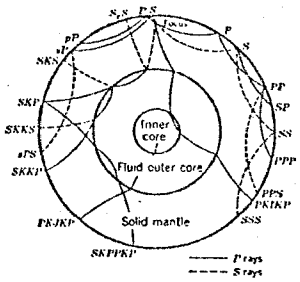

INTERNATIONAL TSUNAMI INFORMATION CENTER
NEWSLETTER

ITIC, 2525 CORREA RD., UNIVERSITY OF HAWAII
HONOLULU, HAWAII 96822 USA 15 JUNE 1972

This first issue of the ITIC Newsletter since organizational changes have occurred within the U.S. Department of Commerce describes ITIC as it now is, describes projected changes, reports on the IOC ICG Tsunami meeting, and gives an outline of proposed research response by the Joint Tsunami Research Effort in the event of a major tsunami.

News items of interest are being solicited from all sources for the next ITIC Newsletter. Please forward news items as soon as possible to: Director, ITIC, 2525 Correa Road, Hawaii Institute of Geophysics, Honolulu, Hawaii 96822. Plans are to assemble to next Newsletter for September 1, 1972.

ORGANIZATIONAL INFORMATION ON ITIC

During the past year, a series of organizational changes within the Department of Commerce has resulted in a shifting of the International Tsunami Information Center (ITIC) from the agency which was the Coast and Geodetic Survey (now the National Ocean Survey) to a section of the National Oceanic and Atmospheric Administration (NOAA) called the Environmental Research Laboratories. Headquarters for the seismological division have been moved from the Washington, D.C. area to Boulder, Colorado.

The seismological and magnetic observatory staff at Ewa Beach remains the same as it was prior to the reorganization. The operational aspects of the tsunami warning system have not changed. Of course, efforts to improve the warning system continue, and there are slight modifications in communications plans and data acquisition systems.

The Coast and Geodetic Survey Honolulu Field Office in downtown Honolulu was directed by Capt. Watkins, and prior to that, Capt. Munson and Capt. Whipp.

The responsibilities of that field office have been distributed to other components of NOAA in Honolulu. We can summarize the current status of the ITIC as follows. The operational part of the tsunami warning system at Ewa Beach remains as it was before. With the closing of the Honolulu Field Office, the directorship of the ITIC has been transferred to Dr. Gaylord R. Miller who also serves as director of the Joint Tsunami Research Effort which is housed at the University of Hawaii.

Plans for further organizational changes which will effect the ITIC have been made. The National Weather Service (formerly the Weather Bureau) had been designated as the agency from which all natural hazard warnings will emanate. This is a change toward an organizational arrangement similar to that in Japan where the Japan Meteorological Agency already has the seismic and tsunami warning responsibilities.

As a start, in order to make the transition smoothly, two personnel assignments have been made transferring Mr. Robert Eppley of the seismology division of the National Ocean Survey (NOS) to the National Weather Service (NWS) in Honolulu. He thus becomes the NWS's first seismologist. Mr. Eppley has had much experience in the tsunami warning system. He has served at Ewa Beach at the observatory and in Washington, D.C. as the National Tsunami Coordinator. Commander Ray Moses, a member of the NOAA Commissioned Corps, has also been aasigned to the Honolulu office of the NWS where, in addition to working on the transitional changes to the tsunami warning system, he serves as the State of Hawaii Tsunami Advisor. Other members of the NWS, including Mr. Paul Kutschenreuter, Director of the Pacific region and Mr. Edward Carlstead who attended the recent ICG meetings in Tokyo, are assisting in the planning and development of capability within the NWS to maintain the tsunami warning system in such a way that there will be no reduction in effectiveness when the transfer is made from the Environmental Research Labs to the NWS. This transition will occur over a long period of time. No aspect of the warning service will be discontinued at the Honolulu Observatory until it is fully functional and operational at the new location of the Tsunami Warning Center at the Honolulu Airport.

