Intergovernmental Oceanographic Commission
Technical Series

102

TSUNAMI EARLY WARNING AND MITIGATION SYSTEM IN THE NORTH-EASTERN ATLANTIC, THE MEDITERRANEAN AND CONNECTED SEAS

Second Enlarged Communication Test Exercise (CTE2)

22 May 2012

Vol.1 Exercise Manual

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UNESCO 2012

IOC Technical Series, 102 Vol.1
Paris, October 2012
English only

For bibliographic purposes, this document should be cited as follows:

Intergovernmental Oceanographic Commission. 2012. *Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Second Enlarged Communication Test Exercise (CTE2). Exercise Manual.* Paris, UNESCO/IOC Technical Series No.102 Vol.1. (English only)

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Published in 2012
by United Nations Educational, Scientific
and Cultural Organization
7, Place de Fontenoy, 75352 Paris 07 SP

(IOC/2012/TS/102 Vol.1)

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1. INTRODUCTION

The Tsunami Watch Providers (TWPs), National Tsunami Warning Centres (NTWCs) and Tsunami Warning Focal Points (TWFPs) must keep a high level of readiness so as to be able to act efficiently and effectively to provide for the public's safety during fast-onset and rapidly-evolving natural disasters like the tsunamis. To maintain this high state of operational readiness and especially for infrequent events such as tsunamis, TWP/NTWC and emergency agencies must regularly practice their response procedures to ensure that vital communication links work seamlessly, and that agencies and response personnel know the roles that they will need to play during an actual event. For this purpose, Tsunami Communication Test Exercises (CTEs) must be conducted regularly, ideally every 1 to 3 months on a fully operating system.

General objectives of a CTE are:

(i) Evaluate and validate the Tsunami Watch Providers' dissemination process of issuing tsunami messages to the NEAM (North-Eastern Atlantic, Mediterranean and Connected Seas) region.

(ii) Evaluate and validate the process for countries to receive and confirm tsunami messages.

(iii) Develop and implement mechanisms for the regular update of NTWC and TWFP contacts.

(iv) Help the establishment and updating of Standard Operational Procedures (SOPs) as regards the communications used to disseminate and receive tsunami messages in the NEAM region.

TWFPs are the key players in terms of translating the warning message into essential information for Civil Protection and Disaster Management Authorities (CP–DMA), especially if they are not CP–DMA by themselves. The CTEs are important tools in terms of seeking the involvement of CP-DMAs. Therefore, the NEAMTWS–CTE will address not only the questions related to the evaluation and issuance of the warning message by (candidate) Tsunami Watch Providers, but will also attempt to assess the national and/or local response and warning dissemination mechanisms once emergency authorities receive a warning.

The CTE will involve all possible TWFPs using conventional message dissemination channels, like e-mail, fax and SMS. Message dissemination using GTS will be only available between TWFPs that have that system available at the operational level. It is also desirable that relevant organizations not belonging to the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), like the European Union Monitoring and Information Centre (MIC), and the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (CARIBE-EWS) participate in the NEAMTWS–CTE as observers and they are encouraged to fill also the questionnaires related to the exercise.

Tsunami Communication Test Exercises are planned, conducted and evaluated by dedicated Task Teams established by the ICG/NEAMTWS. This manual together with the report of previously conducted CTEs are available through the IOC website. This manual provides detailed information and guidance on the preparation, conduct and evaluation of a CTE. A CTE Timeline Flowchart has been provided in ANNEX **XIV** to use as a quick-guide for the CTE covering the most essential issues and a CTE Checklist is provided in ANNEX **XV** as a process control mechanism for all parties involved in the CTE. While these two annexes could be considered as a chart summary of the manual, parties involved in a CTE are

strongly encouraged to read this manual thoroughly to have a better understanding of all the requirements in detail.

2. PREPARATION OF NEAMTWS–CTE

The Message Provider is chosen among the candidate TWPs and agreed upon within the ICG/NEAMTWS appropriate Task Team (TT). The identification of the Message Provider will be clearly identified in the CTE announcement. When in operation, the TWPs will define in their SOP the periodicity for conducting CTEs. Message recipients will involve all possible TWFPs and NTWCs belonging to the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS).

The CTE period begins by issuing a first announcement from official channels of the Intergovernmental Oceanographic Commission (IOC) to all TWFPs registered in the NEAMTWS, at least 4 weeks in advance of the planned exercise date. This CTE Manual should also be sent at the First Announcement as an attachment, and the announcement should clearly indicate from where this manual could be downloaded.

In the announcement, CTE participants should be strongly invited to read this manual in detail and report any inconsistencies to the IOC Secretariat. During the following 3 weeks period, TWFPs from Member States (MS) will have the time to correct and or update all the contact information.

The CTE is preceded, one week before, by a Second Announcement sent by the Message Provider via e-mail in order to ensure that the anti-spam and firewall software operating in the Message Receivers' networks do not block the Communication Test Exercise Message. This will also allow the Message Provider to check any limitation in the number of email recipients. The text of these two announcements should be very clear on the actions that are required by the message recipients in order to participate in the exercise and in its evaluation. **Evaluation Questionnaire to Message Receiver (**ANNEX **VI) should also be distributed as a word file to the Message Receivers during this Second Announcement.**

On the day of the second announcement, the IOC Secretariat will send the most up-to-date list of TWFP/TNC contact information in the format below (Table 1) to the Message Provider, copied to the Task Team Chair/Co-Chairs. It should be reminded that it is the responsibility of the Member States to nominate their Tsunami National Contacts (TNCs) and Tsunami Warning Focal Points (TWFPs) and to ensure the actuality of this information.

		TWFP CONTACT INFO				TSUNAMI MESSAGES					
						Fax Message		E-mail Message		Voice Message	
		Name	Address	E-mail	Fax	Primary	Alternate	Primary	Alternate	Primary	Alternate
Country 1	Institute 1										
	Institute 2										
Country 2	Institute 1										
	Institute 2										

Table 1. Format of the TWFP/TNC contact information list

3. DESCRIPTION OF NEAMTWS–CTE

NEAMTWS Tsunami Communication Test Exercises will simulate the dissemination of tsunami messages by one Regional Tsunami Watch Centre (RTWC) Tsunami Watch

Provider (TWP) and its timely reception by the NTWCs and all participating TWFPs. It will try to evaluate the communications delays that may be involved in the international communication systems, and identify possible bottlenecks by requiring the record of adequate time stamps. To do this properly, it is desirable that all exercise participants have their equipments synchronized, either to local time or universal time. If possible, each exercise participant should provide the methods and procedures used to ensure the synchronization of equipments, PCs and fax.

The NEAMTWS–CTEs will use email, fax and GTS as means of communication. It will be conducted in such a way to be completed in a timely manner during reasonable work hours across the time zones found in the NEAM region, most likely between 10.00–14.00 UTC (Universal Time Coordinated). It is important to note that, while being an old generation of communication technology, the well-proven reliability of GTS in case of emergency situations makes its use indispensable.

The NEAMTWS–CTE begins by the broadcast of a Tsunami Test Message by one of the candidate TWP. (See the message description in ANNEX **I** and ANNEX **II**).

In order to simulate in the best way possible the operation of a TWP, the instant when the message provider is aware that a tsunami message has to be delivered should be considered as time zero of the evaluation (time stamp zero or TS0). The message should already be preformatted, missing only the time stamp on the header. The message provider will then take all the actions required to issue this message by email, fax and GTS to all possible message recipients. This means that the preparation latency from the message provider can be also evaluated.

The participant NTWC/TWFP then receives this message. It is required that the operator who receives the message takes note of the time the message was received by the local equipment (TS1), and the time when the message was read and understood by the operator (TS2). It is important that these time stamps are well taken and reported in the evaluation questionnaire. Some guidelines on the cares to be taken to report TS1 accurately are presented in ANNEX **X** and ANNEX **XI**.

The NEAM-TWP tsunami text messages, format and content, including information on the rules used for the numbering of Tsunami Communication Test Messages, can be found in the *Interim Operational Users Guide (I-OUG) for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS)* , also given at the NEAMTWS website. The names of countries/institutions and corresponding abbreviations to be used in the test should also be taken from the I-OUG. [http://neamtic.ioc-unesco.org/images/pdf/neamtws.pdf]

4. REQUIREMENTS AND GUIDELINES FOR THE COMMUNICATION TECHNOLOGIES TO BE USED IN NEAMTWS–CTE

4.1 GENERAL REQUIREMENTS

ASCII character set should be used in the message templates used in all communication technologies. All times in the evaluation questionnaires should be reported in HH:MM:SS UTC format.

Message Providers are encouraged to make use of an interface especially created for message dissemination by accessing preformatted messages and updating the time information and channelling the messages to email, fax and GTS dissemination to avoid human errors.

No country/institution other than the Message Provider is entitled to broadcast the CTE message. Participating institutions are free to make use of CTE message as they wish as long as they ensure that the communication test messages will not cause concern among the public and/or relevant institutions. All deviations from this guideline need to be reported in the Evaluation Questionnaire.

4.2 REQUIREMENTS FOR EMAIL

The number of email message recipients would be restricted to 2 email addresses per agency and 4 email addresses per Member State.

In addition to TS0, TS1E (time stamp of email message) should be reported by the Message Provider. Message Recipients are recommended to develop codes to automatically detect email messages and send the subject line to the designated mobile phone number of TWFP via SMS.

4.3 REQUIREMENTS FOR FAX

The number of fax message recipients would be restricted to 2 per Member State; thus 1 per agency if two agencies are designated. If a single agency has been designated, both primary and alternate fax numbers would be utilized.

At least an 8-channel fax server should be used for the fax message dissemination. The Message Provider should set up the fax server in such a way that each recipient fax number will be subject to at least 3 attempts to send the fax message, where in each attempt the fax recipient will be ringed at. In addition to TS0, TS1F (time stamp of fax message) should be reported by the Message Provider and ASCII character set should be used in the fax message templates.

For the easier evaluation of fax message dissemination, the sequencing of the fax numbers should be done in such a way that in each group, the last two digits of the three digit fax sequence code would always correspond to the same country, sorted in alphabetical order. An example is given in Table 2:

101_COUNTRY-1	INSTNO-1	FAXNO-PRIM
1XX_COUNTRY-N	INSTNO-1	FAXNO-PRIM
201_COUNTRY-1	INSTNO-2	FAXNO-PRIM
1XX_COUNTRY-N	INSTNO-2	FAXNO-PRIM
201_COUNTRY-1	INSTNO-1	FAXNO-ALT

Table 2. Example of fax requirements to be used in CTE

As described above, it is recommended to limit the fax numbers to 2 per institute, where the number of institutes per countries should be limited to 2, also. If required, messages could be distributed by the primary or alternate TWFPs to other national organizations. Any arrangement for this should be within the discretion of the respective country. Member States are encouraged to provide alternate fax numbers.

Message Recipients are recommended to develop codes to automatically detect fax messages and send them as internal email.

4.4 REQUIREMENTS FOR GTS

In addition to TS0, TS1G (time stamp of GTS message) should be reported and ASCII character set should be used in the GTS message templates. In coordination with the WMO-NR (NEAM Region), detailed GTS logs should be acquired both by the Message Provider and Message Recipient, where applicable. Message Recipients are recommended to develop codes to automatically detect GTS messages and send them as internal email. A similar mechanism could be implemented to automatically detect the header of the message and inform the TWFP via SMS.

GTS connects meteorological and other centres throughout the world. Its primary purpose is to distribute meteorological, hydrological, and other data, products, alerts, and warnings to the global meteorological community, composed of member nations of the World Meteorological Organization (WMO). The structure of the GTS makes use of terrestrial communication circuits to disseminate data, products, and messages over a tiered network. The three tiers of the GTS are the World Meteorological Centres (WMCs), the Regional Telecommunications Hubs (RTHs), and the National Meteorological Centres (NMCs).

NTWCs and TWPs should employ backup communications for data and information collection required to detect a tsunami. Alternative communication paths within a centre should be employed by tsunami warning centres. In the event of the failure of one of a centre's primary communication links, such as email or fax, information can be re-routed through a secondary connection. GTS is among the most robust communication methods that are used for the transmission of tsunami warnings. A general overview of GTS can be found in ANNEX **VII**.

4.4.1 GTS Capacity Building

TWFPs should contact their national representative for WMO (WMO-NR; see ANNEX **IX**) to establish the necessary infrastructure for GTS including hardware and software. TWFPs can receive the GTS messages through email, ftp, VPN and/or in-situ satellite system, which are connected to the GTS system hosted by WMO-NR. TWFP contact info should be registered at GTS also through the WMO-NR.

To establish a link between the WMO-NR and the TWFP, the TWFP has to contact its WMO-NR requesting :

- Type of transmission mode existing in the WMO-NR (email, ftp, VPN, ...)
- The establishment of a MoU or other type of agreement to receive the messages.

The TWFP has to provide the list of messages header that would like to receive (ANNEX **VIII**). TWPs are invited and encouraged to cooperate with other TWPs to validate the succesful establishment of GTS links. CENtre d'Alerte aux Tsunamis (CENALT) of France, the Instituto Português do Mar e da Atmosfera (IM) of Portugal, and the Kandilli Observatory and Earthquake Research Institute (KOERI) of Turkey in 2011, before taking place the First Enlarged Communication Test Exercise (ECTE1) (IOC/2011/TS/98Rev.3), which led to the successful utilization of GTS.

The Tsunami Communication Test Exercise will also validate the first part of the transmission path, namely the latency between the TWP and the WMO-NR.

5. MESSAGE SECURITY

Message security is a major concern in any Tsunami Communication Test Exercise. In NEAMTWS–CTE, the message authorship will be ensured by validating the fax number, and/or fax-id code, email address and message headers that the Message Provider will use for the exercise and that are known beforehand. The CTE will provide a true evaluation of the communication channels used for the message dissemination, but it is recommended that message recipients ensure that the anti-spam and firewall software operating in their networks do not block the Communication Test Exercise message.

6. EXERCISE PARTICIPANTS

There are two types of exercise participants: The Message Provider and the Message Receivers. The Message Provider is the candidate Tsunami Watch Provider that offered to participate. The basic requirement for a provider is to be able to disseminate messages to multiple recipients using email, fax and GTS.

Only Member States with designated TWFP/TNC can participate in the CTE. TNCs communication details would be used in the CTE only if the respective Member State has no TWFP designated. In case of a designated TWFP, TNCs communication details would not be used during the CTE.

The NEAMTWS–CTE messages will be delivered to the TWFP/TNC operational addresses as provided by the Member States to the IOC Secretariat. Member States are invited to verify that these addresses are accurate and up-to-date. **Any changes, corrections or amendments should be sent to the IOC Secretariat through the official channels described in UNESCO/IOC TWFP and TNC nomination forms**. They will be used in the NEAMTWS–CTE if received at least one week before the exercise.

The information that is required from each exercise participant is presented in ANNEX **III** for the Message Provider and ANNEX **IV** for the Message Recipients.

Since the information from the Message Provider is needed to verify the authorative source of the CTE messages, it has to be given beforehand by the two exercise annoucement messages.

The basic information of the Message Recipients (TWFPs and candidate TWPs) is the one that is officially collected by the IOC following information by the Member States. The forms available under ANNEX **IV** will be used to verify the Message Recipient Information provided via official channels.

Participants are especially encouraged to read the Exercise Reports of previously conducted CTE, *First Enlarged Communication Test Exercise (ECTE1); Exercise Manual and Evaluation Report* (IOC/2011/TS/98Rev.3)

7. EVALUATION OF NEAMTWS–CTE

The evaluation will be conducted by filling a questionnaire (see the proposed questionnaires in ANNEX **V** and ANNEX **VI**, one for the Message Provider and one for each Message Receivers). Each agency that participates in the CTE is requested to deliver one report encompassing all messages received. These questionnaires should be answered shortly after the end of the exercise, and they must be sent via email to the Message Provider within one week of the CTE. The complete address is provided in ANNEX **III**.

