30 May 2011

Submission on Emergency Communications issues

Senate Standing Committees on Environment and Communications

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Dear Sir or Madam:

Please find enclosed my submission for the Senate inquiry *'The capacity of communication networks and emergency warning systems to deal with emergencies and natural disasters'.*

This submission is made in the capacity of a private individual, currently employed by a carrier licensed under *Telecommunications Act 1997,* however I have previously been employed in broadcast engineering as well as serving almost ten years with the Queensland Police Service in Information Communications Technology (ICT) roles, at Police Headquarters Brisbane and Toowoomba District Office, Southern Region. I possess experience in the design of ICT and radio systems utilised in the context of emergency communications management as well as contextual situational awareness and cognitive overload factors inherent in such systems.

There are several reasons for my submission to this inquiry. Personally and professionally I hold an interest in communications technologies across many modalities. My background has led to study and thoughts in this area that I believe would be of interest to the committee in relation to the terms of reference presented for such submissions. Five recommendations are made.

The factors that make this inquiry a timely one are as follows:

a) Learnings and reflection on the recent Queensland flood situations
b) Proposal for the 'digital dividend' 700MHz & 2.5GHz spectrum auctions
c) National Broadband Network (NBN) rollout and planned technologies
d) The update of the *Radiocommunications (Citizen Band Radio Stations) Class Licence 2002* to expand from 40 to 80 channels (narrow-banding)

Underpinning this submission is the hope that the Senate Committee will provide recommendations across multiple portfolios that are affected by the above factors, in such a way that is set in a regulatory framework so as to continue in an apolitical fashion beyond the auspices of a particular party.

It is also critical to balance the requirements of public safety agencies with commercial interests in spectrum allocations and product standardisations to allow for open and interoperable communications mechanisms to serve the broader populace both directly and indirectly.

After disasters such as those experienced in Victoria (2009 bushfires) and Queensland (2010/2011 flooding events, 2011 Cyclone Yasi) there is generally a significant amount of interest in promoting systems that have been developed to aid emergency communications. This was also the case across many previous disaster events

Recommendation 1: It should be noted that commercial systems proposed would have limited uptake unless intellectual property portfolios are opened to several manufacturers, and conform to international standards.

The European Telecommunications Standards Institute EMTEL group[1] define the four following scenarios, which I will use to address the terms of reference:
Emergency Calls,
Public Safety Communications,
Warning Systems and
Citizen emergency communications

Emergency Calls:
Communication from citizens to authorities/organisations

Communications between the civilian populace and emergency services are paramount during a disaster or emergency scenario. From the view of those affected in a time of crisis, immediate concerns on preservation of life should attract an appropriate response when calling triple-0.

With the introduction of the National Broadband Network, there is some concern that the removal of the copper public switched telephone network (PSTN) may itself cause issue for contacting emergency services. 'Fixed line decline' has seen PSTN exchange line penetration stagnate between 2000 and 2010 at 10.7M landlines, whilst mobile connections have increased from 8.2M to 24.2M (ACMA).

With the removal of copper PSTN lines and the introduction of fibre optic cabling, there is a greater reliance on telephony services to be battery backed up at both the exchange and subscriber ends, rather than the present standard of exchange powered -48VDC devices (standard telephones). Whilst the stagnation in fixed line services has already occurred, there is a greater possibility that PSTN services over the NBN will be taken up at an even lesser rate due to the added costs of installing and maintaining a battery backed up service.

New methods of communications to engage with emergency services will need to be developed to allow diversification of call methods from traditional PSTN methods to voice over IP and short text message services whilst increasing caller location accuracy and subscriber identification features.

Recommendation 2: It should be noted that the mobile telephone network will be increasingly relied upon, but planning for it to fail is also necessary.

[1] http://www.emtel.etsi.org Emergency Management Telecommunications

Public Safety Communications:
Communication between authorities/organisations

The radio spectrum changes that were introduced after Cyclone Tracy in Darwin in 1974 were significant for communications interoperability across Australia. The provision of 64 channels in the 450-470MHz spectrum allowed a harmonisation of radio systems employed by police communication operations.