Honolulu International Airport was chosen as the location for the new Tsunami Warning Center partly because of the excellent communication facilities which are there. In addition, the National Weather Service maintains a 24-hour

a day operational office there. The new Geo-stationary Orbiting Environmental Satellite, GOES 2, ground station will be at the NWS airport location. Thus, within a comparatively short time, one of the world's most advanced and effective communication systems will be available to the Tsunami Warning Center. It is important to note that with the changes which have been made, there has been no essential change in the operational aspect of ITIC. With the proposed changes which will be occurring over the period of the next year, no changes are planned which will in any way degrade the warning system. In fact, we can realistically look forward to the improvements which will result from the new arrangement.

UNESCO Intergovernmental Oceanographic Commission International Coordination Group for the Tsunami Warning System in the Pacific

The third meeting by the IOC ICG on the tsunami warning system was held in Tokyo 8-12 May 1972. Following the meetings, an exceptionally informative and pleasurable field trip was conducted to observe the tsunami breakwaters and barricades in Iwate Prefecture.

A final report on the meetings will be available later. Most of the following comments on the meeting are taken from the summary report.

Dr. G. L. Pickard, Vice-Chairman of the Group, opened the meeting, welcomed the participants, and made special mention of the addition of Peru and Thailand to the Group. He reported that as Mr. Klaasse, the Chairman of ICG, had retired because of ill health, he had acted as Chairman in preparation for the meeting. It was agreed that Professor Pickard should act as Chairman for the remainder of the meeting.

On behalf of the host country, welcoming speeches were made by Dr. K. Takahashi, Director General of the Japan Meteorological Agency, and Dr. K. Nishida, Director General of the Japan National Committee for UNESCO. They underlined the importance of the work of the Group and wished it every success. On behalf of the IOC, Mr. Tolkachev welcomed the participants and expressed appreciation to the host country and the Japan Meteorological Agency for the warm hospitality and excellent arrangements made for the meeting. Mr. Tolkachev agreed to become rapporteur.

The previously proposed agenda was adopted by the Group without any changes, and the Chairman opened the discussion on the various items.

The Chairman reviewed the report of the actions taken on the Recommendations of the Second ICG Meeting. During the discussion, the representative of the Philippines made a request for one more tide gage, and the Canadian delegate agreed that this would be sent if approval was given by both UNESCO and ITIC. The delegate from the United States stated that they have equipment available, including a number of seismographs and tide gages, and any request from member countries would be welcomed. Such requests should be transmitted through ITIC and UNESCO.

The representative of the IOC Secretariat indicated that invitations to member states to join the Group will be reissued.

The delegates of Canada, Chile, Japan, Peru, United States, the Philippines, and the U.S.S.R. presented reviews of their reports on the national activities of their countries.

The representative of Canada, Mr. Dohler, presented his report describing instrument developments and applications as well as current research on tsunami problems.

The delegate of the USSR expressed his appreciation of the effective work of the Group, and in particular, the ITIC, in further developing the Tsunami Warning System in the Pacific, and noted that the USSR had been actively participating in this work since 1965 in close collaboration with other countries of the Pacific. In this connection, special attention in his report was given to the tsunami dummy transmissions conducted in 1970 and 1971 between Honolulu, Tokyo and Khabarovsk. In these dummy tests, the USSR had used the regulations on the exhange of urgent information between the USSR, Japan and the US set up in December 1964. He mentioned that in the USSR they had been designing new instruments for measuring sea level, and some improvements had been made at the observation stations of the Kurile Islands and Kamchatka. The meeting was also informed of the research work the USSR is doing on improved methods of tsunami forecasting.

In presenting the national report of Chile, Mr. Carcia-Huidobro noted that his country has a complete program for improving the communication network.

In reviewing the report of Japan, Dr. Suyehiro proposed to discuss the setting up of an international formating system so that all tsunami messages can be handled by computers used by Japan for this purpose and to provide rapid relay of information to other countries. Dr. Suyehiro stated that in recent years the tele-communication system around Tokyo had been greatly improved. The Group noted with satisfaction the completion of the plan, introduced during the first meeting of the Group, for the creation of a network of telemetering seismic stations for tsunami warning in Japan. Five Tsunami Warning Centers had been set up in Japan to provide warnings on tsunamis generated by local earthquakes. In answer to a question by Dr. Soloviev, Dr. Suyehiro explained that they palnned to set up ocean bottom stations equipped with seismic and hydraulic pressure gages.