After reception of all the questionnaires, the Message Provider is responsible for preparing the Exercise Report within 4 weeks after the conduct of the CTE2 and circulating to the TT–CTTE Co-Chairs. The Exercise Report should include a story book of the CTE starting from TS0 (as the instant when the Message Provider is aware that a tsunami message has to be delivered) to TSE (as the instant when the message dissemination activities are finalized). The Exercise Report should also make use of system logs (including GTS logs obtained from the WMO-NR) of the Message Provider and include statistical information on message dissemination concerning each communication technology utilized. Following parameters should be included: Number of recipients, number of successful message delivery, minimum time of message delivery, maximum time of message delivery, median time of message delivery, and mean time of message delivery. The Exercise Report should include also an evaluation of the TWFP response. The main responsibility of the Message Provider is to prepare a technical report on the exercise based on the logs-questionnaires, of course underlining important issues, which then could be considered by the TT–CTTE Co-Chairs as recommendations for the CTE manual after a TT–CTTE meeting. Hence, CTE report should provide a section at the end of the report with a title as “Issues to be considered by the TT-CTTE”, where each “problem” could be listed as an item, from which the TT–CTTE could pick up and formulate a recommendation.

The Message Provider should also provide all the information required to update the “CTE Performance Indicators” document, distributed in the initial announcement of the CTE together with this manual. These performance indicators are grouped into two major sets, the first one characterizing the universe of the exercise participants, and the second one summarizing the technical details of the exercise results. The “CTE Performance Indicators” document is closely linked and cross-referenced to the CTE Manual and will be updated by the TT–CTTE Co-Chairs after each CTE.

TT–CTTE Co-Chairs are responsible to provide their comments to the Message Provider within the following 2 weeks. If necessary, the Message Provider will update/modify the CTE report accordingly and send it back to the TT–CTTE Co-Chairs within the following 2 weeks. The Task Team Chair/Co-Chairs will send the report to the IOC Secretariat asking for their comments on the report’s content and editorial changes required. The IOC Secretariat will provide these comments within the following 2 weeks. If necessary, the CTWP and/or TT–CTTE Co-Chairs will update the report and the approved version of the report will be sent to the IOC Secretariat by the TT–CTTE Co-Chairs within the following 2 weeks. The IOC Secretariat should then ensure that the CTE Report is electronically published within the following one month. Lessons learned will be applied on consecutive exercises and relevant documentation updated if necessary.

In the Evaluation Report, Message Provider will also indicate which Member States TWFP/TNC contact information differences are observed between the information they have received from IOC Secretariat and from the ANNEX IV. After this, a standard message could be sent by the Secretariat to the respective Member State stating this fact and informing the Member State on the urgent need of updating TWFP/TNC via official channels, indicating that when NEAMTWS is in place, ANNEX IV will be removed from the CTE Manual and CTEs will rely only to the information provided to the IOC Secretariat via official channels.

8. SMALL SCALE COMMUNICATION TEST EXERCISE (SSCT)

A Small Scale Communication Test Exercise (SSCT) could be conducted after the initial evaluation of the CTE2 focusing on the problem areas of the CTE and to consolidate the lessons learnt from it. The decision on this would be taken by the Task Team responsible for the CTE. The main differences of a SSCT from a CTE are the following:

- A SSCT is limited only to a subset of communication technologies and a subset of TWFPs. In case of a need to use all communication technologies involving all participants of CTE, a new CTE has to be conducted.

- The requirements and guidelines for the communication technology(ies) provided in this manual will be also applicable to SSCT.

- The announcement of the SSCT will be made by the TWP and should be sent to the participants of the CTE it follows, 10 days before the SSCT; clearly defining which States/Centres will be involved.

- The reporting of SSCT will not be subject to the same requirements and guidelines as the CTE provided in this document. The Message Provider will be responsible to prepare an exercise report within 15 days and submit it to the the Task Team Chair/Co-Chairs who will be responsible for the approval of the SSCT report within the next 15 days.

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ANNEX I

SAMPLE TEST MESSAGES FOR E-MAIL AND FAX

Subject: TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001

Body:

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001
NEAM KOERI CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1430Z 10 AUG 2011

... TSUNAMI COMMUNICATION TEST ...
THIS TEST APPLIES TO … CGCCR(BELGIUM)… BAS(BULGARIA)… INMG(CAPE VERDE)… NPRD(CROATIA)… OC(CYPRUS)… DMI(DENMARK)… NRIAG(EGYPT)… EMI(ESTONIA)… FMI(FINLAND)… GSC(FINLAND)… CENALT(FRANCE)… BSH(GERMANY… DWD(GERMANY)… NOA(GREECE)… GSI(ISRAEL)… DPC (ITALY) … NCGR(LEBANON)… CPD(MALTA)… SPMC(MONACO)… KNMI(NETHERLANDS)… DSB(NORWAY)… NHQ SFS(POLAND)… IM (PORTUGAL)… NIEP(ROMANIA)… NPO “Typhoon”(RUSSIAN FEDERATION)… DGPCE(SPAIN)… SMHI(SWEDEN)… SWO(SYRIA)… AFAD(TURKEY)… DFID(UNITED KINGDOM)

FROM – KANDILLI OBSERVATORY AND EARTHQUAKE RESEARCH INSTITUTE (KOERI)

TO – TWFP PARTICIPANTS IN THE NEAMTWS COMMUNICATION TEST EXERCISE
SUBJECT –TSUNAMI COMMUNICATION TEST

THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE TRANSMISSION TIMES INVOLVED IN THE DISSEMINATION OF OPERATIONAL TSUNAMI MESSAGES FROM THE CANDIDATE TSUNAMI WATCH PROVIDER TO OTHER CANDIDATE TSUNAMI WATCH PROVIDERS, NATIONAL TSUNAMI WARNING CENTERS AND TSUNAMI WARNING FOCAL POINTS OF THE NEAM TSUNAMI WARNING SYSTEM

RECIPIENTS ARE REQUESTED TO FILL THE EVALUATION QUESTIONNAIRE AND SEND IT ACCORDING TO THE NEAMTWS-CTE INSTRUCTIONS

THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST
THIS WILL BE THE FINAL MESSAGE ISSUED

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001

ANNEX II

SAMPLE TEST MESSAGES FOR GTS

Body:

WEME40 LTAA YYGGgg

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001
NEAM KOERI CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 1430Z 10 AUG 2011

... TSUNAMI COMMUNICATION TEST ...
THIS TEST APPLIES TO … CGCCR(BELGIUM)… BAS(BULGARIA)… INMG(CAPE VERDE)… NPRD(CROATIA)… OC(CYPRUS)… DMI(DENMARK)… NRIAG(EGYPT)… EMI(ESTONIA)… FMI(FINLAND)… GSC(FINLAND)… CENALT(FRANCE)… BSH(GERMANY… DWD(GERMANY)… NOA(GREECE)… GSI(ISRAEL)… DPC (ITALY) … NCGR(LEBANON)… CPD(MALTA)… SPMC(MONACO)… KNMI(NETHERLANDS)… DSB(NORWAY)… NHQ SFS(POLAND)… IM (PORTUGAL)… NIEP(ROMANIA)… NPO “Typhoon”(RUSSIAN FEDERATION)… DGPCE(SPAIN)… SMHI(SWEDEN)… SWO(SYRIA)… AFAD(TURKEY)… DFID(UNITED KINGDOM)

FROM – KANDILLI OBSERVATORY AND EARTHQUAKE RESEARCH INSTITUTE (KOERI)

TO – TWFP PARTICIPANTS IN THE NEAMTWS COMMUNICATION TEST EXERCISE
SUBJECT –NEAMTWS TSUNAMI COMMUNICATION TEST

THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE TRANSMISSION TIMES INVOLVED IN THE DISSEMINATION OF OPERATIONAL TSUNAMI MESSAGES FROM THE CANDIDATE TSUNAMI WATCH PROVIDER TO OTHER CANDIDATE TSUNAMI WATCH PROVIDERS, NATIONAL TSUNAMI WARNING CENTERS AND TSUNAMI WARNING FOCAL POINTS OF THE NEAM TSUNAMI WARNING SYSTEM

RECIPIENTS ARE REQUESTED TO FILL THE EVALUATION QUESTIONNAIRE AND SEND IT ACCORDING TO THE NEAMTWS-CTE INSTRUCTIONS

THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST
THIS WILL BE THE FINAL MESSAGE ISSUED

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001

ANNEX III

INFORMATION ON MESSAGE PROVIDER

Name of the Country:

Name of the Institution:

Email address to broadcast the communication test message:

Fax number(s) to broadcast the communication test message[1]:

Fax ID code(s):

GTS Message Header:

TWFP Information[2]

Name:

E-mail address:

Fax:

Mailing address:

[1] Include all the lines used by the Fax machine in case of parallel broadcasting.

[2] Please note that this information is only to identify the person responsible for sending the message, and also responding to the technical questions concerning the CTE.

ANNEX IV

INFORMATION ON MESSAGE RECEIVER

COUNTRY:

INSTITUTION:

Email addresses to receive the test message:

Primary e-mail address:

Alternate e-mail address (if any):

Fax numbers to receive the test message:

Primary fax number:

Alternate fax number:

Is your institute connected to GTS?

Contact Info:

Name:

E-mail:

Fax:

Mailing Address:

ANNEX V

EVALUATION QUESTIONNAIRE
FOR MESSAGE PROVIDER

Please note that all times should be provided in Universal Time in HH:MM:SS format. Please copy and paste confirmation sheets from the fax machine (if available), and a copy of the messages distributed by email, fax and GTS. Please verify that the time-stamp information is visible on the documents, if applicable. Preferably the email message text appended to this report should be copied directly from the mail-box server in order to provide all the details on timing and routing.

COUNTRY:			
INSTITUTION:			
Provide T0 Time:			
Provide times of message delivery for each communication technology below:			
	E-MAIL	**FAX**	**GTS**
time stamp:			
Provide a detailed story of all activities starting from T0 and TN (end of the exercise). Did you receive any error messages or observed any problems? If yes, describe them for all dissemination technologies and addresses concerned.			
Describe the operational service to deliver the e-mail messages.			
Describe the operational service to deliver the fax messages.			
Describe the operational service to deliver the GTS messages.			
Describe briefly the preparation made in your agency for the Communication Test Exercise			
Describe briefly the procedures taken during the exercise, before time zero, and after time zero.			

Did you synchronize the PC before distributing the email messages? If yes, describe briefly the procedure used.
Did you synchronize the fax machine before sending the messages? If yes, describe briefly the procedure used.
Did you find the exercise useful in assessing the readiness of your agency to distribute tsunami related messages?
Do you have any comments on the exercise, including the exercise manual and/or information received related to the exercise?
Have you and/or your institution been contacted by media concerning the exercise before/during/after the exercise? Please provide brief information if applicable.

ANNEX VI

EVALUATION QUESTIONNAIRE
TO MESSAGE RECEIVER

Please note that all times should be provided in Universal Time in HH:MM:SS format, where applicable. Please copy and paste into this questionnaire e-mail, fax and GTS messages received for each delivery.

COUNTRY:				
INSTITUTION:				
Provide the time stamps of the messages received through each communication technology:				
Is your institution connected to GTS?				
E-MAIL	**FAX**	**GTS**		
Provide times of message delivery for each communication technology:				
Primary E-MAIL	**Alternate E-MAIL**	**Primary FAX**	**Alternate FAX**	**GTS**
[type e-mail address]	*[type e-mail address]*	*[type fax number]*	*[type fax number]*	
[type time in UTC HH:MM:SS format]	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*
Provide times for each communication technology when the message is read and understood by the operator:				
Primary E-MAIL	**Alternate E-MAIL**	**Primary FAX**	**Alternate FAX**	**GTS**
[type e-mail address]	*[type e-mail address]*	*[type fax number]*	*[type fax number]*	
[type time in UTC HH:MM:SS format]	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*
Was the provider e-mail address as expected?				
Was the e-mail message complete as expected? If not, report the differences.				
Was the provider fax number as expected?				

Was the fax message complete as expected? If not, report the differences.
Was the GTS message complete as expected? If not, report the differences.
Did the operator that received the messages understood its content and knew how to respond to it?
Describe briefly the preparation made in your agency for the Communication Test Exercise.
Did you synchronize the PC before distributing the email messages? If yes, describe briefly the procedure used.
Did you synchronize the fax machine before receiving the messages? If yes, describe briefly the procedure used.
Did you find the exercise useful in confirmation communication contacts and delays?
Do you have any comments on the exercise, including the exercise manual and/or information received related to the exercise?
Do you have any suggestions for the next exercises?
Have you and/or your institution been contacted by media concerning the exercise before/during/after the exercise? Please provide brief information if applicable.

ANNEX VII

GENERAL OVERVIEW OF GTS

WMO's Global Telecommunication System (GTS) is the communications and data management component that allows the World Weather Watch Programme (WWW) to operate through the collection and distribution of information critical to its processes. GTS is defined as: *"The co-ordinated global system of telecommunication facilities and arrangements for the rapid collection, exchange and distribution of observations and processed information within the framework of the World Weather Watch."* It is implemented and operated by National Meteorological Services (see ANNEX IX) of WMO Members and International Organizations, such as ECMWF and EUMETSAT.

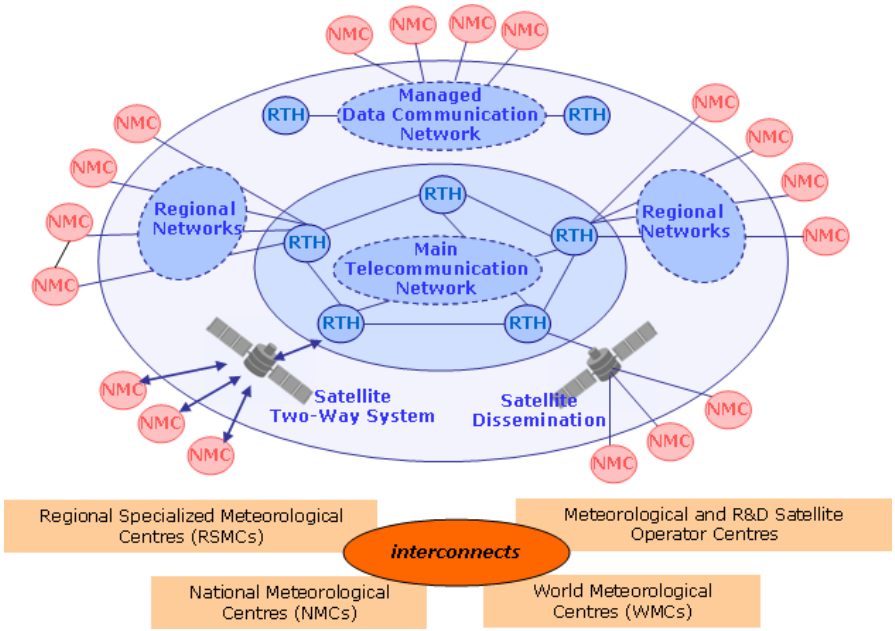

Figure VII-1. Structure of GTS

GTS also provides telecommunication support to other WMO programmes, facilitating the flow of data and processed products to meet requirements in a timely, reliable and cost-effective way, ensuring that all Members have access to all meteorological and related data, forecasts and alerts. This secured communication network enables real-time exchange of information, critical for forecasting and warnings of hydrometeorological hazards in accordance with approved procedures.

The GTS has a hierarchical structure on three levels. The Main Telecommunication Network (MTN), linking together three World Meteorological Centres (Melbourne, Moscow and Washington) and 15 Regional Telecommunication Hubs (Algiers, Beijing, Bracknell, Brasilia, Buenos Aires, Cairo, Dakar, Jeddah, Nairobi, New Delhi, Offenbach, Toulouse, Prague, Sofia and Tokyo). This core network has the function of providing an efficient, rapid and reliable communication service between the Meteorological Telecommunication Centres (MTCs).

The Regional Meteorological Telecommunication Networks (RMTNs) is an integrated network of circuits covering the six WMO regions – Africa, Asia, South America, North America, Central America & the Caribbean, South-West Pacific, Europe and Antarctic – and interconnecting the MTCs thus ensuring the collection of observational data and regional selective distribution of meteorological and other related information to Members. Until the

integrated network is completed, HF-radio-broadcasts may be used in order to meet the requirements of the WWW for the dissemination of meteorological information.

The National Meteorological Telecommunication Networks (NMTNs) enable the National Meteorological Centres (NMCs) to collect observational data and receive and distribute meteorological information on a national level.

Satellite-based data collection and/or data distribution systems are also integrated in the GTS as an essential element of the global, regional and national levels of the GTS. Data collection systems operated via geostationary or near-polar orbiting meteorological/environmental satellites, including ARGOS, are widely used for the collection of observational data from *Data Collection Platforms*. International data distribution systems operated either via meteorological satellites such as the Meteorological Data Distribution (MDD) of METEOSAT, or via telecommunication satellites, such as RETIM or FAX-E via EUTELSAT are efficiently complementing the point-to-point GTS circuits. Several Countries, including Argentina, Canada, China, France, India, Indonesia, Mexico, Saudi Arabia, Thailand and the USA, have implemented satellite-based multi-point telecommunication systems for their national Meteorological Telecommunication Network.

