



International Civil Aviation Organization

**TWENTIETH MEETING OF THE METEOROLOGICAL SUB-GROUP
(MET SG/20) OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING
AND IMPLEMENTATION REGIONAL GROUP (APANPIRG)**

6 – 9 June 2016, Bangkok, Thailand

Agenda Item 7: Regional guidance material

THE ASIA/PACIFIC REGIONAL GUIDANCE ON AERODROME TSUNAMI WARNINGS

(Presented by Ad Hoc Group - Australia, Indonesia and Japan (Rapporteur))

SUMMARY

This paper presents the draft regional guidance on aerodrome tsunami warnings revised in response to the outcome of the MET SG/19.

1. INTRODUCTION

1.1 The fourth meeting of the Meteorological Hazards Task Force (MET/H TF/4) reviewed the results of the survey conducted in 2011 and 2014 related to the current capabilities in providing information to aviation on tsunami.

1.2 In relation to the survey results, the meeting agreed to form an ad-hoc group to review the Tsunami survey results and develop regional guidance on the provision of tsunami warning information directly from the relevant tsunami warning centres to the 'at-risk' aerodromes that the METWSG proposed in draft Amendment 77 to Annex 3 (Agreed action 4/8 refers).

1.3 The ad-hoc group prepared a draft *Asia/Pacific Regional Guidance on Integration of Aerodrome Tsunami Warnings into the National Tsunami Warning Systems for Public* and submitted it to the fifth meeting of the Meteorological Hazards Task Force (MET/H TF/5) held in Seoul, Republic of Korea from 18 to 20 March 2015.

1.4 The MET/H TF/5 agreed that practices in States, in addition to those in Indonesia and Japan, could be reflected in the guidance if available and that it would be beneficial to the development of the guidance for the ad-hoc group to receive more feedback from States.

1.5 After the discussion at the MET/H TF/5, the ad-hoc group prepared the second draft of the guidance material and submitted it to the nineteenth meeting of the Meteorology Sub-Group (MET SG/19) held in Bangkok, Thailand from 3 to 6 August 2015.

1.6 Through getting feedback from the MET SG/19, the ad-hoc group submitted updated draft of the guidance material to the sixth meeting of the MET/S WG (MET/S WG/6) held in Bangkok, Thailand from 9 to 11 August 2016 and the meeting agreed to forward to the MET SG/20 for final review.

2. DISCUSSION

Outcome of MET SG/19 review

2.1 The MET SG/19 reviewed the second draft of *Asia/Pacific Regional Guidance on Integration of Aerodrome Tsunami Warnings into the National Tsunami Warning Systems for Public* and agreed that additional input should be sought to further develop the guidance.

2.2 In response to the discussion of MET SG/19, Australia offered to provide additional information with respect to its tsunami warning service for the aviation community.

Revised draft guidance material

2.3 The ad-hoc group, with the cooperation of Australia, prepared the revised draft *Asia/Pacific Regional Guidance on Aerodrome Tsunami Warnings and their integration into National Public Safety Plan for Tsunami* in **Attachment A**.

2.4 The differences from previous version are shown in **Attachment B**.

3. RECOMMENDATION

3.1 It is recommended that the MET SG/20 adopt the following draft Conclusion:

Draft Conclusion 20/x – Regional guidance on aerodrome tsunami warning

- a) The MET SG review the draft *Asia/Pacific Regional Guidance on Aerodrome Tsunami Warnings and their integration into the National Public Safety Plans for Tsunami* and provide comment to the ICAO RO MET no later than 9 June 2016.
- b) The MET SG submit the draft *Asia/Pacific Regional Guidance on Aerodrome Tsunami Warnings and their integration into the National Public Safety Plans for Tsunami* to APANPIRG/27 for final review.
- c) The final version of the *Asia/Pacific Regional Guidance on Aerodrome Tsunami Warnings and their integration into the National Public Safety Plans for Tsunami* be forwarded to ICAO RO MET for publication on the APAC eDocuments website.

4. ACTION REQUIRED BY THE MEETING

4.1 The meeting is invited to:

- a) review the draft *Asia/Pacific Regional Guidance on Aerodrome Tsunami Warnings and their integration into the National Public Safety Plans for Tsunami* in **Attachment A**;
- b) discuss any relevant matters as appropriate; and
- c) adopt the Conclusion in paragraph 3.1.

ATTACHMENT A

ASIA/PACIFIC REGIONAL GUIDANCE
on
Aerodrome Tsunami Warnings and their integration
into National Public Safety Plans for Tsunami.

19 February 2016
Draft Version 0.5

<i>Revision</i>	<i>Date</i>	<i>Description</i>
0.1	15/12/2014	Initial Draft of Guidance
0.2	13/01/2015	Reviewed by ad-hoc members
0.3	10/07/2015	Reviewed by MET/H TF members
0.4	12/02/2016	Updated by ad-hoc group
0.5	19/02/2016	Reviewed by ad-hoc members (Australia and Indonesia)

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PART I: Integration of aerodrome tsunami warnings into national public safety plans for tsunami.

1. Introduction

1.1 Background

1.1.1 The ASIA/PAC Air Navigation Planning and Implementation Regional Group (APANPIRG), at its twentieth Meeting held in Bangkok, Thailand, 7 to 11 September 2009 formulated its Conclusion 20/69 b). This conclusion requested that ICAO consider developing Annex 3 provisions and guidance material, as necessary, related to the issuance of aerodrome warnings for tsunami, as the implementation of the existing provisions had been considered to be problematic.

