continue to grow and become more accessible to those who are not yet connected. Furthermore, it is already clear that the Internet is the most versatile, convenient, and efficient communication medium for quickly and widely distributing tsunami data, warning status, and related information in real-time during events and for discussing tsunami research, measurement, survey, preparedness, and mitigation issues.

2. Purpose of the Project

The purpose of the proposed project is two fold.

Firstly, it is directed for the enhancement of the International Tsunami Information Center (ITIC) ability to provide the numerous recipients with the historical tsunami data and information.

Secondly, it can be considered as the first step to the development of the Integrated Tsunami Information Network (ITIN) that will serve for the entire tsunami community as an universal information exchange media (Gusiakov, McCreery, Yeh, 1996).

3. Content of the Work

The primary data collection has already been made in the form of a relational database in the Novosibirsk Tsunami Laboratory (NTL) within the Historical Tsunami Database for the Pacific (HTDB/PAC) Project. The database covers the whole period of historical observations of tsunamis in the Pacific (from 47 BC to the present time) and contains parametric source data on 1,490 historical tsunamigenic events and more than 9,000 coastal run-up observations provided with geographical co-ordinates of sites. The database is embedded within specially developed graphic shell that acts as geographic mapping subsystem and provides fast and convenient access to the data. Recently, the basic content of the database (event file and run-up height file) has been converted to MS SQL Server format and made available for remote users through specially developed interface running under standard Internet browsers (Netscape or Internet Explorer). This NTL Web site can be found at http://tsun.sscc.ru/htdbpac.

Because the access to this site from outside of Russia can often be slow (due to the limited capacity

of the domestic Internet channels) it is proposed to establish a mirror site at the ITIC, Honolulu, USA. This site will be connected to the NTL site in the manner allowing all changes made in the database content on the NTL server to be immediately reflected on the ITIC server. It can be achieved through the application of standard replication mechanism of the Internet Information Server.

This two-node network can be considered as a prototype of the future Tsunami Information Network (TIN) for the access to historical data and for information exchange that is organized on the basis of "client-server" methodology as a distributed system with two (on the first stage) server nodes located at the ITIC (Honolulu) and the NTL (Novosibirsk).

The prototype of the system can be assembled and checked on two separate NTL computers connected by LAN, so that the working system could be installed during the short-term (2 week) visit of the NTL site programmer to Honolulu.

4. Product

The final product will be two interacting Web sites (at NTL, Novosibirsk and at the ITIC, Honolulu) that will contain the full parametric catalogue of historical tsunamis in the Pacific and, possibly, the catalogue of historical Pacific earthquakes above certain threshold magnitude (say, higher that 6.0). The NTL staff. It will be supported by the Internet Information Server.

5. Project Duration

Six months (1 January 2000 - 30 June 2000).

6. Project Participants

Novosibirsk Tsunami Laboratory (NTL), Institute of Computational Mathematics and Mathematical Geophysics, Siberian Division, Russian Academy of Sciences, Novosibirsk, Russia.

International Tsunami Information Center (ITIC), Honolulu, Hawaii, USA.

7. Working Schedule

January - April 2000 - experimental installation of the system on two NTL computers in Novosibirsk.
May 2000 - installation of the software and database in Honolulu.
June 2000 - final testing and debugging of the whole system.

8. Requested Amount of Money

Travel Novosibirsk - Honolulu - Novosibirsk	US$1,100
Hotel and per diem for 15 days in Honolulu	US$1,800
Total travel cost	US$2,900
Licensed copy of the MS SQL Server 4.0	US$3,000
Total	US$5,900

ANNEX XII

LIST OF HTDB NATIONAL CO-ORDINATORS

List of Regional Co-ordinators of the HTDB/PAC Project

1. **Mr. Jim Lander** — **Alaska & US Pacific Coast**

CIRES, University of Colorado
Campus Box 449
Boulder, CO 80309 20
USA
Tel: (303) 497 6446
Fax: (303) 497 6513
E-mail: jfl@ngdc.noaa.gov

2. **Dr. Salvador Farerras** — **Central America**

M. Sc. Oceanografia Fisica
Km.107 Carret. Tijuana-Ensenada
Apdo. Postal 2732
Ensenada, B.C., 22800
MEXICO
Tel: <52> (61) 745 050 al 53 Ext.24047
Fax: <52> (61) 750 574 y 75 0507
E-mail: sfarrera@cicese.mx