The MTCs function is to accommodate the volume of meteorological information and its transmission within the required time limits for global and interregional exchange of observational data, processed information and any other data required by its Members. Regional Telecommunication Hubs (RTHs) on the MTN perform an interface function between the RMTNs and the MTN.

The GTS is an integrated network of surface-based and satellite-based telecommunication links of point-to-point circuits, and multi-point circuits, interconnecting meteorological telecommunication centres operated by countries for round-the-clock reliable and near-real-time collection and distribution of all meteorological and related data, forecasts and alerts. This secured communication network enables real-time exchange of information, critical for forecasting and warning of hydrometeorological hazards.

WMO GTS is the backbone system for global exchange of data and information in support of multi-hazard, multipurpose early warning systems, including all meteorological and related data; weather, water and climate analyses and forecasts; tsunami related information and warnings, and seismic parametric data. WMO is building on its GTS to achieve an overarching WMO Information System (WIS), enabling systematic access, retrieval, and dissemination and exchange of data and information of all WMO and related international programmes.

ANNEX VIII

GTS HEADER FORMAT FOR TSUNAMI MESSAGES

Detailed information for the GTS format can be found at *Manual on the Global Telecommunication System, Volume I* (WMO-No. 386). In general, the abbreviated GTS header has the following format:

$T_1T_2A_1A_2$ii CCCC YYGGgg BBB

Where:

T_1T_2 data type and/or form designators

T_1=W (Warning)*

T_2=E (Tsunami, when T_1=W)

**In the case of NEAMTWS, this WMO terminology applies to all levels of NEAMTWS Tsunami messages.*

A_1A_2 geographical and/or data type and/or time designators

A_1A_2 is one of the following:

ME	Eastern Mediterranean area
MM	Mediterranean area
MP	Central Mediterranean area
MQ	Western Mediterranean area
NT	North Atlantic area

ii A number with two digits. When an originator or compiler of messages issues two or more messages with the same T1T2A1A2 and CCCC the ii shall be used to differentiate the messages and will be unique to each message.

CCCC International four-letter location indicator of the station or centre originating or compiling the message, as agreed internationally, and published in WMO-No. 9, Volume C1, Catalogue of Meteorological Messages. Examples are:

LFPW	Toulouse (Centre Régional de Télécommunications)
LPMG	Lisboa (MET COM Centre)
LTAA	Ankara (Turkish State Meteorological Service)

YYGGgg International date-time group, where

YY Day of the month.

GGgg UTC time of the compilation of the message.

BBB An abbreviated heading defined by T1T2A1A2 ii CCCC YYGGgg shall be used only once. Consequently, if this abbreviated heading has to be used again for an addition, a correction or an amendment, it shall be mandatory to add an appropriate BBB indicator, identified by a three-letter indicator which shall be added after the date-time group. The BBB indicator shall have the following forms:

RRx for additional or subsequent issuance of messages;

CCx for corrections to previously relayed messages;

AAx for amendments to previously relayed messages; where x is an alphabetic character of A through X.

For example,

WEME40 LTAA YYGGgg CCA; for the same hour, when the warning message is updated for the first time.

WEME40 LTAA YYGGgg CCB; for the same hour, when the warning message is updated for the second time.

Example Headers for France, Portugal and Turkey are the following:

	FRANCE	PORTUGAL	TURKEY
Tsunami Watch, Advisory and Tests	*WEMQ40 LFPW*	*WENT40 LPMG*	*WEME40 LTAA*
Tsunami Information Message	*WEMQ42 LFPW*	*WENT42 LPMG*	*WEME42 LTAA*

The first type of message with the header format xxxx40 requests an action from the recipient (Watch-Advisory or respond to the communication test); hence these messages are the highest priority. The second type of message with the header format xxxx42 does not request action; it is only an information.

Sample GTS message for NEAMTWS-CTE is given in ANNEX II. Any candidate Tsunami Watch Provider has to inform WMO, via an official letter from IOC/NEAMTWS Secretariat and from its national weather service, on the GTS headers used and requesting the prioritization and re-routing of all tsunami messages.

ANNEX IX

LIST OF NATIONAL METEOROLOGICAL SERVICES IN NEAM REGION

Albania	The Hydrometeorological Institute
Algeria	Ministère des Transports
Belgium	Institut Royal Météorologique
Bosnia and Herzegovina	Meteorological Institute
Bulgaria	National Institute of Meteorology and Hydrology
Croatia	Meteorological and Hydrological Service
Cyprus	Meteorological Service
Denmark	Danish Meteorological Institute
Egypt	The Egyptian Meteorological Authority
Estonia	Estonian Meteorological and Hydrological Institute
Finland	Finnish Meteorological Institute
France	Météo-France
Georgia	Department of Hydrometeorology
Germany	Deutscher Wetterdienst
Greece	Hellenic National Meteorological Service
Iceland	Icelandic Meteorological Office
Ireland	The Irish Meteorological Service
Israel	Israel Meteorological Service
Italy	Servizio Meteorologico
Latvia	Latvian Environment, Geology and Meteorology Agency
Lebanon	Service Météorologique
Lithuania	Lithuanian Hydrometeorological Service
Libyan Arab Jamahiriya	Libyan National Meteorological Centre
Malta	Meteorological Office
Monaco	Mission Permanente de la Principauté de Monaco

Montenegro	Hydrometeorological Institute of Montenegro
Morocco	Direction de la Météorologie Nationale
Netherlands (the)	Royal Netherlands Meteorological Institute
Norway	Norwegian Meteorological Institute
Poland	Institute of Meteorology and Water Management
Portugal	Instituto de Meteorologia
Romania	National Meteorological Administration
Russian Federation	Russian Federal Service for Hydrometeorology and Environmental Monitoring
Serbia	Republic Hydrometeorological Service of Serbia
Slovenia	Meteorological Office
Spain	Agencia Estatal de Meteorología
Sweden	Swedish Meteorological and Hydrological Institute
Syrian Arab Republic	Ministry of Defence Meteorological Department
Tunisia	National Institute of Meteorology
Turkey	Turkish State Meteorological Service
Ukraine	Ukrainian Hydrometeorological Center
United Kingdom	Met Office

ANNEX X

EXAMPLE OF MESSAGE DETAILS AVAILABLE IN THE SERVER MAIL BOX

```
From ???@??? Thu Jun 24 10:05:46 2010
Return-Path: <hl_ntwc@gein.noa.gr>
Delivered-To: pt.ntwc@meteo.pt
Received: from eris.meteo.pt (eris1.meteo.pt [193.137.20.2])
        by afrodite.meteo.pt (Postfix) with ESMTP id B35684546A9
        for <pt.ntwc@meteo.pt>; Thu, 24 Jun 2010 10:05:47 +0100 (WEST)
Received: from ste.anubis.internal (unknown [80.67.98.165])
        (using TLSv1 with cipher ADH-AES256-SHA (256/256 bits))
        (No client certificate requested)
        by eris.meteo.pt (Postfix) with ESMTPS id 840886A204F
        for <pt.ntwc@meteo.pt>; Thu, 24 Jun 2010 10:04:20 +0100 (WEST)
Received: from mx.anubis.local (ste [10.1.2.2])
        by ste.anubis.internal (Postfix) with ESMTP id 2012A7D815C
        for <pt.ntwc@meteo.pt>; Thu, 24 Jun 2010 10:05:19 +0100 (WEST)
Received: from egelados.gein.noa.gr (egelados.gein.noa.gr [194.177.194.10])
        by mx.anubis.local (Postfix) with ESMTP id D92B17D8159;
        Thu, 24 Jun 2010 10:05:18 +0100 (WEST)
Received: from unknown (localhost [127.0.0.1])
        by egelados.gein.noa.gr (8.12.10+Sun/8.12.10) with ESMTP id o50956nf005048;
        Thu, 24 Jun 2010 12:05:06 +0300 (EEST)
Date: Thu, 24 Jun 2010 12:04:55 +0300
From: hl_ntwc <hl_ntwc@gein.noa.gr>
To: Nicolas.alabrune@cea.fr, pt.ntwc@meteo.pt, twfp_tr@boun.edu.tr
Subject: TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001
Message-ID: <20100624120455.0000538a@unknown>
Organization: Geodynamics Institute
X-Mailer: Claws Mail 3.7.6 (GTK+ 2.16.0; i586-pc-mingw32msvc)
Mime-Version: 1.0
Content-Type: text/plain; charset=UTF-8
X-EsetId: 4DE50F2977A9B96C52E30F7D7FFEF9

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001
NATIONAL OBSERVATORY OF ATHENS (NOA)
ISSUED AT 0900 UTC 24 JUN 2010
```

Image X–1. Message details in the server mail box

In this example (from CTE1, June 2010) the sequence of message routing is as follows:

Delivery	Reception	Time UTC
hl_ntwc	NOA-local machine	**09:04:55**
NOA-local machine	egelados.gein.noa.gr	09:05:06
egelados.gein.noa.gr	mx.anubis.local	09:05:18
mx.anubis.local	ste.anubis.internal	09:05:19
ste.anubis.internal	eris.meteo.pt	09:04:20*
eris.meteo.pt	afrodite.meteo.pt	09:05:47
afrodite.meteo.pt	<pc operacional>	**09:05:46**

Table X–1. Example of sequence of message routing

It should be noted that the time stamp that the mail servers usually report is the first one in the table which represents indeed the delivery time by the Message Provider, not the reception time. The reception time is the last one in the table and that is the one that it is requested to provide in the Evaluation Questionnaire as TS1. If all computers are synchronized, a time delay in the delivery of the message of 51 seconds could be measured. Also remark that many servers do intervene in the message routing and not all are synchronized.

ANNEX XI

EXAMPLE OF TIME STAMPS ON A FAX MESSAGE

Only the bottom line provides the reception time.

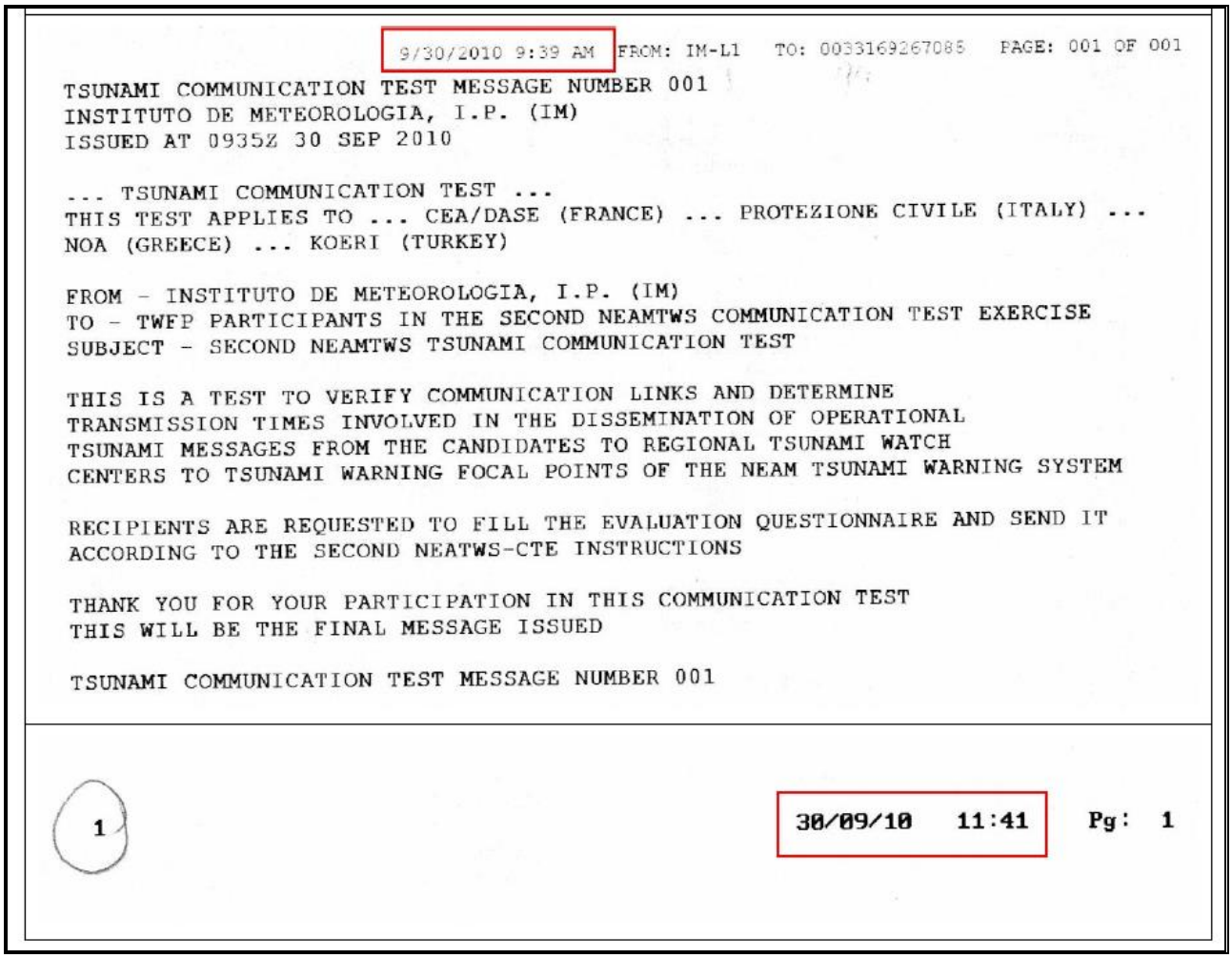

Image XI–1. Example of time stamps on a fax message

In this example, taken from CTE1 June 2010, the time stamp shown on the top of the page is indeed the delivery time of the message and the reception time is found at the bottom of the message. It is this second time that has to be reported in the Evaluation Questionnaire as TS1.

ANNEX XII

CTE FIRST ANNOUNCEMENT
MESSAGE TEMPLATE

We have the pleasure to announce the next NEAMTWS Communication Test Exercise (NEAMTWS-CTE), which will be conducted on [DD/MM/YYY]. The NEAMTWS-CTE will involve the National Tsunami Warning Centres (NTWC), the Tsunami Warning Focal Point (TWFP) and the Tsunami National Contacts (TNC) for Member States (MS) without a designated TWFP.

The Candidate Tsunami Watch Providers (CTWP), National Tsunami Warning Centres (NTWC) and Tsunami Warning Focal Points (TWFP) must keep a high level of readiness so as to be able to act efficiently and effectively to provide for the public's safety during fast-onset and rapidly-evolving natural disasters like the tsunamis. To maintain this high state of operational readiness and especially for infrequent events such as tsunamis, tsunami watch/warning centres and emergency agencies must regularly practice their response procedures to ensure that vital communication links work seamlessly, and that agencies and response personnel know the roles that they will need to play during an actual event.

This NEAMTWS-CTE will consist of the broadcast of a Tsunami Communication Test Message by [MESSAGE PROVIDER] that will act as the Message Provider. This message will be distributed by e-mail, fax and GTS. The details of the Message Provider are given in Annex II.A so that each CTE participant can recognize the authority and validity of the messages received. It is suggested that the exercise participants check beforehand that their communication systems do not block the messages originated by the Message Provider. For GTS users, the exercise participants should verify that they are able to receive the appropriate message header identifiers.

The NEAMTWS–CTE messages will be delivered to the TWFP (TNC in the absence of a designated TWFP) operational addresses as provided by MS to the IOC secretariat. MS are invited to verify that these addresses are accurate and up-to-date. Any changes, corrections or amendments should be sent to the IOC secretariat through the official channels described in UNESCO IOC TWFP and TNC nomination forms. They will be used in the NEAMTWS-CTE if received one week before the exercise.

All agencies participating in the NEAMTWS–CTE (TWFPs and optionally TNCs) are requested to fill in the evaluation questionnaire sent as ANNEX VI, one questionnaire for each agency. The questionnaires should be sent to the Message Provider address, given in ANNEX III within one week after the exercise. It is the responsibility of the Message Provider to collect all evaluation questionnaires and produce the first version of the NEAMTWS-CTE Evaluation Report to be distributed to all exercise participants. The Message Provider will fill a similar questionnaire that will be part of the Evaluation Report.