Conclusion 20/69 — Implementation of SIGMET on Radioactive Clouds and Aerodrome Warnings on Tsunami

That, in view of clarifying existing Annex 3 provisions,

a) (Omitted)

b) ICAO consider developing Annex 3 provisions and guidance material as necessary related to the issuance of aerodrome warnings on Tsunami.

1.1.2 The Meteorological Warning Study Group (METWSG), at its third Meeting held in Montréal, Canada, 15 to 18 November 2010, agreed that the intent of the inclusion of tsunami in the list of phenomena in aerodrome warnings was simply to relay any notification of an impending impact from a State emergency response structure to those concerned at an aerodrome, so that emergency measures could take place. It was noted that tsunami was not a meteorological phenomenon, but also recognized that the aerodrome warning was a convenient pre-existing means to get such information to the authorities concerned. With this in mind, the group agreed that an ad hoc group could consider the form of any appropriate guidance that could be provided to assist States in this respect. Furthermore, the group agreed that in order to prepare appropriate guidance, a better understanding of the existing capabilities of the States involved would be necessary.

1.1.3 The Meteorological Warning Study Group (METWSG), at its fourth Meeting held in Montréal, Canada, 15 to 18 May 2011, received a report from the ad hoc group that the aerodrome warning for tsunami be replaced by an element of a national tsunami system. The group agreed that it would be difficult to place requirements in ICAO for national public safety systems or indeed for the Tsunami Service Providers. However, the group agreed that in cases where a national public safety plan was in place concerning the incidence of tsunami, and that the aerodrome in consideration was a full and active part of that plan, then the issuance of a separate aviation-related tsunami warning would be redundant and could even cause confusion. As a result the group agreed the following action:

Action Agreed 4/7 — Tsunami warnings where national public safety plans incorporating the aerodrome exist

That the Secretary develop a draft amendment proposal to Annex 3, Appendix 6, 5.1.3 to add a note stating that tsunami warnings are not required in cases where a national public safety plan for tsunami was fully integrated with the “at risk” aerodrome concerned.

Draft Amendment 77 to Annex 3 related to aerodrome warnings for tsunami

1.2 The Meteorological Warning Study Group (METWSG), at its fifth Meeting held in Montréal, Canada, 20 to 21 June 2013, agreed a draft amendment proposal to Annex 3, Appendix 6, 5.1.3 to add the following note and submitted the draft amendment to Meteorology Divisional Meeting held in Montréal, Canada, 7 to 18 July 2014:

Note. — Aerodrome warnings related to the occurrence or expected occurrence of tsunami are not required where a national public safety plan for tsunami is integrated with the ‘at risk’ aerodrome concerned.

Overview of the concept on aerodrome warnings for tsunami

1.3 The ‘at risk’ aerodrome which is a full and active part of a national public safety plan for tsunami receives warnings from national public safety systems for tsunami according to that plan. On the other hand, the ‘at risk’ aerodrome which is not a part of a national public safety plan for tsunami receives aerodromes warnings for tsunami from the meteorological office designated by the meteorological authority concerned (refer to PART II of this document).

2. Integration of aerodromes into the national tsunami warnings

Aerodrome warnings for tsunami

2.1 The provisions for aerodrome warnings are provided in Annex 3, 7.3, and tsunami is included in the list of phenomena in aerodrome warnings in Appendix 6, 5.1.3. The aerodrome warnings for tsunami are issued where required by operators or aerodrome services, and shall be disseminated in accordance with local arrangements to those concerned.

National tsunami warning system for public

2.2 A large number of States which have a risk of tsunami develop national public safety plans for tsunami and disseminate warnings from national tsunami warning centres to the public.

Integration of aerodromes into the national tsunami warning systems for public

2.3 Warnings from national tsunami warning centres are relayed to the ‘at risk’ aerodrome according to a national public safety plan for tsunami and are treated as aerodrome warnings for tsunami.

3. Responsibilities

National Tsunami Warning Centres

3.1 Each national tsunami warning centre issues information or warnings for tsunami and disseminates them to organizations concerned.

Tsunami Service Providers

3.2 Tsunami Service Providers (TSP) provide threat information to national tsunami warning centres to formulate a tsunami warning. An example of a tsunami threat message from the Pacific Tsunami Warning and Mitigation System (PTWS) is provided in Appendix D of this document.

Meteorological Office or Meteorological Watch Office

3.3 The Meteorological Office (MO) or Meteorological Watch Office (MWO) which is designated as a part of a national tsunami warning system also should play the role that is defined in the national public safety plan and provide appropriate information to aviation users concerning the aerodrome. In the case of ‘at risk’ aerodromes where aviation users do not receive tsunami warning directly from tsunami warning centre, the MO or MWO should issue aerodrome warnings for tsunami. In preparing aerodrome warnings for tsunami the format determined in Annex 3 (detailed format description is provided in Appendix 6, Table A6-2 of Annex 3)

3.4 The Meteorological Office (MO) or Meteorological Watch Office (MWO) should provide consultation, on request, to aviation users who receive tsunami warnings for aerodrome concerned.

Aviation users

3.5 Aviation users who receive tsunami warnings by measures established in a national tsunami warning system should take the appropriate action based on the evacuation plan developed in each organization.

Coordination between units

3.6 Not to mention the coordination between units based on a national public safety plan, it is desirable to coordinate between each unit concerning the ‘at risk’ aerodrome and to develop each appropriate tsunami evacuation plan regardless of a national public safety plan.