Emergency services interoperability needs are recognised as both vertical and horizontal in nature. The vertical needs of each service are generally well taken into account, with most states and territories now employing an APCO P25 digital voice network at least across their respective metropolitan areas which is also analogue compatible when working with regional colleagues. However recent disaster scenarios have shown a requirement for horizontal interoperability in the form of multi-service interoperability which is much more difficult in nature due to the often different band plan and channel allocations of each agency.

The announcement of the 700MHz and 2.5GHz spectrum reallocation (known as the 'Digital Dividend') provides a rare opportunity to craft into the planning process an appropriate amount of reserved spectrum for public safety agencies, or a pathway for public/private partnership in order to maximise community benefit from the spectrum license auction process. A similar approach is suggested as optimal in Australia for the reason that devices utilise this public safety band will be available at a price point that does not starve public safety agencies of funding to continue digital voice rollouts.

The ability to re-deploy commercial off the shelf (COTS) technology already utilised in domestic applications will be beneficial to the emerging public safety network standards. One such area of evidence for this is the 4.9GHz public safety band utilised in the USA with several vendors now providing slightly modified versions of 802.11a standard (5.4GHz) equipment available to work in this band. The upshot of this is that a standard COTS notebook computer for example could be retrofitted with a public safety network WiFi card allowing secure access to a network (ad-hoc, point to point or mesh) that could be easily deployed at an emergency site.

The need for customisations to work within Australian regulatory frameworks (such as those seen with the DVB-T and T-DAB+ broadcast standards) are not seen as being conducive to effective cross-sector emergency services communications. Due to the limited nature of customers that would be inclined/licensed to purchase such equipment, customisation beyond that already seen in the USA (or similarly, 802.11j equipment in Japan) would potentially reduce the scale of deployment across agencies for financial reasons.

Recommendation 3: Lessons learnt from Cyclone Tracy, regarding emergency communications interoperability have been forgotten but are now being revisited. Spectrum harmonization should be in line with international developments to take advantage of economies of scale.

Warning Systems:
Communication from authorities/organsiations to citizens

Another area that stands to benefit from economies in scale and once again fortuitous timing in terms of spectrum reallocation is the area of warning systems for public use.

Attempts to utilise the mobile telephone networks for warning purposes have been somewhat hampered by inaccurate home location and cell data records, though it is acknowledged that research in this area to better serve a warning function is ongoing. Congestion of networks due to greatly increased use during emergency events will continue to be a challenge for warning systems utilising these networks, unless conditional privileged access systems such as access overload control (ACCOLC or Mobile Telecommunication Privileged Access Scheme, as used in the UK during the 2005 London bombings) are made available and do not impede other priority functions of the network during such a time.

One notable citizen emergency warning service is the NOAA All Hazard/Weather radio system utilised in the USA. This system broadcasts National Weather Service warnings, watches, forecasts and other hazard information 24 hours a day. It also broadcasts alerts of non-weather emergencies related to national security, natural, environmental, and public safety matters. It utilises approximately 1000 transmitter sites covering the continental US, sharing 7 VHF frequencies between all sites. This system is extensive in nature and shares an emergency warning procedure communicated across all broadcast mechanisms via the FCC Emergency Alert System that has been a federal government civil defence initiative since the 1950's.

In the USA and Canada, portable warning radios that receive the NOAA Weather Radio transmissions are available for approximately $40. Furthermore, newer equipment can detect a digital protocol known as Specific Area Message Encoding (SAME), which allows the users to program their receivers for specific geographical areas using a 6-digit numeric code, rather than receiving transmissions across an entire regional broadcast area.

The SAME system could be used in Australia, and given that most receivers are either DC/battery powered (or in some cases, hand crank charged for power outage situations) would be easily adapted for operation on our differing power standards. The seven frequencies used could be potentially re-designated for this application or due to the non-overlapping frequency coverage design, could be allocated in areas where no licenses exist until frequency relocation can occur. Currently no more than 16 licensees occupy any one of these VHF frequencies Australia wide.

Whilst the cost of individual equipment would be able to benefit from US economies of scale (and likewise, Australian companies could compete in design and development for eventual market back to a large US audience) there would be a significant government investment required in the form of transmitter sites.

Cooperation could be sought from national broadcasters however to assist in the implementation of these sites, and this would be an area that government investment from proceeds of the digital dividend auctions could be placed.