In presenting the US national report, Mr. L. M. Murphy cited the addition of several stations to the Tsunami Warning System during the past two years. By installation of the tide station at Manzanillo, Mexico, it was mentioned the gap between California and Central America will be practically closed. Mr. Murphy described briefly the new communication system in Hawaii for providing immediate communication between the various islands in Hawaii. He also described the Palmer, Alaska system for detection of earthquakes in the Alaskan area. Mr Eppley informed the meeting the next year several communication channels of a geostationary satellite, to be positioned at 0° lat. 100° long., would be available to the Tsunami Warning System for the relay of seismic and sea level data. Dr. Miller summarized the tsunami research as related to source mechanism, propagation and run up, model studies, and instrumentation.

The Peruvian delegate in his report noted that Peru, in cooperation with other Central American countries (Colombia, Ecuador, Trinidad/Tobago, and Venezeula) could undertake studies on tsunamis, in accordance with a program to be developed in the period 1974-1978 under the CERESIS project. He also made some comments on the ITIC proposal on the expansion of the seismic and tidal networks in the Tsunami Warning System, as related to the tide stations in Peru, and expressed the hope that UNESCO would provide support for the establishment of a Peruvian National Service on tsunami warning.

Dr. Gaylord Miller, Director of ITIC, expalined the many organizational changes within ITIC, the relocation of the seismologists, and the moving of the Director's office to the University of Hawaii. He requested those present at the meeting to contribute information which might be appropriate for inclusion in "The International Tsunami Information Center Newsletter." He expressed the desire to have good continuity from now on, and said that he would be sending out inquiries to members of the Group because he is still unfamiliar with many operational aspects. He added that the National Weather Service will ultimately be operating the Tsunami Warning System. Dr. Miller said that two scientists, one from Japan and one from the USSR, had worked at the Center and he expressed the hope that others could also visit the Center in the future. Dr. Soloviev pointed out that there was a great need for the existence of such a Center and that the Group must underline the necessity to take other steps to secure the activities of the Center, the regular preparation of the Newsletter, and the program to enable scientists from different countries to work at the Center, which had proved to be of great help. A recommendation was adopted on this subject.

Dr. Suyehiro of Japan introduced the proposals of Japan on improvement in communication and the Group set up a sub-committee to consider this subject and prepare a recommendation. The meeting was informed about the work of the Joint WMO/IOC Group of experts on tele-communication, and recognizing the pmportance of further close contact with that Group, decided that the Group should be represented at the 4th Meeting of ITELY to be held 12-19 December 1972. It was agreed that the Chairman of the Group would designate a representative of ICG to participate in the above meeting.

Dr. Miller, Director of ITIC, distributed suggestions for the expansion of the Tsunami Warning System. He quoted Recommendation No. 3 from the Vancouver meeting of the Group, i.e., "Considering the locations of seismic and tidal stations in the Pacific Ocean area, it is recommended that a list of key stations be compiled for use in designing a network to protect life and property in those countries belonging to the Tsunami Warning System in the Pacific, and which may join in the future. In selecting the stations, consideration should be given to the tsunami origin, either close to or distant from the coasts. It is further recommended that ICG should accept

the offer of the ITIC to compile a draft list which will be distributed to member states for review and finalization."

The stations in the draft lists were selected on the basis of the following considerations. Existing seismograph and tide stations were chosen, where possible, in order to provide more complete geographic coverage. The density of tide stations in the major tsunamigenic areas will permit tsunami detection within at most one half hour.

Several delegates commented on the proposed tide and seismograph stations to be included in the Pacific Tsunami Warning System. The Group felt that further study of different aspects of this proposal would be necessary by each member country.

Dr. Soloviev, Chairman of the IUGG Tsunami Committee, gave a report on the International Symposium on Tsunamis held in Moscow in August 1971. The Group was informed that reports made at the Symposium would be made available in Russian, and that there are tentative plans to publish the papers in English. Dr. Soloviev outlined proposals of the IUGG Tsunami Committee which are related to the activities of the ICG.

It was agreed that the next meeting should be in two years time, i.e., in early 1974. In the meantime, ICG activities will be coordinated through the Chairman's office.