4. Procedures for dissemination of tsunami warnings to at-risk aerodrome

Dissemination of tsunami warnings to aviation users

4.1 Tsunami warnings are disseminated using appropriate measures established in national tsunami warning systems. In some States, tsunami warnings are disseminated directly from national tsunami warning centres to aviation users, and in other States, aerodrome meteorological offices which receive tsunami warning as a part of a national tsunami warning system may provide them to aviation users concerning the aerodrome.

Examples in States

4.2 Appendices A, B and C show examples of procedures for dissemination of tsunami warnings to at-risk aerodrome in Japan, Indonesia and Australia.

PART II: Guidance for issuing aerodrome tsunami warnings when not integrated into a national public safety plan for Tsunami.

5. Introduction

5.1 When aerodromes are not incorporated into a States national public safety plan for tsunami, the Meteorological Watch Office (MWO) or Meteorological Offices responsible for providing aviation meteorological services to those aerodromes is required to issue a Tsunami Aerodrome Warning when the aerodrome is at risk of a tsunami.

5.2 The purpose of this section of the document is to provide guidance to States who are required to issue Tsunami Aerodrome Warnings services.

6. Tsunami information

6.1 Each ocean basin has designated Tsunami Service Providers (TSPs) which detect, analyse and assess the threat of tsunamis for all countries in that area and provide information to the National Tsunami Warning Centre (NTWCs) of those countries. It is then the responsibility of each country to issue any watches or warnings to their own communities.

6.2 Tsunami Warning Focal Points (TWFPs) are the official point of contact to receive tsunami event information. The TWFP is either the States emergency authority, or has the responsibility of notifying the emergency authority, in accordance with national procedures. The TWFP receives international tsunami bulletins from the TSPs.

6.3 The Intergovernmental Oceanographic Commission (IOC) Tsunami Programme supports IOC Member States in assessing tsunami risks, implementing warning systems and in educating communities about tsunami preparedness. Four Intergovernmental Coordination Groups (ICGs) have been established for the Pacific, Caribbean, Indian Ocean and Mediterranean to address regional needs.

6.4 Further information on the IOC and ICGs, including lists of established TWFP can be found at <http://www.ioc-tsunami.org/> or from the TSP websites listed below:

- Pacific Tsunami Warning Centre (PTWC) <http://ptwc.weather.gov/>
- US National Tsunami Warning Center (US NTWC) <http://wcatwc.arh.noaa.gov/>
- JMA North West Pacific Tsunami Advisory Center (JMA NWPTAC) <http://www.jma.go.jp/en/tsunami/>
- Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) http://www.ioc-tsunami.org/index.php?option=com_content&view=article&id=8&Itemid=13&lang=en

7. Establishing which aerodromes are “at risk” of tsunamis

7.1 In developing local procedures, Meteorological Authorities should first establish which aerodromes within their area are at risk of tsunami inundation. This should be done in consultation with airport owners or operators or the relevant emergency services. An individual

airport's vulnerability to tsunamis will depend on its elevation and distance to the coast.

8. Issuing a tsunami Aerodrome Warning

8.1 Once a MWO has received tsunami warning information and assessed an aerodrome to be at risk of tsunami inundation, a tsunami aerodrome warning should be issued.

8.2 The format of a tsunami aerodrome warning is shown in Table 1 below. ICAO Annex 3, Table A6-2 provides further information on the format of aerodrome warnings.

Element	Location indicator	Type of message	Validity period	Phenomenon	Observed or Forecast
Template	nnnn	AD WRNG [n]n	VALID nnnnnn/nnnnnn	TSUNAMI	OBS [AT nnnnZ] or FCST
Example	YBCS	AD WRNG 1	VALID 032200/041000	TSUNAMI	FCST
YBCS AD WRNG 1 VALID 032200/041000 TSUNAMI FCST					

Table 1 Format and example of tsunami aerodrome warning

NOTE:

- The validity period of the tsunami aerodrome warning should commence at the time of inundation indicated on the tsunami warning.

8.3 Appendix C explains the procedures for issuing aerodrome tsunami warnings to at-risk aerodromes in Australia.

Appendix A -The use of public tsunami warnings in aerodromes in Japan

1.1 Japan Meteorological Agency (JMA) issues tsunami warnings as a national tsunami warning centre. JMA disseminates tsunami warnings using public measures such as community wireless systems and public broadcast services. Aviation users concerning 'at risk' aerodrome receive tsunami warning from public measures described above and via aerodrome meteorological office.

1.2 Aviation users concerning 'at risk' aerodrome coordinate with each other and have developed tsunami evacuation plan in the aerodrome. Aviation users receiving tsunami warning will take the appropriate action based on the evacuation plan.

Appendix B - The use of public tsunami warnings in aerodromes in Indonesia

1.1. Indonesian Meteorological Climatological and Geophysical Agency (BMKG) is responsible for providing tsunami warning in Indonesia. BMKG disseminates tsunami warning through various communication media including SMS, email, website, Warning Receiver System and Global Telecommunication System.

1.2. Aviation users receiving tsunami warning through dissemination media described above will take the appropriate action based on the evacuation plan

Appendix C - Procedures for tsunami aerodrome warnings in Australia

1. Procedures

1.1 In Australia, the Joint Australian Tsunami Warning Centre (JATWC) which is operated by the Australian Bureau of Meteorology and Geoscience Australia, provides a tiered service for tsunami warnings using three different threat levels.

