

Submission by the Bureau of Meteorology to the Senate
Environment and Communications References Committee

*Inquiry into the capacity of communication networks and emergency
warning systems to deal with emergencies and natural disasters.*

4 July 2011

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1. Executive Summary

1.1 Key Points

- The Bureau of Meteorology (Bureau) provides warning information through a large range of communication channels in an endeavour to reach the widest audience in the minimum possible time.
- Automatic delivery of warning information is considered the most effective method to alert the community and emergency response agencies to Bureau warnings. As personal contact can be time consuming during severe weather events, it is best limited to primary contacts who can convey the alert through emergency response agency networks.
- The Bureau communicates directly with all tiers of government as well as emergency services and counter disaster organisations to ensure that messages are received and understood.
- The Bureau conducts education campaigns to highlight what information is promulgated by the Bureau and how information can be obtained.
- Existing projects, such as the Next Generation Forecast and Warning System provide opportunities for improved delivery of location specific warning information, which will be realised in the next few years, including the use of the Common Alerting Protocol (CAP) for Bureau warnings.
- There is ongoing contention for access to the radio frequency spectrum used for the operation of observation systems and for the communication systems used to relay the data which underpin the Bureau's warning systems.

1.2 Relevance to the Inquiry's Terms of Reference

In accordance with Section 6 of the *Meteorology Act 1955*, the Bureau of Meteorology is obliged to warn the community, emergency services and other stakeholders of impending or current severe weather events and to provide current weather information.

1.3 Specific points against Terms of Reference (TOR)

1.3.1 TOR A

The effectiveness of communication networks, including radio, telephone, Internet and other alert systems (in particular drawing on the spate of emergencies and natural disasters of the 2010/2011 Australian summer):

- i. in warning of the imminent threat of an impending emergency;*
- ii. to function in a coordinated manner during an emergency; and*
- iii. to assist in recovery after an emergency.*

The Bureau of Meteorology uses a range of communication networks to fulfil its functions to observe and understand Australian weather and climate and to provide meteorological, hydrological, oceanographic and space weather services in support of Australia's national need and international obligations. To ensure weather warnings are promulgated to the community in a timely manner, the Bureau works with the mass media in order to transmit warnings as quickly as possible, to the widest possible audience in affected areas. The Bureau also makes use of its own highly respected website to transmit emergency information to the community and works in a cooperative manner with many private sector organisations that provide meteorological information and warnings on their own websites. In addition, the Bureau provides information directly to emergency service organisations and key government stakeholders during emergency situations to ensure that the key messages are received and understood. The Bureau also maintains a weather warning service that is available by telephone for a low cost call. Finally, the Bureau also provides High Frequency (HF) and supports Very High Frequency (VHF) radio broadcast services, principally for marine users. These radio services may be accessed by

anyone with the appropriate radio equipment and also provide near real time broadcasts of weather warnings and threats to those in the maritime areas around Australia, or near the coast. All these services are used to maximise the communication of warning information to the Australian community, providing the greatest possible lead time for a severe weather event.

1.3.2 TOR B

The impact of extended power blackouts on warning systems for state emergency services, including country fire brigades and landholders or home owners.

This TOR is not seen to be directly relevant to the Bureau, though we note that while the Bureau aims to provide warnings via various means, extended blackouts could inhibit the public from receiving the warnings and may also impact the communication systems used by the Bureau.

1.3.3 TOR C

The impact of emergencies and natural disasters on, and implications for, future communication technologies such as the National Broadband Network.

This TOR is not seen to be directly relevant to the Bureau.

1.3.4 TOR D

The scope for better educating people in high-risk regions about the use of communications equipment to prepare for and respond to a potential emergency or natural disaster.

The Bureau of Meteorology undertakes numerous public and key stakeholder education activities to familiarise users with its products and services. Of note is the Bureau's pre-cyclone season public education campaign, designed to alert communities in areas at high risk of being affected by tropical cyclones. These campaigns are frequently run in conjunction with local emergency services and counter disaster organisations.

The Bureau also works in partnership with other agencies in the emergency management sector to assess community understandings of weather related terms and language, weather phenomena and perception and understanding of weather related risk

The Bureau's website also provides information on severe weather threats, education material about the Bureau's warning system and guidance on how to interpret Bureau warnings.

1.3.5 TOR E

New and emerging technologies including digital spectrum that could improve preparation for, responses to and recovery from, an emergency or natural disaster.

The Bureau's Next Generation Forecast and Warning System project is currently under a phased implementation which is due for completion in 2014. The system will increase capability for delivery of spatially aware warnings.