On the afternoon of Wednesday, May 10th, the Group visited the Japan Meteorological Agency and were shown the various aspects of the mechanisms for receiving and transmitting tsunami information and, in particular, the Tsunami Warning System center. At the conclusion of the visit, two films were shown. These were produced in the USSR and the USA to inform the public on the dangers of tsunamis and on the Tsunami Warning System to mitigate such dangers.

Dr. Suyehiro was elected Chairman and Prof. Pickard was re-elected Vice-Chairman of the Group, both to take office at the conclusion of this meeting.

The Acting Chairman then closed this Third Meeting of the ICG on Thursday afternoon, May 11, 1972.

The Joint Tsunami Research Effort Research Response in the Event of the Generation of a Major Tsunami

The Tsunami Observation Program is divided into two major categories: observations in the immediate area of generation and observations over the area of the ocean boundaries affected by the tsunami.

Section 1 - Existing Water Level Recorders in the Hawaiian Islands

Two standard tide gages exist for the island of Oahu, as well as standard gages at Hilo, Nawiliwili, and Port Allen. Cooperative programs with the AEC have paid for installation of gages at Kona, Hawaii near the airport, and at Mokuleia, Oahu. Three portable tide gages of the float type exist and in the event of an emergency can be installed at existing prepared locations (Haleiwa, Ala Wai, Hawaii Kai). A two-channel, portable, digital tsunami recorder is available, and plans would be to put it at some convenient location, probably at Kewala Basin or the Ala Wai Yacht Harbor.

State of Hawaii funds have been made available for the reactivation of the Hilo Bay gage system. An interested faculty member at the University of Hawaii at Hilo will be participating in the maintenance of these gages. Two time lapse photographic systems exist for Hilo Bay. They are manned on a cooperative basis by the Physics Department of the University of Hawaii at Hilo. The Ocean Engineering Department of the University of Hawaii has a wave gage outside of Kewalo Basin on the south shore of Oahu. This gage and the Mokuleia gage on the north shore of Oahu are telemetered into the National Weather Service and the Hawaii Institute of Geophysics where data are recorded and made available for real time observation.

In the event of a tsunami as many of these water-level recording systems as possible will be activated or be continued in operation.

Section 2 - Observations in the Hawaiian Islands

In the event of a tsunami of a magnitude sufficient to cause noticeable high water marks in the state of Hawaii, the staff members of JTRE have available a set of super-eight movie cameras with time-lapse capability -- four instruments in all, purchased specifically for recording the effects of a tsunami locally. The requirement for time-lapse capability stems from the fact that tsunamis are a relatively long period phenomena. Typical

periods are of the order of 15 to 30 minutes, thus at conventional movie film speed, several sequential films would be required to record even the effects of one cycle of a tsunami.

In general, the largest effects from a tsunami occur in the first few waves. Immediately after the highest waves have occurred and the photographic program is completed, it will be highly useful to obtain data on the highest wave run-up which has occurred along the borders of the islands. In order to obtain the largest number of observations we have procured a large number of metal tags similar to dog tags, each member of the observation team has an allocated number of these tags which are numbered. The tags will be nailed to structures and trees and other places at the level of highest inundation. In places where there is no suitable substrate to nail the tags such as a rocky shore, spray paint will be used. Notes will be taken indicating the location and characteristics of the tree or structure on which tags or markings are placed.

As soon as possible after the tsunami, the same team members which have emplaced the tags and spray paint will go out and level in the maximum run-up heights relative to the sea level at the time. Later these run-up heights will be corrected for the tide elevation at the time of the leveling.

It is believed that each member of JTRE will be able to cover several kilometers of shoreline prior to the time when evidence of maximum run-up is eradicated by either rain or the drying out of the high water marks. Within this observation program, we hope to document the actual run-up height in the Hawaiian Islands to a far greater extent than has previously been done.

Section 3 - Observation Program Remote from These Hawaiian Islands

Observation of the effects of the tsunami remote from the Hawaiian Islands fall into two natural categories. First, there are effects near the epicenter, or local effects within the generating area. Much information was gained in the 1964 Alaskan tsunami by the observations of Van Dorn, Cox, and others which were made immediately after the earthquake in the region of generation. It was possible to separate effects of the major generating mechanism from local landslides and local generation such as occurred at Port Valdes, for example. Direct observation of the net ground motion as

evidenced by the elevation of, or the depression of, the shoreline was made while these evidences were still fresh.