- **No Threat:** advice that an undersea earthquake has been detected, but it has not generated a tsunami, or the tsunami poses no threat to Australia or its offshore territories;
- **Marine Threat:** warning that tsunami waves could cause potentially dangerous rips, waves and strong ocean currents in the marine environment, and the possibility of some localised overflow onto the immediate foreshore; and
- **Land Inundation Threat:** warning for low-lying coastal areas of major land inundation and flooding, and of dangerous rips, waves and strong ocean currents in the marine environment.

1.2 For aviation purposes, Tsunami warnings are produced by the JATWC and are distributed to the relevant MWO. Once the MWO receives the tsunami warning, the aviation forecaster will assess the need to issue any aerodrome warnings. Tsunami aerodrome warnings will be issued for relevant aerodromes if they are considered to be an “at risk” aerodrome and if the tsunami warning is advising of a potential land inundation threat.

1.3 In Australia, aerodromes which are located within one kilometre of the sea and have an elevation less than 10 metres (approx. 30 feet) above mean sea level are considered to be at risk of tsunamis. However it should be noted that under some circumstances a tsunami can penetrate much further inland or to greater elevations, for example across a flat coastal plain, along an estuary or if close to the source earthquake.

2. Format of Australian tsunami aerodrome warnings

2.1 Australian aerodrome warnings for tsunami provide some additional

information to the format outlined in ICAO Annex 3 (see Table 1) including the threat level and a web link for further information.

- 2.2 An example of the format used for Australian tsunami aerodrome warnings is given below.

YBCS AD WRNG 1 VALID 032200/041000Z

AERODROME WARNING NUMBER 1 FOR CAIRNS VALID 040800/042000 LOCAL

ISSUED 031830Z (040430 LOCAL)

TSUNAMI WARNING HAS BEEN ISSUED. MAJOR LAND INUNDATION IS POSSIBLE

FROM 0800 LOCAL. ALSO REFER <http://www.bom.gov.au/tsunami/>

Appendix D - Example PTWC Tsunami Threat Message

TSUNAMI MESSAGE NUMBER 2
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
2323 UTC WED SEP 16 2015

..PTWC TSUNAMI THREAT MESSAGE...

**** NOTICE **** NOTICE **** NOTICE **** NOTICE **** NOTICE ****

THIS MESSAGE IS ISSUED FOR INFORMATION ONLY IN SUPPORT OF THE
UNESCO/IOC PACIFIC TSUNAMI WARNING AND MITIGATION SYSTEM AND IS
MEANT FOR NATIONAL AUTHORITIES IN EACH COUNTRY OF THAT SYSTEM.

NATIONAL AUTHORITIES WILL DETERMINE THE APPROPRIATE LEVEL OF
ALERT FOR EACH COUNTRY AND MAY ISSUE ADDITIONAL OR MORE REFINED
INFORMATION.

**** NOTICE **** NOTICE **** NOTICE **** NOTICE **** NOTICE ****

PRELIMINARY EARTHQUAKE PARAMETERS

- * MAGNITUDE 8.3
- * ORIGIN TIME 2254 UTC SEP 16 2015
- * COORDINATES 31.5 SOUTH 72.0 WEST
- * DEPTH 10 KM / 6 MILES
- * LOCATION NEAR THE COAST OF CENTRAL CHILE

EVALUATION

- * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 8.3 OCCURRED
NEAR THE COAST OF CENTRAL CHILE AT 2254 UTC ON WEDNESDAY
SEPTEMBER 16 2015.
- * BASED ON ALL AVAILABLE DATA... HAZARDOUS TSUNAMI WAVES ARE
FORECAST FOR SOME COASTS.

TSUNAMI THREAT FORECAST...UPDATED

- * TSUNAMI WAVES REACHING MORE THAN 3 METERS ABOVE THE TIDE
LEVEL ARE POSSIBLE ALONG SOME COASTS OF

CHILE.
- * TSUNAMI WAVES REACHING 0.3 TO 1 METERS ABOVE THE TIDE LEVEL
ARE POSSIBLE FOR SOME COASTS OF

ECUADOR... AND PERU.

* ACTUAL AMPLITUDES AT THE COAST MAY VARY FROM FORECAST AMPLITUDES DUE TO UNCERTAINTIES IN THE FORECAST AND LOCAL FEATURES. IN PARTICULAR MAXIMUM TSUNAMI AMPLITUDES ON ATOLLS WILL LIKELY BE MUCH SMALLER THAN THE FORECAST INDICATES.

* FOR OTHER AREAS COVERED BY THIS PRODUCT A FORECAST HAS NOT YET BEEN COMPUTED. THE FORECAST WILL BE EXPANDED AS NECESSARY IN SUBSEQUENT PRODUCTS.

RECOMMENDED ACTIONS

* GOVERNMENT AGENCIES RESPONSIBLE FOR THREATENED COASTAL AREAS SHOULD TAKE ACTION TO INFORM AND INSTRUCT ANY COASTAL POPULATIONS AT RISK IN ACCORDANCE WITH THEIR OWN EVALUATION... PROCEDURES AND THE LEVEL OF THREAT.

* PERSONS LOCATED IN THREATENED COASTAL AREAS SHOULD STAY ALERT FOR INFORMATION AND FOLLOW INSTRUCTIONS FROM NATIONAL AND LOCAL AUTHORITIES.