3. **Dr. Emilio Lorca** — **South America**

Departamento de Geofisica
Universidad de Chile
Casilla 2777
Santiago
CHILE
Tel: <56> (32) 282 697
Fax: <56> (32) 283 537
E-mail: elorca@dgf.uchile.cl

4. **Dr. Willem de Lange** — **New Zealand/Tonga**

Coastal Marine Group
Dept. of Earth Science
The University of Waikato
Private Mail Bag 3105
Hamilton 2001
NEW ZEALAND
Tel: <64> (7) 858 42 39
Fax: <64> (7) 856 0115
E-mail: w.delange@waikato.ac.nz
Web page: http://realjobs.org.nz

5. **Dr. Kevin McCue** — **Australia, New Guinea Solomon Island**
AGSO Seismological Centre
Australian Geological Survey Organization (AGSO)
GPO Box 378
Canberra ACT 2601
AUSTRALIA
Tel: <61> (2) 6249 9675
Fax: <61> (2) 6249 9969
E-mail: kmccue@agso.gov.au

6. **Dr. Ibnu Purwana** — **Indonesia**
Head, Geophysical Division
Meteorological & Geophysical Agency
P.O. Box 3540
Jakarta 10720
INDONESIA
Tel: <62> (21) 424 64 74
Fax: <62> (21) 424 67 03
E-mail: ibnu@bmg.go.id

7. **Dr. Itsuo Furuya** — **Japan**
Director, Earthquake & Tsunami Observations Division
Seismological & Volcanological Dept.
Japan Meteorological Agency
1-3-4 Ote-machi, Chiyoda-Ku
Tokyo 100-8122
JAPAN
Tel: <81> (3) 3212 8341
Fax: <81> (3) 3215 2963
E-mail: ifuruya@met.kishou.go,jp

8. **Dr. Viacheslav Gusiakov** — **Kurile-Kamchatka**
Institute of Computational Mathematics &
Mathematical Geophysics
Pr. Lavrentieva, 6
630090 Novosibirsk
RUSSIAN FEDERATION
Tel: <7> (3832) 342 070
Fax: <7> (3832) 324 259
E-mail: gvk@omzg.sscc.ru
Web page: http://omzg.sscc.ru/tsulab

9. **Dr. Doak C. Cox** — **Hawaii**
Senior Fellow, Joint Institute Marine &
Atmospheric Research
University of Hawaii
1929 Kakela Drive
Honolulu, HI 96822,
USA
Tel: (808) 949 7893
Email: 105215.575@compuserve.com

Note: The Regional Co-ordinator for **Philippines** should be designated

ANNEX XIII

LIST OF ACRONYMS

ASEAN	Association of South-East Asian Nations
CIRES	Co-operate Institute for Research In Environmental Science (USA)
CPPT	Polynesian Tsunami Warning Centre (France)
DCP	Data Collection Platform
EC	European Community
ETDB	Expert Tsunami Data Base
EU	European Union
GIS	Geographic Information System
GOOS	Global Ocean Observing System
GPO	General Post Office
GPS	Global Positioning System
HTDB	Historical Tsunami Data Base
IAS	Inter-Americas Sea
IASPEI	International Association of Seismology & Physics of the Earth's Interior
ICG/ITSU	International Co-ordination Group for the Tsunami Warning System in the Pacific
IDNDR	International Decade for Natural Disaster Reduction
INF	Information Document (IOC)
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOCARIBE	IOC Sub-Commission for the Caribbean & Adjacent Regions
ITIC	International Tsunami Information Centre
IUGG	International Union of Geodesy & Geophysics
IYO	International Year of the Ocean (1998)
JMA	Japan Meteorological Agency
KMA	Korean Meteorological Agency
LAN	Land Area Network
LDG	Laboratoire de Géophysique (France)
NOAA	National Oceanic & Atmospheric Administration (USA)
PMEL	Pacific Marine Environmental Laboratory
PTWC	Pacific Tsunami Warning Centre
SOA	State Oceanic Administration (China)
SOPAC	South Pacific Applied Geoscience Commission
TF	Trust Fund (IOC)
TOPEX	Ocean Topography Experiment

TUNAMI	Tohoku University Numerical Analysis Modeling for Inundation (Japan)
TWC	Tsunami Warning Centre
TWS	Tsunami Warning System
TWSP	Tsunami Warning System in the Pacific
UNESCO	United Nations Educational, Scientific & Cultural Organization
USGS	United States Geological Survey
WDC	World Data Centre