It will also enable the production of warning information in the Common Alerting Protocol (CAP) and the Bureau's Australian Meteorological and Oceanographic Code (AMOC) formats for improved interoperability and compliance with all-hazards warning systems.

Digital HF and VHF radio provide the potential for provision of an enhanced suite of voice, text and graphical warnings, forecasts and observations to ocean mariners. Migration of Bureau services to digital systems would be more feasible after digital transceivers become the standard equipment on vessels. This is dependent on standards established by state and commonwealth maritime safety agencies.

1.3.6 TOR F

Any other relevant matters.

There is ongoing contention for access to the radio frequency spectrum used for the operation of observation systems and for the communication systems to relay the data which underpin the Bureau's warning systems.

For example, the Bureau's radar network operates in the 5600-5650 MHz (C-band) and 2700-2900 MHz (S-band) frequency ranges. There have been examples of competition for, and interference with, these bandwidths. Preservation of these bands is critical to ensure the integrity of meteorological radar data is not compromised.

2. Introduction

2.1 The nature of the Bureau of Meteorology's response

The functions of the Bureau of Meteorology are prescribed by the *Meteorology Act 1955*¹, including:

- 6 (1)(c) the issue of warnings of gales, storms and other weather conditions likely to endanger life or property, including weather conditions likely to give rise to floods or bush fires; and*
- 6 (1)(d) the supply of meteorological information.*

Together, these functions implicitly recognise the Bureau's role in employing a communication system which facilitates the timely and reliable provision of weather information to its stakeholders, including emergency services agencies and the broader community.

3. Response to the Terms of Reference

3.1 TOR A

The effectiveness of communication networks, including radio, telephone, Internet and other alert systems (in particular drawing on the spate of emergencies and natural disasters of the 2010/2011 Australian summer):

- i. in warning of the imminent threat of an impending emergency;*
- ii. to function in a coordinated manner during an emergency; and*
- iii. to assist in recovery after an emergency.*

The Bureau of Meteorology uses a range of communication networks to fulfil its functions of observing and understanding Australian weather and climate and providing meteorological, hydrological, oceanographic and space weather services in support of Australia's national need and international obligations.

Communication systems underpinning the Bureau's observation network

The Bureau's numerical weather prediction and flood forecasting models, used to forecast severe weather, rely on a composite network of surface, ocean and upper air observation data which are underpinned by a variety of mainstream and specialised communication systems. These data are monitored by Bureau forecasters to support warning services and also by the community and emergency response agencies during severe weather situations to provide near real-time weather information. This includes the radar data and key observations such as river heights, rainfall and wind observations.

The network is underpinned by a range of communication systems which are critical to the provision of warning and weather information by the Bureau. These include

- PSTN, NextG/3G, the Internet, radio telemetry and satellite to support the surface observations network spanning Australia and its territories (including offshore and Antarctica),

¹ Additional authority is provided by the *Water Act 2007*

- satellite ground receiving stations, international FTP and microwave links for satellite data,
- radio, the Internet and Frame Relay communications for upper air and ozone data,
- satellite and radio for marine and tsunami observations, and
- landline and 3G for radar.

The composite observation network is designed to enable analysis and monitoring of critical weather to continue, even if some components of the system fail. There are ongoing pressures for sharing some of the radiofrequency bands used for observation networks. This is discussed in section 3.6 of this submission.

Direct dissemination of warnings via fax, email and SMS to key stakeholders

Bureau systems directly disseminate warnings and forecasts via fax, email and SMS to key stakeholders, primarily the media to communicate to the public, and to emergency services agencies to inform emergency responses. This method enables automatic near simultaneous distribution to many recipients, typically within minutes of warnings being issued by forecasters. Near simultaneous distribution of warnings to the widest audience possible contributes to consistency of awareness of current warning information across response agencies and affected communities. Fax is historically the preferred method of delivering warnings to emergency services and media due to the ability to confirm delivery, although the Bureau recognises that many recipients are migrating from fax in favour of newer technologies. Email delivery is relatively low cost, with messages typically sent to a single generic email address in each agency for on-forwarding through their networks. SMS provides rapid broadcast of a truncated message to alert emergency response agencies as warnings are issued, though delivery to recipients may be delayed, particularly during heavy traffic. As limited information is conveyed in an SMS message (i.e. the first 160 characters of the full text warning), recipients need access to other sources of information (such as the Bureau's website), in order to obtain more detailed information. Despite some advantages over fax, successful delivery of messages sent by email and SMS can not be confirmed. The Bureau has limited capacity to support the infrastructure, communication costs and client databases to freely disseminate warnings via SMS. Because there is a commercial market providing warning information to the public via SMS, the Bureau only sends this information freely via SMS to key emergency services and counter disaster organisations.