ESTIMATED TIMES OF ARRIVAL

* ESTIMATED TIMES OF ARRIVAL -ETA- OF THE INITIAL TSUNAMI WAVE FOR PLACES WITHIN THREATENED REGIONS ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	REGION	COORDINATES	ETA(UTC)
VALPARAISO	CHILE	33.0S 71.6W	2315 09/16
COQUIMBO	CHILE	29.9S 71.4W	2315 09/16
CALDERA	CHILE	27.1S 70.8W	2336 09/16
TALCAHUANO	CHILE	36.7S 73.1W	0000 09/17
ANTOFAGASTA	CHILE	23.3S 70.4W	0001 09/17
IQUIQUE	CHILE	20.2S 70.1W	0028 09/17
CORRAL	CHILE	39.8S 73.5W	0029 09/17
ARICA	CHILE	18.5S 70.3W	0042 09/17
MOLLENDO	PERU	17.1S 72.0W	0053 09/17
SAN JUAN	PERU	15.3S 75.2W	0110 09/17
LA PUNTA	PERU	12.1S 77.2W	0200 09/17
CHIMBOTE	PERU	9.0S 78.8W	0252 09/17
PUERTO MONTT	CHILE	41.5S 73.0W	0324 09/17
EASTER ISLAND	CHILE	27.1S 109.4W	0413 09/17
BALTRA ISLAND	ECUADOR	0.5S 90.3W	0500 09/17

POTENTIAL IMPACTS

* A TSUNAMI IS A SERIES OF WAVES. THE TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR. THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE INITIAL WAVE.

* IMPACTS CAN VARY SIGNIFICANTLY FROM ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND THE SHAPE AND ELEVATION OF THE SHORELINE.

* IMPACTS CAN ALSO VARY DEPENDING UPON THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI WAVES.

* PERSONS CAUGHT IN THE WATER OF A TSUNAMI MAY DROWN... BE CRUSHED BY DEBRIS IN THE WATER... OR BE SWEEPED OUT TO SEA.

NEXT UPDATE AND ADDITIONAL INFORMATION

* THE NEXT MESSAGE WILL BE ISSUED IN ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES -ALL LOWER CASE-.

* FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

* COASTAL REGIONS OF HAWAII... AMERICAN SAMOA... GUAM... AND CNMI SHOULD REFER TO PACIFIC TSUNAMI WARNING CENTER MESSAGES SPECIFICALLY FOR THOSE PLACES THAT CAN BE FOUND AT PTWC.WEATHER.GOV.

* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD ONLY REFER TO U.S. NATIONAL TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT NTWC.ARH.NOAA.GOV.

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— END —

ATTACHMENT B

ASIA/PACIFIC REGIONAL GUIDANCE
on
~~Integration of~~ Aerodrome Tsunami Warnings ~~and~~
their integration
into ~~the~~ National Public Safety Plans for Tsunami
~~Warning Systems for Public.~~

~~10 July 2015~~ **19 February 2016**
Draft Version ~~0.3~~ **0.5**

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PART I: Integration of aerodrome tsunami warnings into national public safety plans for tsunami.

1. Introduction

1.1 Background

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b) ICAO consider developing Annex 3 provisions and guidance material as necessary related to the issuance of aerodrome warnings on Tsunami.

1.1.2 The Meteorological Warning Study Group (METWSG), at its third Meeting held in Montréal, Canada, 15 to 18 November 2010, agreed that the intent of the inclusion of tsunami in the list of phenomena in aerodrome warnings was simply to relay any notification of an impending impact from a State emergency response structure to those concerned at an aerodrome, so that emergency measures could take place. It was noted that tsunami was not a meteorological phenomenon, but also recognized that the aerodrome warning was a convenient pre-existing means to get such information to the authorities concerned. With this in mind, the group agreed that an ad hoc group could consider the form of any appropriate guidance that could be provided to assist States in this respect. Furthermore, the group agreed that in order to prepare appropriate guidance, a better understanding of the existing capabilities of the States involved would be necessary.

1.1.3 The Meteorological Warning Study Group (METWSG), at its fourth Meeting held in Montréal, Canada, 15 to 18 May 2011, received a report from the ad hoc group that the aerodrome warning for tsunami be replaced by ~~either~~ an element of a national **tsunami** system ~~or by information stemming from an international warning centre whose area of responsibility covers the State concerned~~. The group agreed that it would be difficult to place requirements in ICAO ~~provisions~~ for national public safety systems or indeed for the ~~International Tsunami Warning Centres~~ **Service Providers**. However, the group agreed that in cases where a national public safety plan was in place concerning the incidence of tsunami, and that the aerodrome in consideration was a full and active part of that plan, then the issuance of a separate

aviation-related tsunami warning would be redundant and could even cause confusion. As a result the group agreed the following action:

Action Agreed 4/7 — Tsunami warnings where national public safety plans incorporating the aerodrome exist

That the Secretary develop a draft amendment proposal to Annex 3, Appendix 6, 5.1.3 to add a note stating that tsunami warnings are not required in cases where a national public safety plan for tsunami was fully integrated with the “at risk” aerodrome concerned.

Draft Amendment 77 to Annex 3 related to aerodrome warnings for tsunami

1.2 The Meteorological Warning Study Group (METWSG), at its fifth Meeting held in Montréal, Canada, 20 to 21 June 2013, agreed a draft amendment proposal to Annex 3, Appendix 6, 5.1.3 to add the following note and submitted the draft amendment to Meteorology Divisional Meeting held in Montréal, Canada, 7 to 18 July 2014:

Note. — Aerodrome warnings related to the occurrence or expected occurrence of tsunami are not required where a national public safety plan for tsunami is integrated with the ‘at risk’ aerodrome concerned.