More information on the nature of the exercise together with technical details concerning the conduct and evaluation of the exercise can be found in the NEAMTWS-CTE Manual, attached to this Circular Letter. NEAMTIC website has also a dedicated section on CTE where all relevant information and documentation can be accessed: http://neamtic.ioc-unesco.org.

ANNEX XIII

CTE SECOND ANNOUNCEMENT
MESSAGE TEMPLATE

To whom it may concern;

This e-mail message is sent to you from the CTE message provider [MESSAGE PROVIDER] e-mail address [e-mail address] in order to ensure that the anti-spam and firewall software operating at the message recipient side do not block the CTE message on the day of the exercise, [DD/MM/YYY].

You have received this e-mail because either you have provided your e-mail address in ANNEX III of the *NEAMTWS-CTE2 Manual* or your email address was provided in TWFP/TNC forms submitted by your State/Government to UNESCO/IOC.

Please be so kind to confirm the receipt of this message.

Best regards,

[MESSAGE PROVIDER NAME]

ANNEX XIV

CTE TIMELINE FLOWCHART

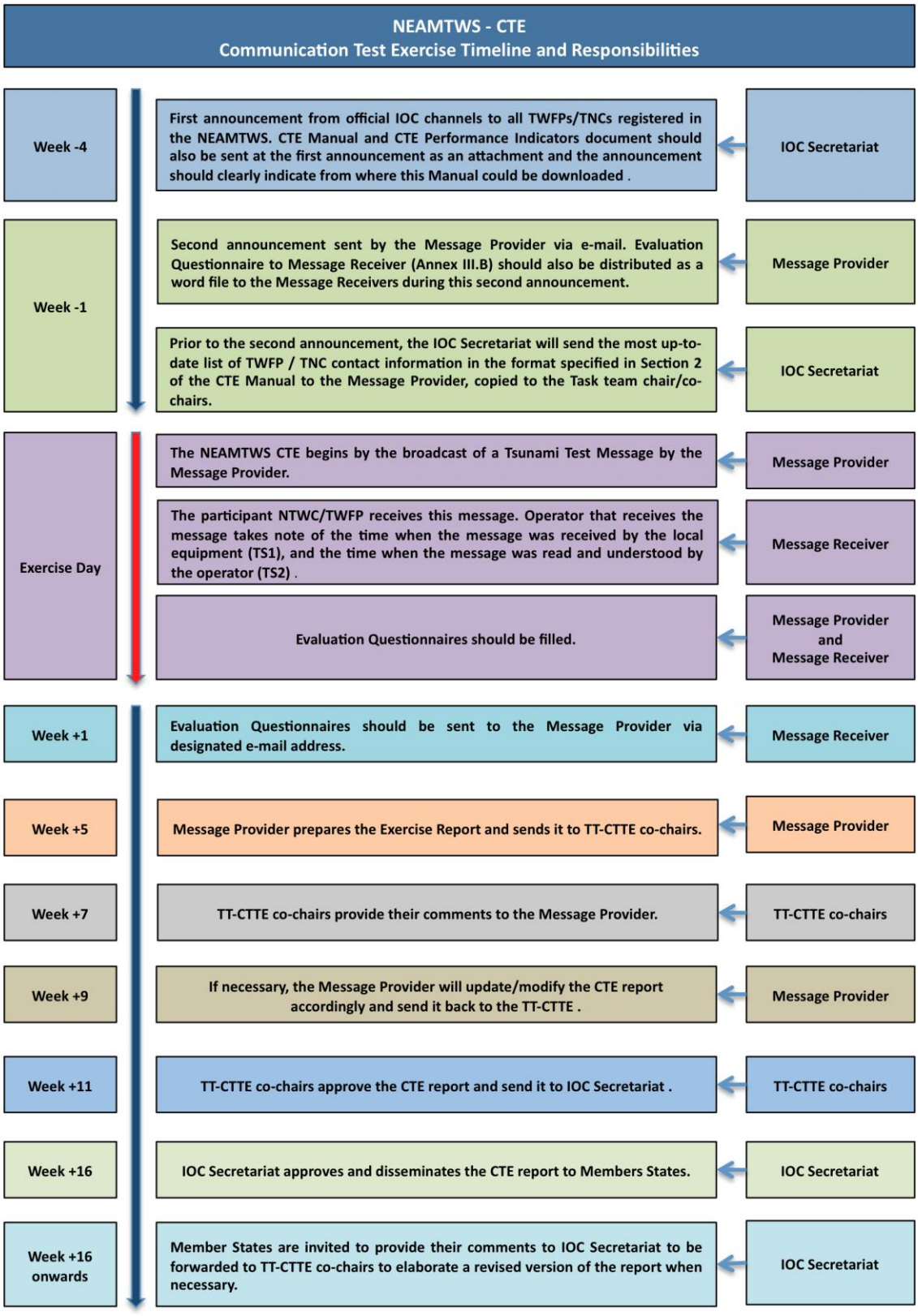

Table XIV–1. CTE Timeline flowchart

ANNEX XV

CTE CHECKLIST

Time-line	Action	Tick Boxes		
Week referred to Exercise Day		MP	MR	IOC
-4	The CTE period begins by issuing a first announcement from official IOC channels to all TWFPs and TNCs registered in the NEAMTWS, at least 4 weeks in advance of the planned exercise date. This CTE Manual and CTE Performance Indicators Document should also be sent at the first announcement as an attachment and the announcement should clearly indicate from where this Manual could be downloaded.			
between -4 and -1	During the following 3 weeks period TWFPs from Member States (MS) will have the time to correct and or update all the contact information. Updates are collected by the IOC Secretariat.			
between -4 and -1	During the following 3 weeks period the Message Provider defines the contacts that will be used to broadcast the Tsunami Test Message. This information is collected by the IOC Secretariat			
-1 and 1/2 days	Prior the CTE second announcement, the IOC Secretariat will send the most up-to-date list of TWFP / TNC contact information in the agreed format (provided in the CTE Manual) to the Message Provider, copied to the Task team chair/co-chairs			
-1	The CTE is preceded, one week before, by a second announcement sent by the Message Provider via e-mail in order to ensure that the anti-spam and firewall software operating in the Message Receivers networks do not block the Communication Test Exercise Message. Evaluation Questionnaire to Message Receiver (Annex III.B) should also be distributed as a word file to the Message Receivers during this second announcement.			
before 0	ASCII character set should be used in the message templates used in all communication technologies. All times in the evaluation questionnaires should be reported in HH:MM:SS UTC format.			
before 0	All communication technology systems should be synchronized.			
before 0	The number of e-mail message recipients would be restricted to 2 e-mail addresses per agency and 4 e-mail addresses per member state.			
before 0	The number of fax message recipients would be restricted to 2 per member state; thus 1 per agency if two agencies are designated. If a single agency has been designated, both primary and alternate fax numbers would be utilized.			
before 0	At least an 8-channel fax server for should be used for the fax message dissemination			
before 0	The Message Provider should set up the fax server in such a way so that each recipient fax number will be subject to at least three attempts to send the fax message, where in each attempt the fax recipient will be ringed at.			
before 0	Message Recipients are recommended to develop codes to automatically detect fax messages and send them as internal email.			
before 0	Message Recipients are recommended to develop codes to automatically detect GTS messages and send them as internal email.			
0	**The Message Provider broadcasts the Tsunami Test Message**			
0	In addition to TS0, TS1E (time stamp of e-mail message) should be reported by the Message Provider			
0	In addition to TS0, TS1F (time stamp of fax message) should be reported by the Message Provider and ASCII character set should be used in the fax message templates.			
0	In addition to TS0, TS1G (time stamp of GTS message) should be reported and ASCII character set should be used in the GTS message templates.			
0	In coordination with the WMO-National Representatives, detailed GTS logs should be acquired both by the Message Provider and Message Recipient, where applicable.			
0	Operator that receives the message takes note of the time when the message was received by the local equipment (TS1), and the time when the message was read and understood by the operator (TS2) .			
0	Evaluation Questionnaires should be filled on the day of CTE.			
1	Evaluation Questionnaires should be sent to the Message Provider via designated e-mail address.			

Table XV–1. CTE Checklist

ANNEX XVI

REFERENCES

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IOC. 2014. *Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Second Enlarged Communication Test Exercise (CTE2). Evaluation Report.* Paris, UNESCO/IOC Technical Series No.102 Vol.2. (IOC/2014/TS/102 Vol.2).

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ANNEX XVII

LIST OF ACRONYMS

CARIBE-EWS	Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
CENALT	CENtre d'Alerte aux Tsunamis (
CP–DMA	Civil Protection and Disaster Management Authorities
CTE2	Communication Test Exercise
ECTE1	First Enlarged Communication Test Exercise
ICG/NEAMTWS	Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
IM	Instituto Português do Mar e da Atmosfera
IOC	Intergovernmental Oceanographic Commission
I-OUG	Interim Operational Users Guide
KOERI	Kandilli Observatory and Earthquake Research Institute of Turkey
MDD	Meteorological Data Distribution
MIC	European Union Monitoring and Information Centre
MTN	Main Telecommunication Network
NEAM region	North-Eastern Atlantic, Mediterranean and Connected Seas
NEAMTWS	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
NMC	National Meteorological Centre
NMTN	National Meteorological Telecommunication Network
NR	NEAM Region
NTWC	National Tsunami Warning Centre
RMTN	Regional Meteorological Telecommunication Network
RTH	Regional Telecommunications Hub
RTH	Regional Telecommunication Hub
RTWC	Regional Tsunami Watch Centre
SSCT	Small Scale Communication Test Exercise

TNC	Tsunami National Contact
TT	Task Team
TWFP	Tsunami Warning Focal Point
TWP	Tsunami Watch Provider
WIS	WMO Information System
WMC	World Meteorological Centre
WMO	World Meteorological Organization

IOC Technical Series

No.	Title	Languages
1	Manual on International Oceanographic Data Exchange. 1965	(out of stock)
2	Intergovernmental Oceanographic Commission (Five years of work). 1966	(out of stock)
3	Radio Communication Requirements of Oceanography. 1967	(out of stock)
4	Manual on International Oceanographic Data Exchange - Second revised edition. 1967	(out of stock)
5	Legal Problems Associated with Ocean Data Acquisition Systems (ODAS). 1969	(out of stock)
6	Perspectives in Oceanography, 1968	(out of stock)
7	Comprehensive Outline of the Scope of the Long-term and Expanded Programme of Oceanic Exploration and Research. 1970	(out of stock)
8	IGOSS (Integrated Global Ocean Station System) - General Plan Implementation Programme for Phase I. 1971	(out of stock)
9	Manual on International Oceanographic Data Exchange - Third Revised Edition. 1973	(out of stock)
10	Bruun Memorial Lectures, 1971	E, F, S, R
11	Bruun Memorial Lectures, 1973	(out of stock)
12	Oceanographic Products and Methods of Analysis and Prediction. 1977	E only
13	International Decade of Ocean Exploration (IDOE), 1971-1980. 1974	(out of stock)
14	A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines. 1976	E, F, S, R
15	Bruun Memorial Lectures, 1975 - Co-operative Study of the Kuroshio and Adjacent Regions. 1976	(out of stock)
16	Integrated Ocean Global Station System (IGOSS) General Plan and Implementation Programme 1977-1982. 1977	E, F, S, R
17	Oceanographic Components of the Global Atmospheric Research Programme (GARP) . 1977	(out of stock)
18	Global Ocean Pollution: An Overview. 1977	(out of stock)
19	Bruun Memorial Lectures - The Importance and Application of Satellite and Remotely Sensed Data to Oceanography. 1977	(out of stock)
20	A Focus for Ocean Research: The Intergovernmental Oceanographic Commission - History, Functions, Achievements. 1979	(out of stock)
21	Bruun Memorial Lectures, 1979: Marine Environment and Ocean Resources. 1986	E, F, S, R
22	Scientific Report of the Interealibration Exercise of the IOC-WMO-UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open Ocean Waters. 1982	(out of stock)
23	Operational Sea-Level Stations. 1983	E, F, S, R
24	Time-Series of Ocean Measurements. Vol.1. 1983	E, F, S, R
25	A Framework for the Implementation of the Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment. 1984	(out of stock)
26	The Determination of Polychlorinated Biphenyls in Open-ocean Waters. 1984	E only
27	Ocean Observing System Development Programme. 1984	E, F, S, R
28	Bruun Memorial Lectures, 1982: Ocean Science for the Year 2000. 1984	E, F, S, R
29	Catalogue of Tide Gauges in the Pacific. 1985	E only
30	Time-Series of Ocean Measurements. Vol. 2. 1984	E only
31	Time-Series of Ocean Measurements. Vol. 3. 1986	E only
32	Summary of Radiometric Ages from the Pacific. 1987	E only
33	Time-Series of Ocean Measurements. Vol. 4. 1988	E only

(continued)

34	Bruun Memorial Lectures, 1987: Recent Advances in Selected Areas of Ocean Sciences in the Regions of the Caribbean, Indian Ocean and the Western Pacific. 1988	Composite E, F, S
35	Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990	E only
36	Bruun Memorial Lectures 1989: Impact of New Technology on Marine Scientific Research. 1991	Composite E, F, S
37	Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature. 1991	E only
38	The Oceans and Climate: A Guide to Present Needs. 1991	E only
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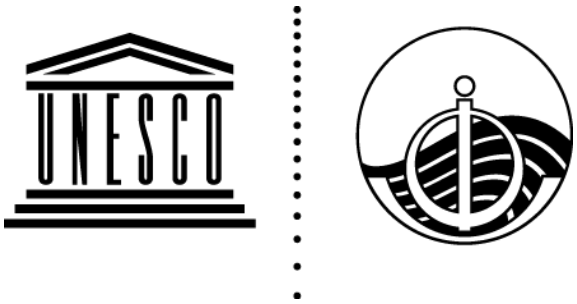

TSUNAMI EARLY WARNING AND MITIGATION SYSTEM IN THE NORTH-EASTERN ATLANTIC, THE MEDITERRANEAN AND CONNECTED SEAS

Second Enlarged Communication Test Exercise (CTE2)

22 May 2012

Vol.2 Evaluation Report

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IOC Technical Series, 102 Vol.2
Paris, October 2014
English only

For bibliographic purposes, this document should be cited as follows:

Intergovernmental Oceanographic Commission. 2014. *Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Second Enlarged Communication Test Exercise (CTE2). Evaluation Report.* Paris, UNESCO/IOC Technical Series No.102 Vol.2. (English only)

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Published in 2014
by United Nations Educational, Scientific
and Cultural Organization
7, Place de Fontenoy, 75352 Paris 07 SP

(IOC/2012/TS/102 Vol.2)

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1. INTRODUCTION

The Seventh session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS-VII) held from 23 to 25 November 2010 in Paris, France, established a Task Team on Communication Test and Tsunami Exercises (TT-CT&TE), which was responsible for the preparation and conduct of the Enlarged Communication Test Exercises (NEAMTWS–CTE) and the organization of its assessment.

The First Enlarged Communication Test Exercise (CTE1) of the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (IOC/2011/TS/98 Rev.3) was held on 10 August 2011 and led by the Kandilli Observatory and Earthquake Research Institute of Turkey (KOERI). The CTE involved all possible Tsunami Warning Focal Points (TWFPs) in 31 countries using conventional message dissemination channels like GTS, fax and email. The aim of the NEAMTWS-CTE1 was to test and refine procedures for the communication, transmission time and availability of tsunami alert messages between National Tsunami Warning Centres (NTWCs) and all nominated TWFPs of the participating countries, within the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAM) region. The designated national TWFPs are the essential recipients that have to translate/interpret the alert message into essential information for the national Civil Protection and Disaster Management Authorities (CP–DMA).

This first CTE was successful, though some issues were noted and recommendations have been made to improve future tests. These recommendations were followed for the preparation of the Second Communication Test (CTE2), which was led by the CENtre d'Alerte aux Tsunamis of France (CENALT) on 22 May 2012.

This report summarizes findings and feedback for this second communication test.

NEAMTWS–CTE2 was an important exercise because:

- As for the CTE1, the procedures for message sending were revised, and the contact information of TWFP were updated for each country;
- It allowed to test the communication channels of the newly established French National Tsunami Warning Centre, which is also expected to assume Candidate Tsunami Watch Provider responsibilities before the end of 2012;
- It was a preparation for the First Tsunami Exercise in the NEAM region, NEAMWave 12 (IOC/2012/TS/103 Vol.1 & Vol.2.), which is currently being planned for November 2012.