Other technologies exist however that could achieve the same outcome (albeit cost would then be borne by consumers unless receivers were widely and cheaply available) with minimal transmission investment or re-work. Some emergency services across Australia still make use of the POCSAG paging network provided by 3 Messaging/VHA – approximately 300 sites currently running a low speed data network at 100W exist covering large areas of population density. It would be trivial to incorporate a data decoder into a receiver designed to handle transmissions of emergency broadcast information. Other options include piggyback onto existing broadcast FM transmissions using RDS/ACS subcarrier methods (data & voice) or newer emerging T-DAB+ stations as they are rolled out in regional areas.

Recommendation 4: Consideration should be given to citizen alerting networks beyond the mobile network, once again with international standards in mind. Implementation of ITU-T Recommendation X.1303 (Common alerting protocol CAP 1.1) is also strongly encouraged.

Citizen emergency communications:
Communication amongst citizens during emergencies

"The recovery process is considered by the Queensland Government via its legislation and political senior management team to be a physical/operational activity only, reflected by the appointment of logistics experts (Defence) to oversee the recovery process. However, community resilience and recovery is a psychological process and communication is the central tool for success."[2]

One of the often-overlooked aspects of emergency communications scenarios are the interaction points of post emergency support organisations (relief groups) and community efforts for volunteer emergency response either coordinated or ad-hoc in nature. More often than not these groups are relying on effective person-to-person or person-to-group communications. Person-to-person is easily solved whilst the mobile network is still active, though difficult to impossible without. Person-to-group is even more problematic, especially when these groups are self-organising and non-hierarchical.

An aspect of the Queensland flooding that came to light was that most of the communications facilities available to the non emergency response organisations were by utilising UHF Citizen's Band (UHF CB) equipment that was cheaply and widely available with no licensing required. This equipment was more often than not already fitted to heavy machinery and transport vehicles deployed during the recovery operations.

[2] http://www.floodcommission.qld.gov.au/__data/assets/file/0004/6997/Ryan_Barbara_USQ.pdf

UHF CB radio channels are programmed into and directly addressable on some emergency service radio networks, but knowledge of which channels are to be used (or mappings of emergency network channels to public network channels) are often confusing unless regularly used. UHF CB operations are generally simplex in nature unless a repeater station has been established which limits the coverage distances that the communications can travel.

The common belief about access to UHF CB spectrum is that this is an anarchic network, affording little protection to users against malicious or interfering transmissions, which to some degree is true, however during events of such a disruptive nature, these interferences will decrease due to understanding of circumstances. Unfortunately this belief has led to the importance of UHF CB in citizen communications to be forgotten, both in an emergency service and local area government management sense. Since the Queensland flooding situation a number of local government agencies are looking at re-introducing UHF CB capabilities to their vehicles.

As part of a recent ACMA spectrum change (May 2011) following a three year review of the 400MHz spectrum band plan, the UHF CB band has been restructured into 80 individual 12.5 kHz-wide channels, changed from the existing 40 individual 25 kHz-wide channels.

Thankfully channelisation arrangements are such that the existing 40 channels will remain compatible with those installed on the newer 80-channel equipment, with retail supply of older 40 channel 25 kHz equipment continuing for approximately 18 months, and a withdrawal date of 6 years for this equipment.

"Difficulties were encountered trying to source a vital UHF repeater station from any government agency or privately" "Once UHF coms were available publically, coordination between various machinery operators, trucks and the command centre were enhanced over a very large area from Toowoomba through to Gatton"[3]

Access to mobile repeaters that can be deployed in an emergency would benefit citizen communications and assist in restoration efforts. UHF CB is commonplace in emergency aircraft and watercraft but with civilian resources also being commandeered or utilised for recovery operations, mixed mode repeaters capable of re-transmitting across maritime and aviation frequencies could also be considered as part of this approach, depending on the type of incident being responded to.

Recommendation 5: It should be noted that now is an ideal time to look toward an integrated Australia wide warning system with the move to replace older UHF CB equipment with 12.5 kHz spacing 80 channel devices. If done correctly, newer models could incorporate a warning network receiver as an option that would be of greatest use to the demographic most likely to require UHF CB equipment.

[3] http://www.floodcommission.qld.gov.au/__data/assets/file/0006/5919/Souter_Peter.PDF