Overview of the concept on aerodrome warnings for tsunami

1.3 The ‘at risk’ aerodrome which is a full and active part of a national public safety plan for tsunami receives warnings from national public safety systems for tsunami ~~or the International Tsunami Warning Centres~~ according to that plan. On the other hand, the ‘at risk’ aerodrome which is not a part of a national public safety plan for tsunami receives aerodromes warnings for tsunami from the meteorological office designated by the meteorological authority concerned (refer to PART II of this document).

2. Integration of aerodromes into the national tsunami warnings

Aerodrome warnings for tsunami

2.1 The provisions for aerodrome warnings are provided in Annex 3, 7.3, and tsunami is included in the list of phenomena in aerodrome warnings in Appendix 6, 5.1.3. The aerodrome warnings for tsunami are issued where required by operators or aerodrome services, and shall be disseminated in accordance with local arrangements to those concerned.

National tsunami warning system for public

2.2 A large number of States which have a risk of tsunami develop national public safety

plans for tsunami and disseminate warnings from national tsunami warning centres ~~or the International Tsunami Warning Centres~~ to the public.

Integration of aerodromes into the national tsunami warning systems for public

2.3 Warnings from national tsunami warning centres ~~or the International Tsunami Warning Centres~~ are relayed to the 'at risk' aerodrome according to a national public safety plan for tsunami and are treated as aerodrome warnings for tsunami.

3. Responsibilities

National Tsunami ~~warning centre~~ Warning Centres

3.1 Each national tsunami warning centre ~~including national tsunami warning centres or the International Tsunami Warning Centres~~ issues information or warnings for tsunami and disseminates them to organizations concerned.

Meteorological Watch Office ~~Tsunami Service Providers~~

3.2 ~~Meteorological Watch Office which is designated~~ Tsunami Service Providers (TSP) provide threat information to a part of a national tsunami warning system ~~should play the role that defined in the national public safety plan~~ centres to formulate a tsunami warning. An example of a tsunami threat message from the Pacific Tsunami Warning and Mitigation System (PTWS) is provided in Appendix D of this document.

Meteorological Office or Meteorological Watch Office

3.3 The Meteorological Office (MO) or Meteorological Watch Office (MWO) which is designated ~~to~~ as a part of a national tsunami warning system also should play the role that is defined in the national public safety plan and provide appropriate information to aviation users concerning the aerodrome. In the case of 'at risk' aerodromes, where aviation users ~~is~~ do not receive tsunami warning directly from tsunami warning centre, ~~Aerodrome Meteorological Office~~ the MO or MWO should issue aerodrome warnings for tsunami. In preparing aerodrome warnings for tsunami the format determined in Annex 3 (detailed format description is provided in Appendix 6, Table A6-2 of Annex 3)

3.4 The Meteorological Office (MO) or Meteorological Watch Office (MWO) should provide consultation, on request, to aviation users who receive tsunami warnings for aerodrome concerned.

Aviation users

3.45 Aviation users who receive tsunami warnings by measures established in a national tsunami warning system should take the appropriate action based on the evacuation plan developed in each organization.

Coordination between units

3.56 Not to mention the coordination between units based on a national public safety plan, it is desirable to coordinate between each unit concerning the 'at risk' aerodrome and to develop each appropriate tsunami evacuation plan regardless of a national public safety plan.

4. Procedures for dissemination of tsunami warnings to at-risk aerodrome

Dissemination of tsunami warnings to aviation users

4.1 Tsunami warnings are disseminated using appropriate measures established in national tsunami warning systems. In some States, tsunami warnings are disseminated directly from national tsunami warning centres to aviation users, and in other States, aerodrome meteorological offices which receive tsunami warning as a part of a national tsunami warning system may provide them to aviation users concerning the aerodrome.

Examples in States

4.2 ~~Appendix A and Appendix B~~ Appendices A, B and C show examples of procedures for dissemination of tsunami warnings to at-risk aerodrome in Japan ~~and~~, Indonesia ~~and~~ Australia.

PART II: Guidance for issuing aerodrome tsunami warnings when not integrated into a national public safety plan for Tsunami.

5. Introduction

5.1 When aerodromes are not incorporated into a States national public safety plan for tsunami, the Meteorological Watch Office (MWO) or Meteorological Offices responsible for providing aviation meteorological services to those aerodromes is required to issue a Tsunami Aerodrome Warning when the aerodrome is at risk of a tsunami.

5.2 The purpose of this section of the document is to provide guidance to States who are required to issue Tsunami Aerodrome Warnings services.

6. Tsunami information

6.1 Each ocean basin has designated Tsunami Service Providers (TSPs) which detect, analyse and assess the threat of tsunamis for all countries in that area and provide information to the National Tsunami Warning Centre (NTWCs) of those countries. It is then the responsibility of each country to issue any watches or warnings to their own communities.

6.2 Tsunami Warning Focal Points (TWFPs) are the official point of contact to receive tsunami event information. The TWFP is either the States emergency authority, or has the responsibility of notifying the emergency authority, in accordance with national procedures. The TWFP receives international tsunami bulletins from the TSPs.

6.3 The Intergovernmental Oceanographic Commission (IOC) Tsunami Programme supports IOC Member States in assessing tsunami risks, implementing warning systems and in educating communities about tsunami preparedness. Four Intergovernmental Coordination Groups (ICGs) have been established for the Pacific, Caribbean, Indian Ocean and Mediterranean to address regional needs.