Broadcast of warning information via the mass media

The primary means by which the Bureau transmits its forecast and warning messages to the community is through the mass media. Bureau surveys show that around 85% of the public receive their weather information through the mass media. The messages are transmitted by fax, email or are picked up by a user's communication system by interrogating the Bureau's File Transfer Protocol (FTP) site. While fax usage is decreasing, other electronic means of receiving the Bureau's messages such as email and FTP are becoming increasingly popular. These methods lend themselves to automatic retrieval and display, often alerting the user to their arrival, improving the timeliness of the delivery of warning information to key stakeholders.

The Bureau works closely with all forms of media and has a particularly close relationship with the ABC. For example, the Bureau has a Memorandum of Understanding (MoU) with ABC Radio in Victoria, which details conditions under which the ABC will interrupt programs to broadcast the Bureau's warnings, even if the station is networked to another State or Territory. The agreement has been effective in allowing the Bureau to promulgate emergency messages to the community during recent significant events and the ABC seeks to replicate this agreement in other States and Territories. However, even where there are no formal arrangements such as MoUs, local arrangements with the ABC are such that, in most cases, the Bureau can reach the network

control room and ensure that a particular warning is broadcast immediately and receives prominence.

Other arrangements are also in place to allow the Bureau to broadcast message “crawlers” through some television stations. These messages appear or “crawl” along the bottom of people’s TV screens and contain information relating to urgent warnings issued by the Bureau for an area in, or adjacent to, the locations in which the message appears. Usually they will simply state that a warning of some type is current for the area and ask people to check the Bureau’s website for further information. This process can be done manually when the stations have staff. However, in the event that the stations are networked or without staff, it requires the messages to contain information relating to the area for which warnings are current and the TV stations to have equipment that will read the messages. Once a station’s communication system has recognised that a warning message must be displayed, it then composes the message and broadcasts it in the viewing areas affected by the hazard. While some stations and networks have this capability, many do not and therefore not all urgent warnings are broadcast in this manner.

When weather situations pose a significant threat to life and property the Bureau warnings will include a request to media for the broadcast of the Standard Emergency Warning Signal (SEWS) to bring attention to the significance of the threat. Further information on the SEWS is available at http://www.ema.gov.au/www/emaweb/emaweb.nsf/Page/Standard_Emergency_Warning_Signal_%28SEWS%29.

The areas under threat and the broadcast footprint of the various media outlets do not usually align, so broadcast of the SEWS may extend beyond the threatened area or into a subset of the area. Broadcast of the SEWS depends on the media outlet’s staff familiarity with the protocols, capacity, hours of operation and their operational decisions on the transmission footprint.

TV and radio stations with which the Bureau has no special arrangement to broadcast emergency warnings generally broadcast the information as soon as possible. However, in the event that the stations are networked or without staff, there is a significant risk of delays in the information being promulgated.

The Bureau also provides the mass media with access to its experts for both routine and non-routine interviews. Routine interviews are most often conducted with radio stations and provide an opportunity for the forecasters to bring to the attention of the public any significant weather expected during the forecast period. Non-routine interviews can be conducted with press, online press, as well as radio and television outlets in the lead up to, during, and after an event. These interviews allow Bureau staff to highlight particular areas or localities at high risk of a significant weather or tsunami event. Demand for these interviews is increasing, particularly as the numbers of online news outlets and 24 hour news outlets increase, requiring more frequent updates. As a result, the Bureau is increasing its efforts to optimise its contact with the media during significant events, to try and meet all requirements and ensure that the messages are consistent and reach the widest possible audience with particular emphasis on the affected communities.

The Bureau web site and internet services

Another communication channel the Bureau employs to ensure that emergency information is promulgated to the community in a timely manner is through the Bureau’s own website. A recent survey of more than 1000 respondents, selected at random by a professional market survey company in December 2010, indicated that around 53% of respondents had used the Bureau’s website in the past 6 months. Of these respondents, 35% indicated that the Bureau’s website was their most valued source of weather information. Knowledge of the Bureau’s website is steadily increasing with just 15% of respondents unaware of the Bureau’s website in December 2010, compared with 20% who were unaware of the site in a separate survey conducted in winter 2009.