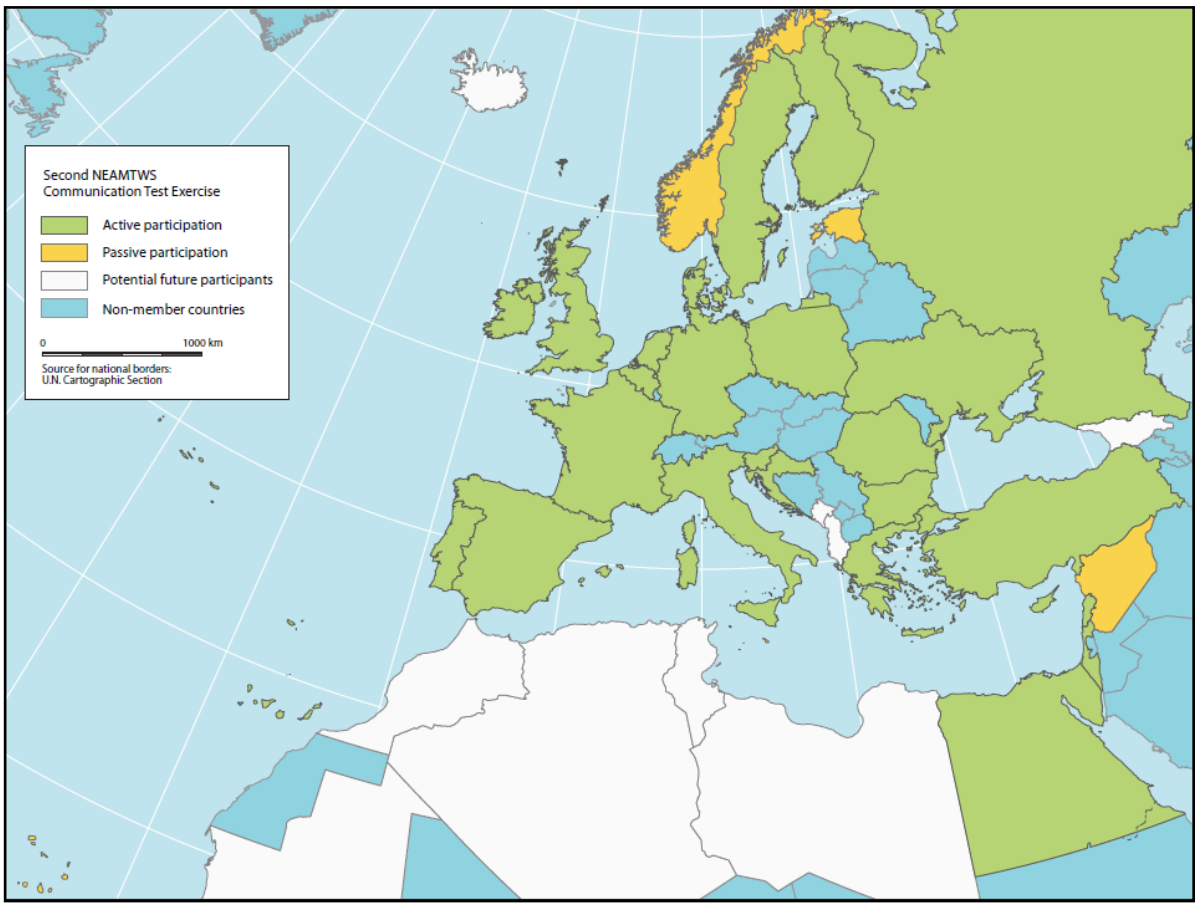

Figure 1. CTE2 Participation Map

On the map in Figure 1, green and orange colours indicate active and passive message recipient countries, respectively; white colour indicates countries that are members of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) and have not nominated TWFP for the CTE2. In total, 31 countries participated in CTE2.

2. RECOMMENDATIONS FROM THE FIRST COMMUNICATION TEST EXERCISE AND THEIR IMPLEMENTATIONS IN CTE2

The following recommendations were noted from the CTE1 report (text in italic). They were followed for the CTE2 with the indicated remarks (text normal):

- *Countries should be encouraged on a regular basis to keep the contact information of their TWFP up to date. IOC Secretariat should provide the TWFP contact information in a structured format*: This was the case thanks to the dedicated update contact form sent to the countries created after CTE1. (ANNEX III).

- *Message Providers should check any limitation in the number of email recipients. A preliminary test to detect possible issues with e-mail dissemination should be conducted three days before the exercise*: A pre-test was led by CENALT one week before the CTE2.

- *Fax servers should be set up in a way so that each recipient fax number will be subject to at least three attempts to send the fax message*: This recommendation was followed.

- *It is recommended to use at least an 8-channel fax server for the fax dissemination*: An 8-channel fax server was used, but the CENALT was only able to send the message by using four lines, as the four other channels are dedicated as back-up in case of a failure.

- *ASCII character set should be used in all kinds of messages and/or message templates*: This was the case and no problem was observed concerning this point.

- *Countries should be encouraged to provide alternate fax numbers*: 55% of countries provided more than one fax number.

- *Message Providers are encouraged to make use of an interface especially created for message dissemination by accessing pre-formatted messages and updating the time information and channelling the messages to e-mail, fax and GTS dissemination to avoid human errors*: The messages were sent thanks to dedicated software.

- *Messages Receivers should veil that their PC and/or faxes are configured to UTC time*: This was partially the case, as 39% of the countries synchronized their computers (32% for faxes).

	Synchronized	**Not synchronized**	**Not applicable**	**No information**
PC	12	9	0	10
PC (%)	**39%**	29%	0%	32%
Fax	10	11	3	7
Fax (%)	**32%**	35%	10%	23%

Table 1. Percentage of Message Receivers
that synchronized/not synchronized PC and/or fax

3. PREPARATION OF THE NEAMTWS–CTE2

3.1 BACKGROUND INFORMATION

It was agreed that France (CENALT) would act as Message Provider for NEAMTWS–CTE2 as well as the planned Exercise NEAMWave 12 (to be held in late 2012). The First Announcement of CTE2 was sent by the IOC on 23 April 2012, and was followed by the Second Announcement which was sent by the CENALT on 15 May 2012. The day chosen for the exercise was 22 May 2012. The questionnaires pertaining to CTE2 should be sent back during the week after for evaluation.

3.2 PREPARATION

The NEAMTWS–CTE2 was conducted following the *Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Second*

Enlarged Communication Test Exercise (CTE2): Exercise Manual (IOC/2014/TS/102 Vol.1) provided by the Intergovernmental Oceanographic Commission (IOC).

Internal meetings were conducted by the CENALT to ensure the good working of all the means of communication. The software dedicated for the sending of the messages was also tested, as well as all the parallel lines of the fax server. Some problems were observed (i.e. the server was badly configured and cut the message in two parts; the header was wrongly configured…) and corrected.

During the preparation phase, the IOC Secretariat provided a contact database, issued from the CTE1, which was updated. Joined to the First Announcement, the IOC sent a contact form which had to be returned to the message provider by each TWFP (ANNEX **I**). The mailing addresses and fax numbers were then entered in the software which sent trial messages two days before the test.

3.1.1 Preparation concerning emails

In the manual of the First Enlarged Communication Test Exercise (CTE1), it is suggested that the final announcement of the NEAMTWS–CTE1 should be sent from the Message Provider's address, with a copy to the Message Recipient's addresses in order to ensure that the anti-spam and firewall software operating in the Message Receivers' networks do not block the Communication Test Exercise Message.

The Second and final Announcement was sent from the Message Provider's address. The preliminary test indicated glitches with one email address. It appeared that it was badly reported in the database, and it was correctly updated for CTE2.

3.1.2 Preparation concerning faxes

The Message Provider had an 8-channel fax server; but with only four channels available for the CTE2. Fax numbers had to be sequenced in such a way so that a fax has to be sent to the primary fax number of each country first, where countries are sorted in alphabetical order, and the alternate fax numbers of each country following this first group of fax numbers. However, as the software used for sending messages seems to sort the numbers, the faxes were sent in numerological order, as it is the default mode of transmission. This issue was noted and is being solved.

3.1.3 Preparation concerning GTS

A collaboration agreement had been signed with French State Meteorological Service (Météo France) for the GTS capacity building. The CENALT has implemented a system (Transmet) developed by Météo France to send and receive messages and sea-level data through a dedicated line (MPLS). Météo France implemented a computer in Toulouse to send automatically the CENALT messages to the GTS network. A preliminary GTS test was conducted successfully on 2 May 2012 with Portugal as recipient.

4. NEAMTWS–CTE2: STORY BOOK

The Messages for email, fax and GTS were preformatted, missing only the time information on the header. The T0 time (as adopted as the instant when the Message Provider is aware that a tsunami message has to be delivered) was 08:30:00 UTC.

The messages were automatically generated by the system at 08:30:33 UTC. The operator then validated the preformatted fax message, and sent them:

- At 08:31:37 for GTS,

- At 08:31:47 for email,
- At 08:31:57 for faxes.

At the time of the exercise, there were five people in the operator room:

- The operator;
- The director of the CENALT;
- The coordinator;
- The software responsible;
- The trainee in charge of the preparation of the CTE2.

5. EVALUATION OF THE MESSAGE DISSEMINATION

One of the comments provided after the exercise was that the names of some countries and institutions were not provided in alphabetical order in the message body; the prescribed order was described in the *Interim Operational Users Guide for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas* (*NEAMTWS*). As institutes were typed in the format “Institute (Country)”, they were sorted by institute and not by country alphabetical order. Moreover, in one case, it was used a different abbreviation of the one provided in TWFP contact list.

Another comment was that some institutions seemed to be forgotten. The explanation is that when a country had more than one institution as TWFP, the one which was already in the database sometimes did not resend the updated form, whereas the new institution did. This led to an update of the database with only the new institute as the country TWFP. In Section 2 of the CTE2 Manual, it is noted that the IOC has to update the database and send it to the Message Provider one week before the exercise.

Some problems were noted also concerning the time stamp. All these problems are reported in Section 6.

5.1 EVALUATION OF THE MESSAGE DISSEMINATION BY EMAIL

Of the 62 mailing addresses tested in the CTE2, the message provider did not receive any error from the mailing server; all of the messages were sent. This is good news as a major earthquake occurred in Italy the night before the test, and the CENALT was encountering many problems with its internet connection.

According to the evaluation questionnaires, the reception was confirmed on 47 addresses, not confirmed on 1 address, and no information has been provided for the last 14 addresses.

The mails were received between 08:31 and 10:16 UTC. The mean time is 08:39 UTC and the median time is 08:32 UTC. From all the countries which confirmed reception (via the questionnaire), more than 50% received the message less than 2 minutes after it was sent. Eighty percent (80%) received the message in less than 3 minutes, and 85% in less than 6 minutes. Thirteen percent (13%) received the message within 12 minutes or more.

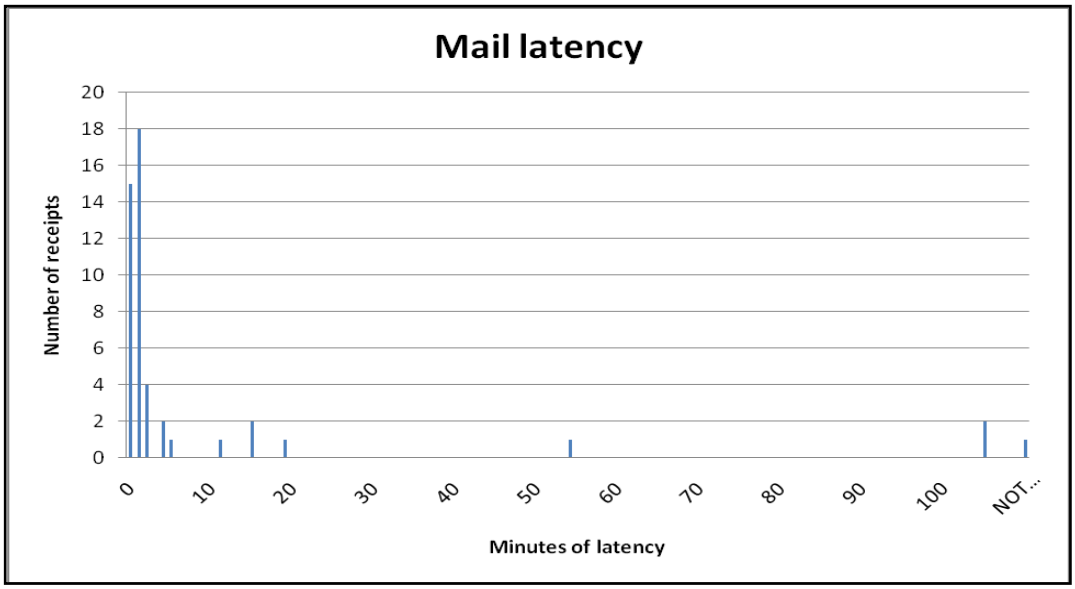

Figure 2.Mail Latency

5.2 EVALUATION OF THE MESSAGE DISSEMINATION BY FAX

Among the 51 addresses tested in the CTE2, the message provider received 7 errors from the fax server. Four (4) channels were used for this test. Thanks to the alternative fax numbers, 5 out of the 6 countries for which a fax was not sent received it anyway on another fax number. Italy was the only country where the 2 fax numbers did not receive the messages.

Another test of these numbers was carried out a few days after in the same conditions and revealed that there was no problem between the CENALT fax server and their fax machines. The problem was supposed to be caused by the earthquake which occurred the night before the CTE2, overloading the Italian communication system.

The fax server sent the messages between 08:32 and 08:55 UTC (Figure 3). This figure shows that at the beginning of the sending, the average number of fax sending per minute is around 3, after 15 minutes it decreases to 2. This may be explained by the increasing number of failures found by the server. In fact, after 08:47 UTC, the server retried to dial the 19 fax numbers for which the message was not successfully sent on the first attempt. Where the average fax sending time for the first attempt was 47 seconds, for the second attempt it increased to 123 seconds.