Concurrent with observations being made on the islands of the State of Hawaii and immediately after these observations were completed, selected members of the observation team would be sent to the generating area of the tsunami in order to document effects there. The essential equipment would again be the super-eight movie cameras, metal tags, spray paint and hand levels.

Questionnaires would be handed out to the local population for return to JTRE. Attempts would be made to distinguish at the time of the observations (which hopefully would start within 24 hours after the tsunami generating earthquake) between purely local effects such as land-slide produced waves and the major generating mechanism.

In addition to measurement of local run-up, an attempt would be made to obtain preliminary data on the net ground deformation in the generating area. In the case of the 1964 earthquake, Dr. William Van Dorn of Scripps Institution of Oceanography was able to determine moderately well the form of the ground displacement which generated that tsunami on the basis of observations at a few islands and along the shore of the Gulf of Alaska. Subsequent precise surveys and leveling have confirmed the basic picture presented by Dr. Van Dorn in his preliminary report on that tsunami.

Section 4 - Major Tsunami Effects Remote from the Generating Area

In May 1960 a major tsunami was generated in Chile. The tsunami spread across the Pacific killing many people in the state of Hawaii, mostly at Hilo Bay. The state of Hawaii is about 90 degrees or a fourth of the way around the world from that generating area. Thus the maximum spreading of the energy of that earthquake had occurred by the time the waves reached Hawaii.

As the waves progressed onward past Hawaii and to Japan, there was an actual convergence of the energy. The people of Japan were at that time relatively ill prepared for the magnitude of the wave which occurred. Should a similar event occur in the future which produces extreme wave destruction remote from the epicenter, we would divide the JTRE field observation team into two groups. One would proceed to the generating area and the nearby heavily affected areas, the second would proceed to the remote location where unusual damage had occurred. The division of the group would depend upon

the circumstances of the event. If Japan, for example, were either the heavily affected remote area or the local generating area, requirement for sending JTRE members there would be relatively small. On the other hand, sections of the Aleutian Islands, Alaska, Canada, the west coast of the United States, and Mexico, Central America, Colombia, Equador, Peru, and Chile might be expected to be relatively less well observed. The South Pacific Islands have in the past not been a source of tsunamis which affect the rest of the Pacific in a major way. However, valuable observations of the local effects of tsunamis may be made there.

In each of the three divisions of the tsunami observation program the same basic instrumentation and technique would be used. That is, local instrumentation would be utilized to record wave heights in the best possible fashion. These recordings would be checked immediately after the tsunami for calibration and instrument response. Photographic data would be required, tags and paint marks would be positioned and leveled in for run-up data within the generation area, ground deformation data would be recorded, notes would be taken, and the questionnaire would be handed out in order to broaden the data base as much as possible.

Section 5 - Pre-Tsunami Observation Instructions and Volunteer Observer Program

A set of guide lines for the observation and recording of data relative to tsunamis has been prepared. These instructions relate to techniques for gathering meaningful data about tsunamis. These observation technique papers have with them a questionnaire similar to the one which would be utilized by the members of the field observation team. Instructions are included on the technique for recording visual observations of water elevation relative to some physical feature such as a piling, the face to the cliff, shoreline, or other objects. In addition instructions are given for observations of the character of the water motion, for example, whether it appears as a relatively calm rising and falling of the water such as occurred in Crescent City in 1964, or rather as a bore or highly turbulent on-rush of water as occurred at Hilo in 1960.

Section 6 - Cooperation with Corresponding Agencies on an International Basis

The advance tsunami observation procedures and the questionnaires will be sent out to all the participants in the tsunami warning system directly and

to all the members on the International Tsunami Information Center mailing list. In addition, these instructions and questionnaires should be distributed appropriately within the individual nations to those elements which have warning responsibilities, research institutions, and other federal agencies. In odrer to reach as large a sector of potential observers as possible, there should be encouragement to have the recipients themselves distribute the information to people who should be made aware of the program.