An innovation for the summer of 2010/11 has been the provision of a Really Simple Syndication (RSS) service that users of the Bureau's website may use to subscribe to warning information. This service alerts users to the presence of new warning data when it is issued, provided they have a web browser open on their devices. While potentially effective at alerting subscribers to warnings as they are issued, the utility of the service is limited by the information only being available in a bundle of either land or marine warnings for the whole state. Future development of spatially aware warning information will enable more location-specific updates to be provided, and is discussed in Section 3.5 of this submission.

In addition to being displayed on the Bureau's website, warning information is also displayed on numerous other websites. These websites are configured to receive and display Bureau warning information automatically. Most data for these sites is sourced from the Bureau's registered user FTP system. The Bureau's registered user FTP site is designed to enable reliable downloads of Bureau information even at times when the public website is under extreme pressure in periods of peak demand. This occurs most frequently during extreme weather events of a nature similar to those which occurred during the summer of 2010/11. Even under these extreme circumstances, the FTP system reliably delivered emergency data to third party providers of weather information.

Liaison with emergency services and counter disaster organisations

The Bureau also provides information and briefings directly to all three tiers of government, emergency authorities and counter disaster organisations either by phone or in person. In addition, some key stakeholders choose to receive SMSs from the Bureau informing them that certain warnings have been issued.

Recorded telephone weather and poll fax services for the general public

Other channels used to communicate weather information include automated telephone services through both a 1300 service (low cost call) for all warning information and also a 1900 service for forecasts and warnings, which is also delivered by fax. Both these services are available 24 hours per day, seven days per week. In addition, the Bureau provides phone access to its offices, mainly during office hours.

Broadcast of voice/fax warnings to marine community via HF and VHF

The Bureau also operates High Frequency (HF) and contributes to the provision of forecasts and warnings via Very High Frequency (VHF) radio services for marine users. These services broadcast the latest forecast and warning information and tend not to be disrupted by extreme weather events. In addition, the Bureau provides its marine safety information through the INMARSAT satellite system for large marine vessels as part of the Global Maritime Distress and Safety System (GMDSS) under the Safety of Life at Sea (SOLAS) Convention. For further information about the systems for large marine vessels please refer to: http://www.amsa.gov.au/search_and_rescue/distress_and_safety_communications/GMDSS_Concept.asp.

Comments and Issues

While these arrangements attempt to maximise the availability of the latest warning and weather information to the community through multiple channels, they can not prevent alternative and possibly conflicting information remaining available.

An example of this is differences in tsunami warning information sourced from the Pacific Tsunami Warning Center (PTWC), or via media outlets that use this source, and that provided by

the Joint Australian Tsunami Warning Centre (JATWC), which is operated by the Bureau and Geoscience Australia. The media may also source commentary on severe weather which differs from information provided by the Bureau.

3.2 TOR B

The impact of extended power blackouts on warning systems for state emergency services, including country fire brigades and landholders or home owners.

This TOR is not seen to be directly relevant to the Bureau, though we note that while the Bureau aims to provide warnings via various means, extended blackouts could inhibit the public from receiving the warnings and may also impact the communication systems used by the Bureau.

3.3 TOR C

The impact of emergencies and natural disasters on, and implications for, future communication technologies such as the National Broadband Network.

This TOR is not seen to be directly relevant to the Bureau.

3.4 TOR D

The scope for better educating people in high-risk regions about the use of communications equipment to prepare for and respond to a potential emergency or natural disaster.

The Bureau conducts numerous public and key stakeholder education activities to familiarise users with its products and services. Of note is the Bureau's pre-cyclone season public education campaign, designed to alert communities in areas which are at high risk of being affected by tropical cyclones. These campaigns are usually run in conjunction with local emergency services and counter disaster organisations to:

- alert people of the dangers presented by tropical cyclones;
- highlight the emergency facilities such as shelters that are available to them; and
- describe the preparations that should be made during the pre season period.

An integral component of the education campaign is to provide information related to the communication channels on which emergency information will be provided (by both the Bureau and the emergency authorities), as well as providing information on how to interpret Bureau warnings.

The Bureau has commissioned, both independently, and in partnership with other agencies in the emergency management sector, a series of surveys across a range of communities. The communities surveyed include those that are culturally and linguistically diverse, remote and indigenous as well as groups from the broader community. The purpose of these surveys is to assess community understanding of weather related terms and language, weather phenomena and perception and understanding of weather related risk. Results and learnings from such research have been applied in the design of warning messages and the shaping of public awareness campaigns. For example, the Bureau has provided input into training for community radio broadcasters in indigenous communities to assist in effectively communicating Bureau warnings to indigenous communities.

The Bureau's website also provides information on severe weather threats, education material about the Bureau's warning system and guidance on how to interpret Bureau warnings.