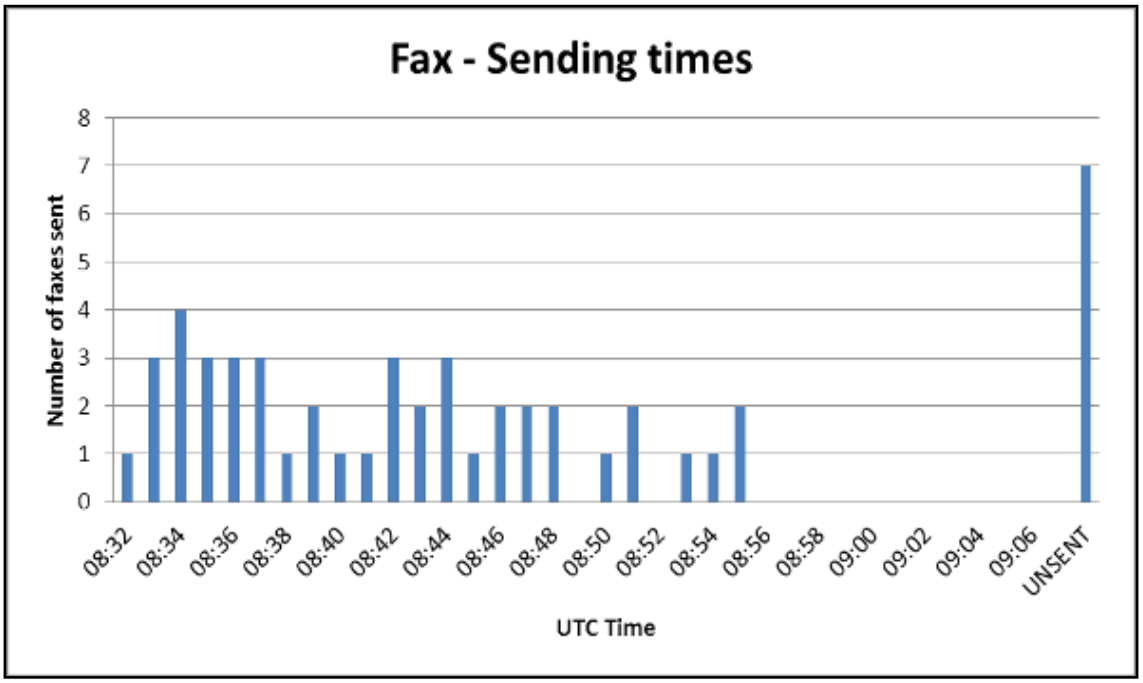

Figure 3. Fax sending times

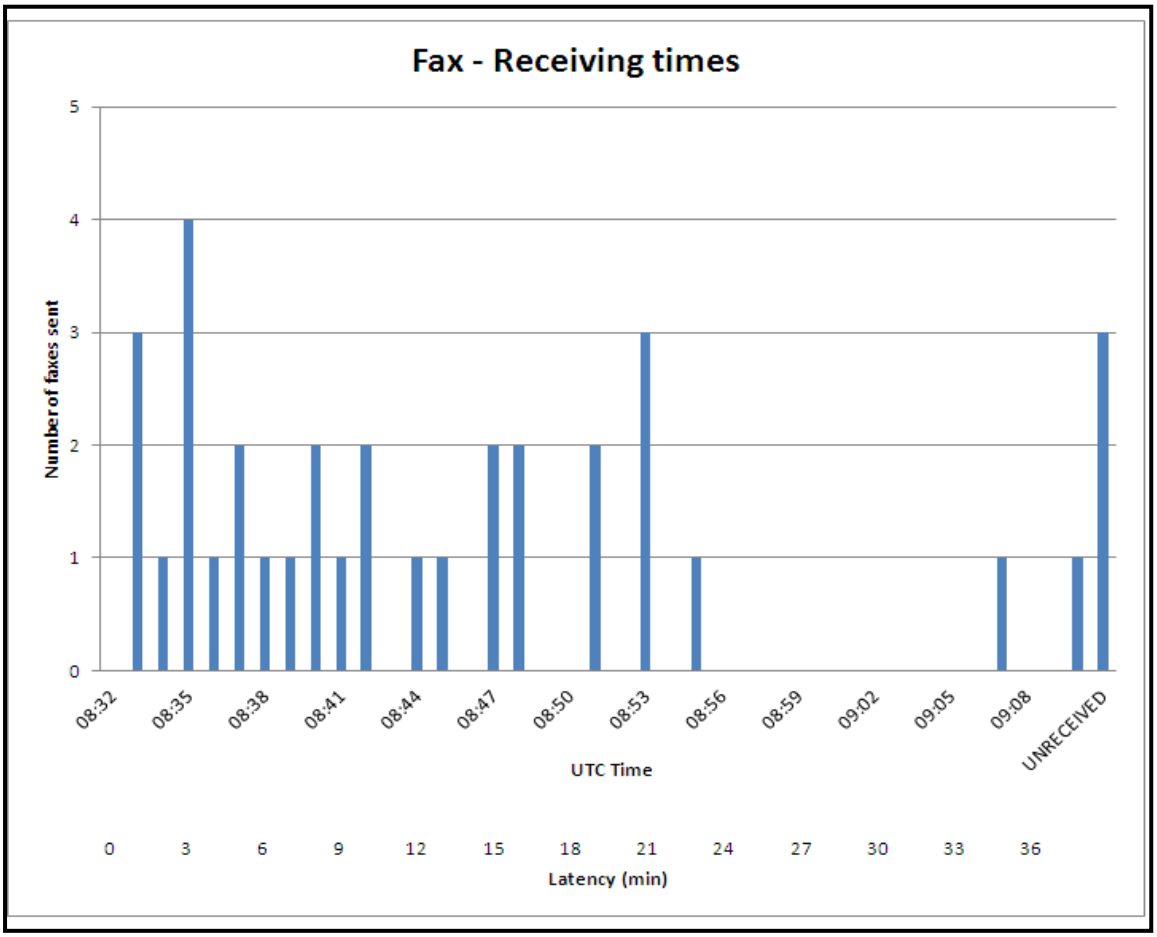

Figure 4. Fax receiving times

Of the 51 faxes sent:

- Thirty-three (33) were successfully sent after the first attempt (65%);
- Eleven (11) were sent after the second attempt (21%);
- None was successfully sent after the third attempt;
- Seven (7) were unsent (14%).

Among the 44 faxes sent, 32 were confirmed as received by countries (73%) between 08:33 and 09:10 UTC. Three (3) faxes were confirmed as not received (7%) and there was no information about the 9 other faxes.

Concerning latency, for each fax, it was calculated as the time between its reception and its sending time by the fax server, and not the time between its reception and its sending time to the fax server (i.e. 08:31 UTC). The minimum latency is of less than 1 minute, and the maximum is 12 minutes.

Mean latency is around 3 minutes and median latency is under 1 minute. Fifty-six percent (56%) of the countries who returned the evaluation questionnaire received the fax in less than 1 minute, and 66% received it in less than 2 minutes.

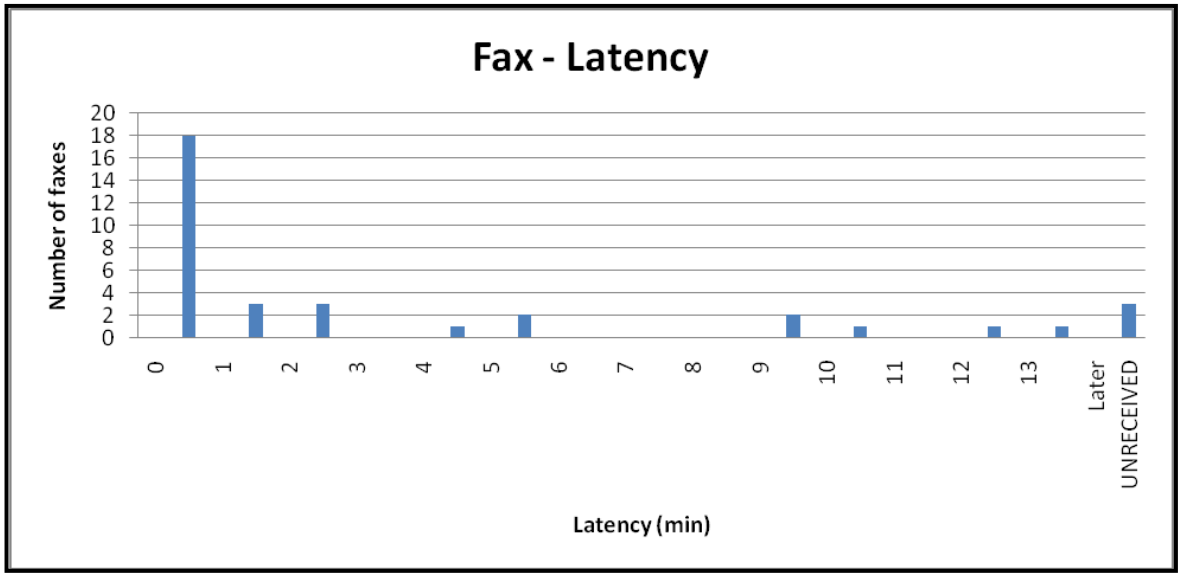

Figure 5. Fax latency

An issue was noted for some faxes: As the width of the message was too big, during the fax print-out, the last two characters at the right were not printed. The problem was solved as the width was reduced from 20 cm to 16 cm.

5.3 EVALUATION OF THE MESSAGE DISSEMINATION BY GTS

Twelve (12) countries out of 31 (39%) confirmed the GTS reception of the message. The minimum latency is of less than 1 minute, and the maximum of 12 minutes. Mean time is around 3 minutes and median time is between 2 and 3 minutes. All countries but one received the GTS message in 5 minutes or less.

Some countries received the test message by GTS on more than one computer, depending on how many institutes and mailing addresses subscribed to the GTS messages reception, and one country received it more than once because their meteorological service forwarded the message to the crisis centre, who already received it.

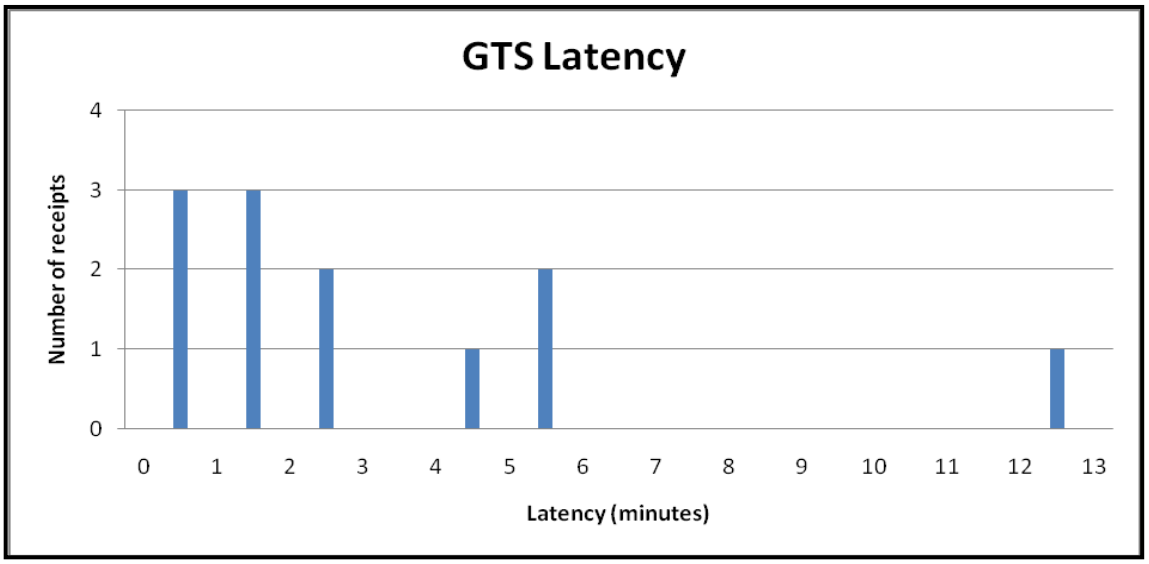

Figure 6. GTS latency

5.4 GENERAL OBSERVATIONS

Twenty-seven (27) countries out of 31 (87%) and 31 institutes out of 35 (89%) answered partially or totally to the evaluation questionnaire.

Among these countries, 21 (78%) received the alert messages in less than 2 minutes by at least one mean of communication. Twenty-five (25) (93%) countries received the alert messages 5 minutes after the message dissemination. The maximum time for reception of the first message is 11 minutes, which means that all the countries were alerted in less than 15 minutes.

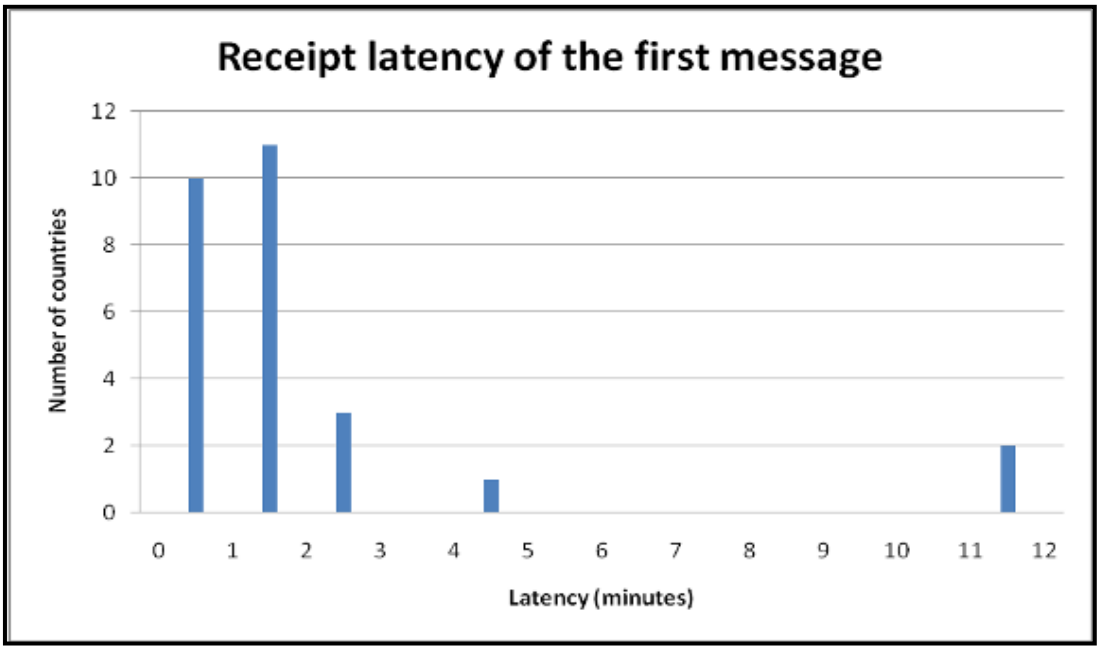

Figure 7. First message received latency

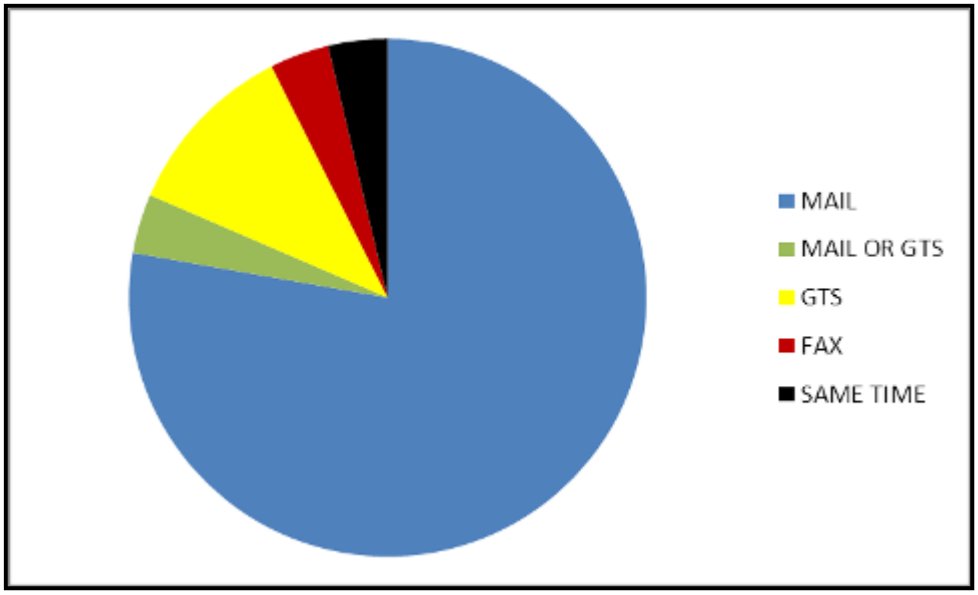

Figure 8. Type of the first message received

Figure 7 shows the latencies of reception of the first message for each country, while Figure 8 shows the type of the first message received (Mail at 78%).