6.4 Further information on the IOC and ICGs, including lists of established TWFP can be found at <http://www.ioc-tsunami.org/> or from the TSP websites listed below:

- Pacific Tsunami Warning Centre (PTWC) <http://ptwc.weather.gov/>
- US National Tsunami Warning Center (US NTWC) <http://wcatwc.arh.noaa.gov/>
- JMA North West Pacific Tsunami Advisory Center (JMA NWPTAC) <http://www.jma.go.jp/en/tsunami/>
- Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) http://www.ioc-tsunami.org/index.php?option=com_content&view=article&id=8&Itemid=13&lang=en

7. Establishing which aerodromes are “at risk” of tsunamis

7.1 In developing local procedures, Meteorological Authorities should first establish which aerodromes within their area are at risk of tsunami inundation. This should be done in consultation with airport owners or operators or the relevant emergency services. An individual

airport's vulnerability to tsunamis will depend on its elevation and distance to the coast.

8. Issuing a tsunami Aerodrome Warning

8.1 Once a MWO has received tsunami warning information and assessed an aerodrome to be at risk of tsunami inundation, a tsunami aerodrome warning should be issued.

8.2 The format of a tsunami aerodrome warning is shown in Table 1 below. ICAO Annex 3, Table A6-2 provides further information on the format of aerodrome warnings.

Element	Location indicator	Type of message	Validity period	Phenomenon	Observed or Forecast
Template	nnnn	AD WRNG [n]n	VALID nnnnnn/nnnnnn	TSUNAMI	OBS [AT nnnnZ] or FCST
Example	YBCS	AD WRNG 1	VALID 032200/041000	TSUNAMI	FCST
YBCS AD WRNG 1 VALID 032200/041000 TSUNAMI FCST					

Table 1 Format and example of tsunami aerodrome warning

NOTE:

- The validity period of the tsunami aerodrome warning should commence at the time of inundation indicated on the tsunami warning.

8.3 Appendix C explains the procedures for issuing aerodrome tsunami warnings to at-risk aerodromes in Australia.

Appendix A -The use of public tsunami warnings in aerodromes in Japan

1.1 Japan Meteorological Agency (JMA) issues tsunami warnings as a national tsunami warning centre. JMA disseminates tsunami warnings using public measures such as community wireless systems and public broadcast services. Aviation users concerning 'at risk' aerodrome receive tsunami warning from public measures described above and via aerodrome meteorological office.

1.2 Aviation users concerning 'at risk' aerodrome coordinate with each other and have developed tsunami evacuation plan in the aerodrome. Aviation users receiving tsunami warning will take the appropriate action based on the evacuation plan.

Appendix B - The use of public tsunami warnings in aerodromes in Indonesia

1.1. Indonesian Meteorological Climatological and Geophysical Agency (BMKG) is responsible for providing tsunami warning in Indonesia. BMKG disseminates tsunami warning through various communication media including SMS, email, website, Warning Receiver System and Global Telecommunication System.

1.2. Aviation users receiving tsunami warning through dissemination media described above will take the appropriate action based on the evacuation plan

Appendix C - Procedures for tsunami aerodrome warnings in Australia

1. Procedures

1.1 In Australia, the Joint Australian Tsunami Warning Centre (JATWC) which is operated by the Australian Bureau of Meteorology and Geoscience Australia, provides a tiered service for tsunami warnings using three different threat levels.

- **No Threat:** advice that an undersea earthquake has been detected, but it has not generated a tsunami, or the tsunami poses no threat to Australia or its offshore territories;
- **Marine Threat:** warning that tsunami waves could cause potentially dangerous rips, waves and strong ocean currents in the marine environment, and the possibility of some localised overflow onto the immediate foreshore; and
- **Land Inundation Threat:** warning for low-lying coastal areas of major land inundation and flooding, and of dangerous rips, waves and strong ocean currents in the marine environment.

1.2 For aviation purposes, Tsunami warnings are produced by the JATWC and are distributed to the relevant MWO. Once the MWO receives the tsunami warning, the aviation forecaster will assess the need to issue any aerodrome warnings. Tsunami aerodrome warnings will be issued for relevant aerodromes if they are considered to be an “at risk” aerodrome and if the tsunami warning is advising of a potential land inundation threat.

1.3 In Australia, aerodromes which are located within one kilometre of the sea and have an elevation less than 10 metres (approx. 30 feet) above mean sea level are considered to be at risk of tsunamis. However it should be noted that under some circumstances a tsunami can penetrate much further inland or to greater elevations, for example across a flat coastal plain, along an estuary or if close to the source earthquake.

2. Format of Australian tsunami aerodrome warnings

2.1 Australian aerodrome warnings for tsunami provide some additional

information to the format outlined in ICAO Annex 3 (see Table 1) including the threat level and a web link for further information.

2.2 An example of the format used for Australian tsunami aerodrome warnings is given below.

YBCS AD WRNG 1 VALID 032200/041000Z

AERODROME WARNING NUMBER 1 FOR CAIRNS VALID 040800/042000 LOCAL

ISSUED 031830Z (040430 LOCAL)

TSUNAMI WARNING HAS BEEN ISSUED. MAJOR LAND INUNDATION IS POSSIBLE

FROM 0800 LOCAL. ALSO REFER <http://www.bom.gov.au/tsunami/>

Appendix D - Example PTWC Tsunami Threat Message

TSUNAMI MESSAGE NUMBER 2

NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI

2323 UTC WED SEP 16 2015

..PTWC TSUNAMI THREAT MESSAGE...

**** NOTICE **** NOTICE **** NOTICE **** NOTICE **** NOTICE ****

THIS MESSAGE IS ISSUED FOR INFORMATION ONLY IN SUPPORT OF THE UNESCO/IOC PACIFIC TSUNAMI WARNING AND MITIGATION SYSTEM AND IS MEANT FOR NATIONAL AUTHORITIES IN EACH COUNTRY OF THAT SYSTEM.