3.5 TOR E

New and emerging technologies including digital spectrum that could improve preparation for, responses to and recovery from, an emergency or natural disaster.

The Bureau's Next Generation Forecast and Warning System project is being progressively rolled out across Australia and is currently operating in three States (New South Wales, Victoria and Tasmania) and due for completion in 2014. It will increase capability for delivering spatially aware warnings, suitable for Geographic Information System (GIS) applications.

This improvement will enable emergency service agencies, for example, to use GIS-based systems to display Bureau warning information together with their own spatial data, such as locations of current fire fronts and locations of staff and equipment.

This system will also enable the production of warning information in the Common Alerting Protocol (CAP) and the Bureau's Australian Meteorological and Oceanographic Code (AMOC) formats for improved interoperability and compliance with all hazards warning systems.

Stakeholders across the three tiers of Government in Australia have worked together over the period since 2009 to develop a national consensus on the implementation of CAP in Australia. This working group has achieved an agreement that has led to an implementation plan that is being coordinated by the Attorney-General's Department (AGD) in close liaison with other key stakeholders (including the Bureau of Meteorology). For more information on CAP refer to <http://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2-os.pdf>.

AMOC is an XML based format that has been specified by the Bureau which provides metadata associated with warnings.

The Bureau endeavours to use a variety of means and formats for the delivery of forecast and warning products under its direct control, including telephone (voice) fax (text and graphics), email (text), website (text, graphics, animation), marine HF radio (fax and voice) and marine INMARSAT satellite (text), and through other third parties such as commercial radio, television and news print. Further expansion and opportunities arise with wireless mobile devices, domestic DAB+ digital radio, and the longer range Digital Video Broadcast (DVB) and Digital Radio Mondiale (DRM) satellite or digital radio broadcasts. DRM offers significant promise as a replacement for the current HF marine broadcasts, and even as an all-hazards warning network, but will require the resolution of a number of issues, including standards, user acceptance, the availability of equipment, ongoing funding and potentially international cooperation.

The Bureau's text-to-speech conversion system supports the automatic conversion of text warnings to electronic voice files. These are used to deliver the latest forecast and warning information via the Bureau's telephone weather services. There is potential for the Bureau to make these files available to other users or providers of warning information to support increased availability and accessibility of warnings.

The use of the HF digital spectrum utilising digital selective calling provides potential for the provision of an enhanced suite of voice, text and graphical warnings, forecasts and observations to ocean mariners. This would also enable improved transmission of observations from mariners into the Bureau's networks. Migration to digital HF would require mariners to obtain digital transceivers, and would be dependent on standards established under the GMDSS and SOLAS international convention.

3.6 TOR F

Any other relevant matters: Competition for, and interference with the existing meteorological radar bandwidth.

There is ongoing contention for access to the radio frequency spectrum used for specific natural frequencies for passive sensing (e.g. CO₂, water vapour, ice, etc), infrared and visible satellite imagery, the operation of observation systems (e.g. radars, radiosondes, buoys) and the communication systems to relay the observation data (e.g. space to earth satellite links, links for automatic weather stations).

The Bureau's radar network operates in the 5600-5650 MHz (C-band) and 2700-2900 MHz (S-band) frequency ranges. In recent years, interference with radar observation data has increased with the use of wireless network transmitters (e.g. RLANS) obtained from overseas, which operate in the 5 GHz band. Australian radio spectrum regulations explicitly exclude the 5600-5650 MHz frequency range from the allowed LIPD (Low Interference Potential Device) bands which includes RLANS. The recently proposed operation of 5GHz wireless LANs onboard passenger aircraft also has the potential for causing interference to meteorological and other radars.

Proposals for sharing this spectrum with other communication systems have been made periodically in international jurisdictions, and the Bureau, through its participation in the ITU-R World Radiocommunication Conference (WRC) processes, the Australian Communications and Media Authority (ACMA) and the World Meteorological Organization, is coordinating internationally to preserve these bands to ensure the integrity of meteorological radar data is not compromised.

The increasing pace of wind farm development will potentially present another form of interference to meteorological radars from the rotating blades of large numbers of grouped wind turbines. Ongoing consultation between the wind farm development industry and the Bureau will be required to minimise the effects of wind farms on the products derived from radar data.

The Bureau has three licensed VHF radio frequencies for flood warning telemetry networks (ALERT). The frequencies are not exclusively available to the Bureau as, with all radio spectrum, sharing is still an issue. As the Bureau has many ALERT systems (about 1000 sites), the Bureau tends to dominate their use. However, interference can impair system performance.