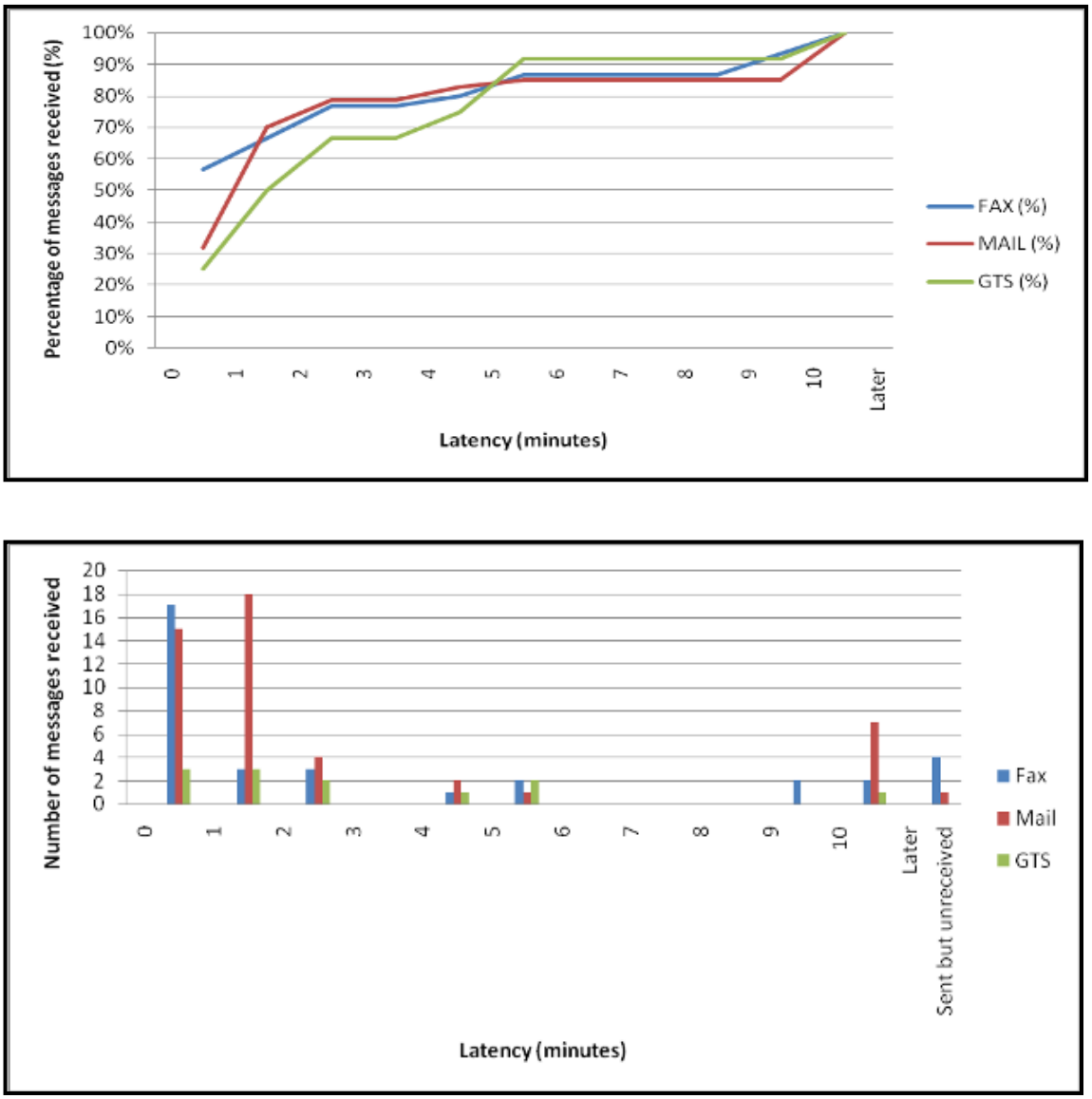

Figure 9. Latencies: General view

Figure 9 sums up the latencies for each way of communication.

5.5 EVALUATION OF TWFP RESPONSE

Even if it was requested in the NEAMTWS–CTE instructions, some TWFP (11 of 31, 35%) did not answer to the correct mailing address (operateur.dase@cenalt.cea.fr) but to the email address which sent the messages (tsunami.dase@cenalt.cea.fr).

6. NOTES – ISSUES TO BE CONSIDERED BY THE TASK TEAM ON COMMUNICATION TEST AND TSUNAMI EXERCISES (TT–CTTE)

1. The update of the TWFP/TNC database and the omission of some institutes have been problematic in CTE2. Some forms were received the last days before the CTE2 day. For two countries, new TWFP forms were interpreted by CENALT that old TWFP of the same country were not participants to the CTE2.

2. There was some misunderstanding about the time of reception which has to be provided in the evaluation questionnaire. The time of reception is the time when the message arrived on the mail box or the fax machine, and not the time when the message is opened/read by the TWFP personnel.

3. Some countries received the GTS message 2 times or 3 times on the same address. In fact, the Turkish State of Meteorological Service (TSMS) has a partnership with the North Atlantic Treaty Organization (NATO), and has to forward every incoming GTS message concerning any alert to a predefined list of receivers; that is the reason why the countries which are both focal points and on this list received it two times.

4. There were, as described previously, problems concerning the reception of the questionnaire: more than a third of countries replied using tsunami.dase@cenalt.cea.fr instead of operateur.dase@cenalt.cea.fr, as described in the Operational User Guide. It could be advisable to recommend that the reply address should be reminded in the test message to avoid reception on the wrong address.

5. It was unknown if the TWFPs had access to the GTS system. Message Receiver Information forms could be updated in such a way to identify whether GTS capability exists or not.

7. COMMENTS BY THE TASK TEAM ON COMMUNICATION TEST AND TSUNAMI EXERCISES (TT–CTTE)

CTE2 was a successful test with the participation of 31 countries. Most of the recommendations previously introduced in the First Enlarge Communication Test Exercise (ECTE1) were successfully implemented, and some of the problems faced during ECTE1 have been successfully resolved; yet there are still some ongoing problems which need further attention. An improvement in the fax and GTS message latencies has been observed and email message latencies are comparable with ECTE1. The number of actively participating countries increased from 20 to 26 with respect to ECTE1. Some of the problems encountered in CTE2 have been reflected in Section 6 of this report. On top of these, the following is a summary provided by Mr Öcal Necmioğlu and Mr Luis Matias, the TT-CTTE Co-Chairs:

- Related to Point 6.1:

  The NEAMTWS–CTE messages should be delivered to the TWFP/TNC operational addresses as provided by the Member States to the IOC Secretariat. Member States are invited to check that these addresses are accurate and up-to-date. Any changes, corrections or amendments should be sent to the IOC Secretariat through the official channels described in UNESCO/IOC TWFP and TNC nomination forms. They will be used in the NEAMTWS–CTE if received at least one week before the exercise. On the day of the Second Announcement, the IOC Secretariat will send the most up-to-date list of TWFP/TNC contact information in the format described in Table 2 to the Message Provider, copied to the Task team Chair/Co-Chairs. It should be stressed that it is responsibility of Member States to nominate their Tsunami National Contacts (TNCs) and Tsunami Warning Focal Points (TWFPs), and to ensure that information is up-to-date. This procedure, clearly defined in the CTE Manual, was not followed during the CTE2, and as a result two TWFPs (Germany – Deutscher Wetterdienst [DWD] and Portugal – Instituto de Meterologia [IM]) were not included in the dissemination list.

		TWFP CONTACT INFO				TSUNAMI MESSAGES					
						Fax Message		E-mail Message		Voice Message	
		Name	Address	E-mail	Fax	Primary	Alternate	Primary	Alternate	Primary	Alternate
Country 1	Institute 1										
	Institute 2										
Country 2	Institute 1										
	Institute 2										

Table 2. Format of the TWFP/TNC contact information list.

- Related to Point 6.3:

  The duplication of the GTS message to a NATO ACOWEX communication channel by Turkish State of Meteorological Service (TSMS) still remains an issue. NTWC-TR (KOERI), in cooperation with the TSMS, should work on a possible resolution.

- Related to Point 6.4:

  The evaluation of the CTE should be conducted by filling a questionnaire (see the proposed questionnaires in Annex V and Annex VI of the CTE2 Manual (Vol.1), one for the Message Provider and one for each Message Receivers). Each agency that participates in the CTE is requested to deliver one report encompassing all messages received. These questionnaires should be answered shortly after the end of the exercise, and they must be sent via email to the Message Provider within one week of the CTE. IOC Secretariat should not be responsible for the collection of evaluation questionnaires at no circumstance.

- The names of countries and institutions in a CTE message should be sorted in alphabetical order in the message body, as described in the Interim Operational User Guide.

- A test calculation launched by the Joint Research Centre (JRC) based on the CTE2 message, which due to a mistake was entered in the Global Disaster Alert and Coordination System (GDACS) list of events and thus ended up in the GDACS daily newsletter. Such use of CTEs is wholeheartedly welcomed, yet external institutions should ensure that communication test messages should not cause concern among the public and/or relevant institutions.

- It is also desirable that relevant organizations not belonging to the ICG/NEAMTWS, like the European Union Monitoring and Information Centre (MIC) and the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS), participate in the NEAMTWS–CTE as observers and are encouraged to fill also the questionnaires related to the exercise. The participation of MIC should be especially encouraged in the next CTE.

ANNEX I

CTE2 FIRST ANNOUNCEMENT
(on-line language versions)

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
COMMISSION OCÉANOGRAPHIQUE INTERGOUVERNEMENTALE
COMISIÓN OCEANOGRÁFICA INTERGUBERNAMENTAL
МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ
اللجنة الدولية الحكومية لعلوم المحيطات
政府间海洋学委员会
UNESCO

UNESCO - 1, rue Miollis - 75732 Paris cedex 15, France
http://ioc-unesco.org - fax: +33 (0)1 45 68 58 10 - contact phone: +33 (0)1 45 68 39 83/84
E-mail: w.watson-wright@unesco.org

IOC Circular Letter No. 2431
(Available in English and French)

IOC/WWW/TA/FS/ch
Paris, 19 April 2012

To : ICG/NEAMTWS Tsunami Warning Focal Points (TWFP) and Tsunami National Contacts (TNC)
ICG/NEAMTWS Chair, Vice-Chairs and Officers

cc. : Official National Coordinating Body for liaison with the IOC Member States
Permanent Delegates/Observer Missions to UNESCO of IOC Member States and
National Commissions for UNESCO of IOC Member States in the NEAM region

Subject : Invitation to participate to the second NEAMTWS Communication Test Exercise (NEAMTWS-CTE2) on 22 May 2012

We have the pleasure to announce the second NEAMTWS Communication Test Exercise (NEAMTWS-CTE2), which will be conducted on 22 May 2012. The NEAMTWS-CTE2 will involve the National Tsunami Warning Centres (NTWC) and the Tsunami Warning Focal Points (TWFP).

The candidate Tsunami Watch Provider (TWP), National Tsunami Warning Centres (NTWC) and Tsunami Warning Focal Points (TWFP) must keep a high level of readiness so as to be able to act efficiently and effectively to provide for the public's safety during fast-onset and rapidly-evolving natural disasters like the tsunamis. A good example has been the Indian Ocean Tsunami Early Warning System (IOTWS) on April 11 through an efficient response to the tsunami threat generated by the earthquake at the Off West Coast of Northern Sumatra. To maintain this high state of operational readiness and especially for infrequent events such as tsunamis, tsunami watch/warning centres and emergency agencies must regularly practice their response procedures to ensure that vital communication links work seamlessly, and that agencies and response personnel know the roles that they will need to play during an actual event.

.../...

NEAMTWS-VIII during 22 – 24 November 2011 in Santander – Spain, confirmed a Task Team on Communication Test and Tsunami Exercises (TT-CT&TE) which is responsible for the preparation and conduct of NEAMTWS-CTE2 and organization of its assessment. The aim of the NEAMTWS-CTE2 is to refine procedures for testing the communication of tsunami alert messages between National Tsunami Warning Centres and all Tsunami Warning Focal Points (TWFPs), including speed and availability within NEAMTWS region. CTEs conducted during the previous intersessional period highlighted the importance of having other communication methods like Global Telecommunication System (GTS), and therefore the utilization of GTS during the NEAMTWS-CTE2 is another aim of the Exercise. The information concerning the Messages Provider (French CENALT National Tsunami Warning center) will be provided in the second letter of Announcement.

NEAMTWS-CTE2 will address the questions related to the evaluation and issuance of the warning message by Tsunami Watch Provider, as in the previous CTEs, but will also attempt to assess the national and/or local response and warning dissemination mechanisms once emergency authorities receive a warning. NEAMTWS-CTE2 will involve all possible TWFPs using conventional message dissemination channels that have been previously subject to test between candidate TWP and NTWCs. Message dissemination using GTS will be only available between TWFPs that have this system available to them at the operation level.

The NEAMTWS-CTE2 messages will be delivered to the TWFP (TNC in the absence of a designated TWFP) operational addresses as provided by Member States to the IOC secretariat. Member States are invited to verify that these addresses are accurate and up-to-date. Any changes, corrections or amendments should be sent to the IOC secretariat through the official channels described in UNESCO IOC TWFP and TNC nomination forms. They will be used in the NEAMTWS-CTE2 if received one week before the exercise.

We kindly ask you to fill the attached form and to send it to the Secretariat (neamtws-secretariat@unesco.org) not later than 8 May 2012.

More information on the nature of the exercise together with technical details concerning the conduct and evaluation of the exercise can be found in the NEAMTWS Communication Exercise Manual, attached to this Circular Letter. All relevant documentation and updated information on the Exercise can be accessed through the NEAMTIC website.

Thank you in advance for your cooperation.

Yours sincerely,

François Schindelé
Chairman, ICG/NEAMTWS

for Wendy Watson-Wright
Assistant Director-General, UNESCO
Executive Secretary, IOC

INFORMATION ON MESSAGE RECEIVER

COUNTRY:

INSTITUTION:

Email addresses to receive the test message:

Primary e-mail address:

Alternate e-mail address (if any):

Fax numbers to receive the test message:

Primary fax number:

Alternate fax number:

Phone numbers to receive the test message:

Primary phone number:
Alternate phone number:

Contact Info:

Name:

E-mail:

Fax:

Mailing Address:

ANNEX II

CTE2 SECOND ANNOUNCEMENT

From: tsunami.dase@cenalt.cea.fr[mailto:tsunami.dase@cenalt.cea.fr]
Sent: 15 May 2012 10:47
To: francois.schindele@cea.fr
Cc: f.santoro@unesco.org
Subject: CTE 2 SECOND ANNOUNCEMENT MESSAGE

To whom it may concern;

This e-mail message is sent to you from the CTE message provider NEAM CENALT Candidate Tsunami Watch Provider e-mail address tsunami.dase@cenalt.cea.fr in order to ensure that the anti-spam and firewall software operating at the message recipient side do not block the CTE message on the day of the exercise, 22/05/2012.

You have received this e-mail because either you have provided your e-mail address in Annex III of the *NEAMTWS-CTE Manual* (IOC/2014/TS/102Vol.1) or your e-mail address was provided in TWFP/TNC forms submitted by your State/Government to UNESCO/IOC.

Please be so kind to confirm the receipt of this message at operateur.dase@cenalt.cea.fr.

Best regards,

NEAM CENALT Candidate Tsunami Watch Provider

ANNEX III

CONTACT UPDATING FORM
FOR THE MESSAGE RECEIVERS AND PROVIDER

INFORMATION ON MESSAGE RECEIVER
COUNTRY:
INSTITUTION:
Email addresses to receive the test message:
Primary e-mail address:
Alternate e-mail address (if any):
Fax numbers to receive the test message:
Primary fax number:
Alternate fax number:
Contact Info:
Name:
E-mail:
Fax:
Mailing Address:

INFORMATION ON MESSAGE PROVIDER	
Name of the Country: **FRANCE**	
Name of the Institution: **CENALT**	
Email address to broadcast the communication test message[1]:	tsunami.dase@cenalt.cea.fr
Fax number(s) to broadcast the communication test message[2]:	+33 1 69 27 18 74
Fax ID code(s):	
GTS Message Header:	WEMQ40
TWFP Information[3]	
Name:	SCHINDELE FRANCOIS
E-mail address:	**Operateur.dase@cenalt.cea.fr**
Fax:	**+33-1-69-26-71-47**
Mailing address:	CEA/DASE/CENALT Bruyères-le-Châtel 91297 ARPAJON CEDEX FRANCE

[1] DO NOT USE THIS EMAIL ADDRESS TO RESPOND

[2] Include all the lines used by the Fax machine in case of parallel broadcasting. DO NOT USE THIS FAX NUMBER TO RESPOND

[3] Please note that this information is only to identify the person responsible for sending the message, and responding to the technical questions concerning the CTE. This email address must be used to send the questionnaire after the test.