Section 7 - Cooperation with Other Federal Agencies Within the U.S.

The National Oceanic & Atmospheric Administration (NOAA) has prime responsibility for the warning system and associated research related to tsunamis. The Corps of Engineers had a long tradition of involvement owing to the fact the design criteria for various coastal structures must be taken into account the possibility of tsunamis. In addition, tsunami breakwater structures have been contemplated such as have already been built in Japan. The AEC has been traditionally interested in tsunamis. Tsunamis would affect the operation of coastal nuclear power generating plants either by flooding or, just as important, by a sudden draw-down of the ocean such as occurs when there is a leading trough in a tsunami; this would wesult in a lack of cooling water for the plant. A sudden unanticipated lack of cooling water may in some special cases cause a certain amount of damage to a nuclear power generating plant.

The U.S. Geological Survey through their interest in seismology as it relates to the various geological aspects of their area of responsibility has maintained an interest in tsunamis and their affects. The Naval Oceanographic Office has maintained an interest in tsunamis, due to the fact that tsunamis affect ships, particularly ship in harbors, and the harbors themselves.

Other agencies have more specific reasons for and interests in the tsunami observation program. Typical examples include the Office of Economic Opportunity funding of shrimp farms on Maui where there can be destruction of the capital improvement by a tsunami, and flood insurance by the Federal Housing Administration of houses near sea level.

Contact is being made with all of the U.S. agencies which might have any interest in the tsunami observation program.

Section 8 - Instructions for Tsunami Observations

In the event of a tsunami, it would be highly desirable of the characteristics of the water motion were carefully observed so that comparisons could be made between the various theories of wave interaction with shorelines and the observations could meaningfully be made.

The most desirable, most complete record of the tsunami is, of course, wave height as a function of time, i.e., similar to what the output of the tide gage might give. An alert observer with a clock or a watch can produce nearly as good a record in calm water by noting the times and elevations of high and low water. In general, such elevation will have to be estimates although if an observer prepares in advance, it will sometimes be possible to install a staff on a piling or on a pier with height increments marked off on it. A less desirable, but totally acceptable alternative, is for the observer to make a simple estimate of the height of the water with the time of highest and lowest excursion.

It should not be assumed that the first or second wave will be the largest, even if the waves are diminishing in size. Important information is still contained in the way that they diminish with time.

Maximum wave run-up heights are an important parameter in determining the effects of a tsunmmi. These run-up heights can be marked either with paint or by markers such as a nail driven into a tree or a structure. Later on, these markings can be leveled in, relative to sea level or some surveying marker that indicates elevation.

Whenever possible, photographs should be taken and a clock should be included in the picture. Otherwise, the times should be carefully noted for each photograph.

Section 9 - Summary

The Joint Tsunami Research Effort's tsunami observation program includes obtaining: (1) wave records, (2) maximum run-up heights, (3) ground deformation data, (4) time-lapse tsunami movies, (5) photographs of effects, and (6) data acquisition by means of questionnaires from volunteer sources.

Suggestions for improvements and participation in these plans are being solicited from the recipients of this ITIC Newsletter.

VISITING SCIENTISTS TO ITIC

In the past, two very successful and productive visits over an extended period of time to ITIC were made by Dr. Ziadin Abouzarov of the Hydrometeorological Agency, USSR, and Dr. Hideo Watanabe of JMA, Japan. These visits were for the purpose of conducting research and observation of the operational aspects of the tsunami warning system. The visiting scientists spent most of their time at the University of Hawaii, Institute of Geophysics (HIG), with the Joint Tsunami Research Effort. Facilities of the University are made available to the visiting scientists. These include the library, the computing center, machine shop, and publication facilities. In addition to the research staff of the ERL of NOAA at the HIG and the University of Hawaii personnel engaged in tsunami research, many other interested scientists, especially in the fields of seismology and oceanography, are housed at the HIG.

A scientist who may wish to visit the ITIC for an extended period of time should begin making arrangements well in advance of his arrival at the University of Hawaii. Data or other materials which need to be acquired can be obtained in advance and thus be ready when the scientist first arrives. Living costs can be minimized by making plans well in advance also.