NATIONAL AUTHORITIES WILL DETERMINE THE APPROPRIATE LEVEL OF ALERT FOR EACH COUNTRY AND MAY ISSUE ADDITIONAL OR MORE REFINED INFORMATION.

**** NOTICE **** NOTICE **** NOTICE **** NOTICE **** NOTICE ****

PRELIMINARY EARTHQUAKE PARAMETERS

* MAGNITUDE 8.3
* ORIGIN TIME 2254 UTC SEP 16 2015
* COORDINATES 31.5 SOUTH 72.0 WEST
* DEPTH 10 KM / 6 MILES
* LOCATION NEAR THE COAST OF CENTRAL CHILE

EVALUATION

* AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 8.3 OCCURRED NEAR THE COAST OF CENTRAL CHILE AT 2254 UTC ON WEDNESDAY SEPTEMBER 16 2015.

* BASED ON ALL AVAILABLE DATA... HAZARDOUS TSUNAMI WAVES ARE FORECAST FOR SOME COASTS.

TSUNAMI THREAT FORECAST...UPDATED

* TSUNAMI WAVES REACHING MORE THAN 3 METERS ABOVE THE TIDE LEVEL ARE POSSIBLE ALONG SOME COASTS OF

CHILE.

* TSUNAMI WAVES REACHING 0.3 TO 1 METERS ABOVE THE TIDE LEVEL ARE POSSIBLE FOR SOME COASTS OF

ECUADOR... AND PERU.

* ACTUAL AMPLITUDES AT THE COAST MAY VARY FROM FORECAST AMPLITUDES DUE TO UNCERTAINTIES IN THE FORECAST AND LOCAL FEATURES. IN PARTICULAR MAXIMUM TSUNAMI AMPLITUDES ON ATOLLS WILL LIKELY BE MUCH SMALLER THAN THE FORECAST INDICATES.

* FOR OTHER AREAS COVERED BY THIS PRODUCT A FORECAST HAS NOT YET BEEN COMPUTED. THE FORECAST WILL BE EXPANDED AS NECESSARY IN SUBSEQUENT PRODUCTS.

RECOMMENDED ACTIONS

* GOVERNMENT AGENCIES RESPONSIBLE FOR THREATENED COASTAL AREAS SHOULD TAKE ACTION TO INFORM AND INSTRUCT ANY COASTAL POPULATIONS AT RISK IN ACCORDANCE WITH THEIR OWN EVALUATION... PROCEDURES AND THE LEVEL OF THREAT.

* PERSONS LOCATED IN THREATENED COASTAL AREAS SHOULD STAY ALERT FOR INFORMATION AND FOLLOW INSTRUCTIONS FROM NATIONAL AND LOCAL AUTHORITIES.

ESTIMATED TIMES OF ARRIVAL

* ESTIMATED TIMES OF ARRIVAL -ETA- OF THE INITIAL TSUNAMI WAVE FOR PLACES WITHIN THREATENED REGIONS ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	REGION	COORDINATES	ETA(UTC)
VALPARAISO	CHILE	33.0S 71.6W	2315 09/16
COQUIMBO	CHILE	29.9S 71.4W	2315 09/16
CALDERA	CHILE	27.1S 70.8W	2336 09/16
TALCAHUANO	CHILE	36.7S 73.1W	0000 09/17
ANTOFAGASTA	CHILE	23.3S 70.4W	0001 09/17
IQUIQUE	CHILE	20.2S 70.1W	0028 09/17
CORRAL	CHILE	39.8S 73.5W	0029 09/17
ARICA	CHILE	18.5S 70.3W	0042 09/17
MOLLENDO	PERU	17.1S 72.0W	0053 09/17
SAN JUAN	PERU	15.3S 75.2W	0110 09/17
LA PUNTA	PERU	12.1S 77.2W	0200 09/17
CHIMBOTE	PERU	9.0S 78.8W	0252 09/17
PUERTO MONTT	CHILE	41.5S 73.0W	0324 09/17
EASTER ISLAND	CHILE	27.1S 109.4W	0413 09/17
BALTRA ISLAND	ECUADOR	0.5S 90.3W	0500 09/17

POTENTIAL IMPACTS

* A TSUNAMI IS A SERIES OF WAVES. THE TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR. THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE INITIAL WAVE.

* IMPACTS CAN VARY SIGNIFICANTLY FROM ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND THE SHAPE AND ELEVATION OF THE SHORELINE.

* IMPACTS CAN ALSO VARY DEPENDING UPON THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI WAVES.

* PERSONS CAUGHT IN THE WATER OF A TSUNAMI MAY DROWN... BE CRUSHED BY DEBRIS IN THE WATER... OR BE SWEEPED OUT TO SEA.

NEXT UPDATE AND ADDITIONAL INFORMATION

* THE NEXT MESSAGE WILL BE ISSUED IN ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES -ALL LOWER CASE-.

* FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

* COASTAL REGIONS OF HAWAII... AMERICAN SAMOA... GUAM... AND CNMI SHOULD REFER TO PACIFIC TSUNAMI WARNING CENTER MESSAGES SPECIFICALLY FOR THOSE PLACES THAT CAN BE FOUND AT PTWC.WEATHER.GOV.

* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD ONLY REFER TO U.S. NATIONAL TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT NTWC.ARH.NOAA.GOV.

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— END —