ANNEX IV

MESSAGE SENT BY FAX

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001
NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 0830Z 22 MAY 2012

... TSUNAMI COMMUNICATION TEST ...
THIS TEST APPLIES TO ANPC (PORTUGAL) ... BAS (BULGARIA) ... BSH (GERMANY) ... CCD (CYPRUS) ... CCS (UNITED KINGDOM) ... CENALT (FRANCE) ... CGCCR (BELGIUM) ... CNRS (LEBANON) ... CPD (MALTA) ... DEPREM (TURKEY) ... DGPCE (SPAIN) ... DMI (DENMARK) ... DPC (ITALY) ... DSB (NORWAY) ... EARS (SLOVENIA) ... EMI (ESTONIA) ... FMI (FINLAND) ... GII (ISRAEL) ... GSC (FINLAND) ... GSI (IRELAND) ... INMG (CAPE VERDE) ... IZOR (CROATIA) ... KNMI (NETHERLANDS) ... KOERI (TURKEY) ... MHI (UKRAINE) ... NHQSFS (POLAND) ... NIEP (ROMANIA) ... NIOF (EGYPT) ... NOA (GREECE) ... NOC (UNITED KINGDOM) ... NPO (RUSSIAN FEDERATION) ... NPRD (CROATIA) ... SMHI (SWEDEN) ... SPMC (MONACO) ... SWO (SYRIA)

FROM - NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER

TO - TWFP PARTICIPANTS IN THE NEAMTWS COMMUNICATION TEST EXERCISE
SUBJECT - NEAMTWS TSUNAMI COMMUNICATION TEST

THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE TRANSMISSION TIMES INVOLVED IN THE DISSEMINATION OF OPERATIONAL TSUNAMI MESSAGES FROM THE CANDIDATE TSUNAMI WATCH PROVIDER TO OTHER CANDIDATE TSUNAMI WATCH PROVIDERS, NATIONAL TSUNAMI WARNING CENTERS AND TSUNAMI WARNING FOCAL POINTS OF THE NEAM TSUNAMI WARNING SYSTEM

RECIPIENTS ARE REQUESTED TO FILL THE EVALUATION QUESTIONNAIRE AND SEND IT ACCORDING TO THE NEAMTWS-CTE INSTRUCTIONS

THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST

THIS WILL BE THE FINAL MESSAGE ISSUED

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001

ANNEX V

MESSAGE SENT BY GTS

WEMQ40 LFPW 220831
TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001
NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 0830Z 22 MAY 2012

... TSUNAMI COMMUNICATION TEST ...
THIS TEST APPLIES TO ANPC (PORTUGAL) ... BAS (BULGARIA) ... BSH (GERMANY) ... CCD (CYPRUS) ... CCS (UNITED KINGDOM) ... CENALT (FRANCE) ... CGCCR (BELGIUM) ... CNRS (LEBANON) ... CPD (MALTA) ... DEPREM (TURKEY) ... DGPCE (SPAIN) ... DMI (DENMARK) ... DPC (ITALY) ... DSB (NORWAY) ... EARS (SLOVENIA) ... EMI (ESTONIA) ... FMI (FINLAND) ... GII (ISRAEL) ... GSC (FINLAND) ... GSI (IRELAND) ... INMG (CAPE VERDE) ... IZOR (CROATIA) ... KNMI (NETHERLANDS) ... KOERI (TURKEY) ... MHI (UKRAINE) ... NHQSFS (POLAND) ... NIEP (ROMANIA) ... NIOF (EGYPT) ... NOA (GREECE) ... NOC (UNITED KINGDOM) ... NPO (RUSSIAN FEDERATION) ... NPRD (CROATIA) ... SMHI (SWEDEN) ... SPMC (MONACO) ... SWO (SYRIA)

FROM - NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER

TO - TWFP PARTICIPANTS IN THE NEAMTWS COMMUNICATION TEST EXERCISE
SUBJECT - NEAMTWS TSUNAMI COMMUNICATION TEST

THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE TRANSMISSION TIMES INVOLVED IN THE DISSEMINATION OF OPERATIONAL TSUNAMI MESSAGES FROM THE CANDIDATE TSUNAMI WATCH PROVIDER TO OTHER CANDIDATE TSUNAMI WATCH PROVIDERS, NATIONAL TSUNAMI WARNING CENTERS AND TSUNAMI WARNING FOCAL POINTS OF THE NEAM TSUNAMI WARNING SYSTEM

RECIPIENTS ARE REQUESTED TO FILL THE EVALUATION QUESTIONNAIRE AND SEND IT ACCORDING TO THE NEAMTWS-CTE INSTRUCTIONS

THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST

THIS WILL BE THE FINAL MESSAGE ISSUED

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001

ANNEX VI

MESSAGE SENT BY E-MAIL

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001
NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER
ISSUED AT 0830Z 22 MAY 2012

... TSUNAMI COMMUNICATION TEST ...
THIS TEST APPLIES TO ANPC (PORTUGAL) ... BAS (BULGARIA) ... BSH (GERMANY) ... CCD (CYPRUS) ... CCS (UNITED KINGDOM) ... CENALT (FRANCE) ... CGCCR (BELGIUM) ... CNRS (LEBANON) ... CPD (MALTA) ... DEPREM (TURKEY) ... DGPCE (SPAIN) ... DMI (DENMARK) ... DPC (ITALY) ... DSB (NORWAY) ... EARS (SLOVENIA) ... EMI (ESTONIA) ... FMI (FINLAND) ... GII (ISRAEL) ... GSC (FINLAND) ... GSI (IRELAND) ... INMG (CAPE VERDE) ... IZOR (CROATIA) ... KNMI (NETHERLANDS) ... KOERI (TURKEY) ... MHI (UKRAINE) ... NHQSFS (POLAND) ... NIEP (ROMANIA) ... NIOF (EGYPT) ... NOA (GREECE) ... NOC (UNITED KINGDOM) ... NPO (RUSSIAN FEDERATION) ... NPRD (CROATIA) ... SMHI (SWEDEN) ... SPMC (MONACO) ... SWO (SYRIA)

FROM - NEAM CENALT CANDIDATE TSUNAMI WATCH PROVIDER

TO - TWFP PARTICIPANTS IN THE NEAMTWS COMMUNICATION TEST EXERCISE
SUBJECT - NEAMTWS TSUNAMI COMMUNICATION TEST

THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE TRANSMISSION TIMES INVOLVED IN THE DISSEMINATION OF OPERATIONAL TSUNAMI MESSAGES FROM THE CANDIDATE TSUNAMI WATCH PROVIDER TO OTHER CANDIDATE TSUNAMI WATCH PROVIDERS, NATIONAL TSUNAMI WARNING CENTERS AND TSUNAMI WARNING FOCAL POINTS OF THE NEAM TSUNAMI WARNING SYSTEM

RECIPIENTS ARE REQUESTED TO FILL THE EVALUATION QUESTIONNAIRE AND SEND IT ACCORDING TO THE NEAMTWS-CTE INSTRUCTIONS

THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST

THIS WILL BE THE FINAL MESSAGE ISSUED

TSUNAMI COMMUNICATION TEST MESSAGE NUMBER 001

ANNEX VII

**EVALUATION QUESTIONNAIRE
FOR MESSAGE PROVIDER**

COUNTRY:		FRANCE	
INSTITUTION:		CENALT	
Provide T0 Time:		08:30:00Z	
Provide times of message delivery for each communication technology below:			
	E-MAIL	**FAX**	**GTS**
time stamp:	08:31:47Z	08:31:57Z	08:31:37Z
Provide a detailed story of all activities starting from T0 and TN (end of the exercise). Did you receive any error messages or observed any problems? If yes, describe them for all dissemination technologies and addresses concerned.			
Cf. Section IV: NEAMTWS–CTE2 Story Book			
Describe the operational service to deliver the e-mail, fax and GTS messages.			
A dedicated software is able to generate automatically test messages by a simple click. The message receivers can be entered before the exercise, and, on the day of the test, the operator just had to tick the box corresponding to the group “CTE2” and then click to generate the test messages. Then, 3 messages are generated, one for each way of communication. The operators can validate or invalidate them, and they are automatically sent then.			
Describe briefly the preparation made in your agency for the Communication Test Exercise			
As described previously, internal meetings were leaded to make sure that CENALT will be able to send correctly the messages of CTE2. The IOC was solicited too about the contact database.			
Describe briefly the procedures taken during the exercise, before time zero, and after time zero.			
The list of message receivers was entered into the software before the exercise. At time zero, the operator just ticked the box corresponding to the group “CTE2” and clicked to generate the test messages. He validated the 3 messages generated, one for each way of communication, and they were automatically sent then.			
Did you synchronize the PC before distributing the email messages? If yes, describe briefly the procedure used.			
The time of all the computers are permanently based upon atomic clock.			
Did you synchronize the fax machine before sending the messages? If yes, describe briefly the procedure used.			

The hour of our fax server is automatically updated based on atomic clock.
Did you find the exercise useful in assessing the readiness of your agency to distribute tsunami related messages?
Yes
Do you have any comments on the exercise, including the exercise manual and/or information received related to the exercise?
Cf. the recommendations inside this report.
Have you and/or your institution been contacted by media concerning the exercise before/during/after the exercise? Please provide brief information if applicable.
No

ANNEX VIII

**EVALUATION QUESTIONNAIRE
FOR MESSAGE RECEIVER**

1. COUNTRY:				
2. INSTITUTION:				
3. Provide the time stamps of the messages received through each communication technology:				
E-MAIL		**FAX**		**GTS**
4. Provide times of message delivery for each communication technology:				
Primary E-MAIL	**Alternate E-MAIL**	**Primary FAX**	**Alternate FAX**	**GTS**
[type e-mail address]	*[type e-mail address]*	*[type fax number]*	*[type fax number]*	
[type time in UTC HH:MM:SS format]	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*
5. Provide times for each communication technology when the message is read and understood by the operator:				
Primary E-MAIL	**Alternate E-MAIL**	**Primary FAX**	**Alternate FAX**	**GTS**
[type e-mail address]	*[type e-mail address]*	*[type fax number]*	*[type fax number]*	
[type time in UTC HH:MM:SS format]	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*	*[type time in UTC HH:MM:SS format]*
6. Was the provider e-mail address as expected?				
7. Was the e-mail message complete as expected? If not, report the differences.				
8. Was the provider fax number as expected?				
9. Was the fax message complete as expected? If not, report the differences.				

10.	**Was the GTS message complete as expected? If not, report the differences.**
11.	**Did the operator that received the messages understood its content and knew how to respond to it?**
12.	**Describe briefly the preparation made in your agency for the Communication Test Exercise.**
13.	**Did you synchronize the PC before distributing the email messages? If yes, describe briefly the procedure used.**
14.	**Did you synchronize the fax machine before receiving the messages? If yes, describe briefly the procedure used.**
15.	**Did you find the exercise useful in confirmation communication contacts and delays?**
16.	**Do you have any comments on the exercise, including the exercise manual and/or information received related to the exercise?**
17.	**Do you have any suggestions for the next exercises?**
18.	**Have you and/or your institution been contacted by media concerning the exercise before/during/after the exercise? Please provide brief information if applicable.**

ANNEX IX

TIME OF REPLYING TO THE CTE2

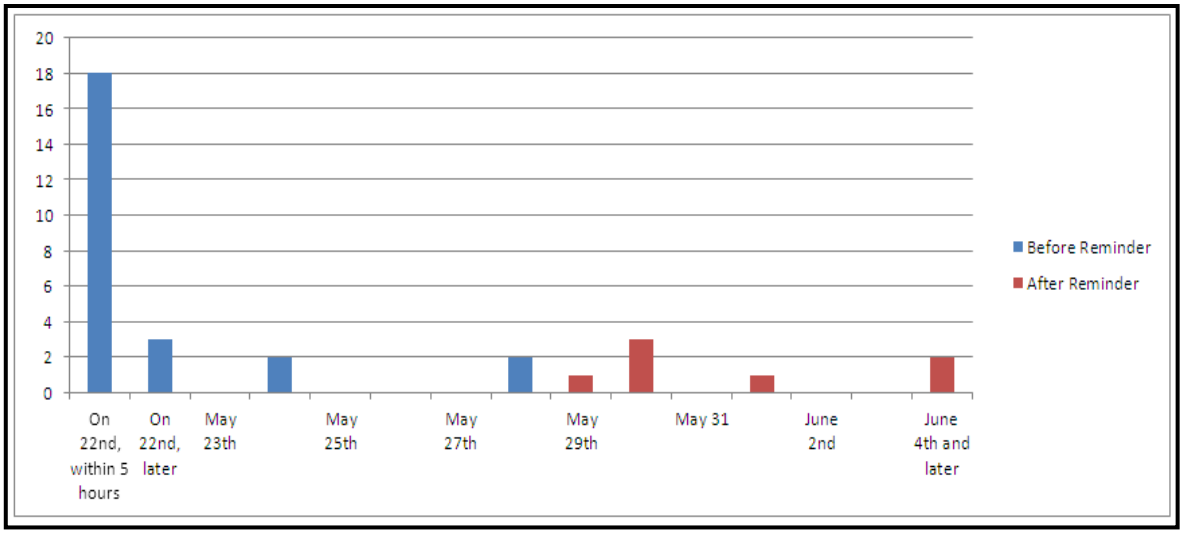

Table IX–1. Time or replying to the CTE2

This graphic shows the number of institutes that confirmed reception of the CTE2 message and/or provided questionnaire, depending on the day they sent their first reply.

A reminder was sent to the countries that did not reply on 29 May 2012.

Mean latency is between 2 and 3 days; and median latency is around 5 hours. Five institutes never replied.

ANNEX X

SYNTHETIC TABLE OF RECEPTION TIMES FOR EACH WAY OF COMMUNICATION

FAX	
SENT AT	RECEIVED AT
08:35	08:35
UNSENT	
08:34	09:10
UNSENT	
08:55	
08:37	08:39
08:50	NOT RECEIVED
08:36	08:38
08:39	08:44
08:48	08:53
08:40	08:40
UNSENT	
08:32	08:42
08:34	08:35
08:34	NOT RECEIVED
UNSENT	
08:34	08:34
08:36	08:36
08:44	08:48
08:47	08:47
08:33	08:33
08:37	08:37
08:46	08:55
08:54	
UNSENT	
UNSENT	
08:55	09:07
08:44	
08:38	NOT RECEIVED
08:35	08:35
08:33	08:33
08:43	
08:42	08:42
08:42	
08:51	08:51
08:36	08:37
08:39	08:40
08:51	08:51
08:42	
08:37	00:00
08:48	08:48
08:35	08:35
08:33	08:33
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Image X–1. Synthetic table of reception times

ANNEX XI

LIST OF ACRONYMS

CP–DMA	Civil Protection and Disaster Management Authority
CENALT	CENtre d'Alerte aux Tsunamis, France
CTE	Communication Test Exercise
CTWP	Candidate Tsunami Watch Provider
ECTE1	First Enlarged Communication Test Exercise
CTE2	Second Enlarged Communication Test Exercise
GDACS	Global Disaster Alert and Coordination System
GTS	Global Telecommunication System
ICG	Intergovernmental Coordination Group
IM	Meteorological Institute, Portugal
IOC	Intergovernmental Oceanographic Commission of UNESCO
I-OUG	Interim Operational User Guide
JRC	Joint Research Centre
KOERI	Kandilli Observatory and Earthquake Research Institute, Turkey
MIC	European Union Monitoring and Information Centre
MS	Member State
NATO	North Atlantic Treaty Organization
NEAM	North-Eastern Atlantic, Mediterranean and Connected Seas
NEAMTWS	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas
NTWC	National Tsunami Warning Centre
RTWC	Regional Tsunami Watch Centre
SOP	Standard Operational Procedure
TNC	Tsunami National Contact
TSMS	Turkish State Meteorological Service
TT–CTTE	Task Team on Communication Test and Tsunami Exercises
TWFP	Tsunami Warning Focal Point
TWP	Tsunami Watch Provider
UNESCO	United Nations Educational, Scientific and Cultural Organization

IOC Technical Series

No.	Title	Languages
1	Manual on International Oceanographic Data Exchange. 1965	(out of stock)
2	Intergovernmental Oceanographic Commission (Five years of work). 1966	(out of stock)
3	Radio Communication Requirements of Oceanography. 1967	(out of stock)
4	Manual on International Oceanographic Data Exchange - Second revised edition. 1967	(out of stock)
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7	Comprehensive Outline of the Scope of the Long-term and Expanded Programme of Oceanic Exploration and Research. 1970	(out of stock)
8	IGOSS (Integrated Global Ocean Station System) - General Plan Implementation Programme for Phase I. 1971	(out of stock)
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10	Bruun Memorial Lectures, 1971	E, F, S, R
11	Bruun Memorial Lectures, 1973	(out of stock)
12	Oceanographic Products and Methods of Analysis and Prediction. 1977	E only
13	International Decade of Ocean Exploration (IDOE), 1971-1980. 1974	(out of stock)
14	A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines. 1976	E, F, S, R
15	Bruun Memorial Lectures, 1975 - Co-operative Study of the Kuroshio and Adjacent Regions. 1976	(out of stock)
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33	Time-Series of Ocean Measurements. Vol. 4. 1988	E only

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85.	Tsunami Glossary	E, F, S
86	Pacific Tsunami Warning System (PTWS) Implementation Plan *(under preparation)*	
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	Vol. 2 Report. 2011	E only
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	Vol. 1 Exercise Manual. 2011 Supplement: Bulletins from the Regional Tsunami Service Providers	
	Vol. 2 Exercise Report. 2013	

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105.	Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System, August 2014. Revised Edition. 2014	E, S
106.	Exercise Pacific Wave 13. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1–14 May 2013. Vol. 1 Exercise Manual. 2013 Vol. 2 Summary Report. 2013	E only
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