METROPOLITAN FIRE AND EMERGENCY SERVICES BOARD

Response to Productivity Commission's "Public Safety Mobile Broadband" Issues Paper

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Initial submission from the Metropolitan Fire Brigade – Melbourne

The following is an initial response from the MFB in relation to issues raised in the PSMB issues paper

1. *What is the merit (or otherwise) of the proposed approach to undertaking first principles analysis in this study?*

- The need to visit first principles in analysing the current and emerging requirements of PSAs is compelling and will support MFB's goals of enhanced capability and improved safety outcomes. Traditionally, MFB and many other first responder organisations have relied heavily on infrastructure-based Land Mobile Radio (LMR), but are increasingly reliant on Mobile Broadband for both voice and data transmissions.
- With the need for more and more use of data comms as well as the traditional radio comms, not only fast broadband will be a consideration, but also the availability to scale in real-time.
- MFB would support dedicated spectrum, rather than a hybrid model, because relying on private carriers to have available the required spectrum in wide-ranging emergency events would not be feasible. MFB is keen to avoid a scenario where, once the maximum dedicated spectrum is used, PSAs could not be given priority (on the mobile network, if you haven't connected, the system doesn't know you're trying to achieve access)
- MFB would be concerned about any planned overflow from PSA-designated spectrum to commercial carriers' spectrum, due to the resultant absence in guaranteed priority.
- The issues paper identified that the International Telecommunication Union ("ITU") identified that the 800MHz band can be used for Public Protection and Disaster Relief (PPDR), but this was not exclusive of other bands.
- The identification of a "Digital Dividend" by the ACMA presented an opportunity to make use of the 700 MHz band formerly occupied by the analogue television stations. The freeing up of this spectrum provided a global opportunity for new developments in this band, particularly in terms of Long Term Evolution ("LTE") usage
- The approach in the US has been to assign part of this spectrum for Firstnet, the US version of PSMB. The legislative and funding arrangements means that this spectrum is directly adjacent to the spectrum opened up for carriers, which allows the development of devices that can cost effectively make use of PSMB and commercial networks as required.
- MFB agrees that LTE is the future of Mobile Broadband communications. Emergency service grade LTE products have already been developed for this large scale emergency services market.
- The spectrum proposed at 800 MHz in Australia needs to be reallocated for PSMB use and incumbent licence holders need to be moved out of this band. This adds a significant delay to the availability of this spectrum
- Given that in Australia the availability of spectrum has been currently limited to the 800MHz band the approach must be to ensure that sufficient band width is available

for combined emergency services use, in times of adverse conditions and extremely high demand.

- Spectrum allocated to PSAs would need to expand dynamically.

2. *What domestic or international developments, reports or experiences in PSMB (or related matters) are relevant to consider in this study?*

- Paramount is a consideration of the ever-increasing reliance on data, not only for communicating situational awareness details, but also for body-worn video purposes and Aerial Unmanned Vehicle usage.
- Spectrum allocated to PSAs would need to be segregated from any parts of the commercial mobile network that might be 'scrambled' during a terrorist incident.
- Security transmissions and encryption of PSA information is a consideration, together with the ability to recognise/authenticate devices.
- Many emergency/disaster events both here and in the USA (Victoria's Black Saturday Bushfires, US's 9/11 and Hurricane Katrina) have all dramatically demonstrated communications inadequacies, especially in the lack of inter-operability of communications devices but also in incompatible technologies and the unco-ordinated use of frequency bands.
- The experiences of the US and UK need to be fully considered, as larger volumes of terminal equipment will be developed for these market
- MFB envisages increasing reliability on Wireless Meshed Networks in the future. This is to lessen its reliability on land-based infrastructure, which could be damaged or wiped out in a major emergency event). Any data and multimedia service (including voice) can easily be implemented by WMNs via the IP protocol. WMNs also support unicast, multicast and broadcast, One of these WMNs could be employed as an "Incident Are Network" for the management of a specific incident or a "Jurisdiction Area Network". First Responders' use of WMNs will undoubtedly increase over time, due to their high level of fault tolerance and their ability to provide wide area broadband coverage very cost effectively. What this will mean is that, once security improvements evolve and both scalability and quality of service concerns are addressed, the take-up of WMNs will be significant. However, since most WMNs operate in unlicensed frequency bands, this presents a problem for PSAs. In the US, the licensed 4.9GHz band has been made available to Public safety entities for this purpose.
- Emergency services, in particular fire fighting, require the use of ruggedized (and sometimes "intrinsically safe") terminal equipment
- Current portable radio equipment used by the MFB has the highest level of intrinsic safety available. The development of intrinsically safe terminals is critical for the MFB, and these are more likely to be cost effectively produced for larger markets.

3. *What are the implications (if any) of the Australian Government's review of the spectrum policy and management framework, and ACMA's ongoing work on spectrum allocation matters, for the delivery of PSMB in Australia?*

- The prime implications relating to the review of spectrum policy and management framework relates to the ability to provide sufficient spectrum to meet the emergency services needs

- The policy and management framework and ACMAs on going work must allow the most effective use of emerging technologies by the emergency services in the protection of the Australian public.

- The policy and management framework must recognise the significance of the use of spectrum by emergency services in the same manner as the Radio communications Act
- The Public Safety Sector's ability to utilise scalable, dedicated spectrum in management of events and in the recovery activities afterwards, should be paramount in thinking of those conducting the review.
- As in the US, consideration should be given to the dedicated allocation of the 4.9GHz band for use by the PSAs..

4. *Are there any other PSAs that should be considered within scope in this study? To what extent are communications between PSAs and the community relevant to this study?*

- In Victoria, firefighting agencies such as MFB and CFA should be included, as well as VICSES, Ambulance Victoria and Victoria Police. Other Emergency Management stakeholders in this matter would be Emergency Management Victoria, DELWP, Parks Victoria, Lifesaving Australia and ESTA.
- Clear communications (both voice and data) between some/all of the above entities is paramount for purposes of managing response to emergency incidents, particularly those requiring a multi-agency response.

5. *How do the organisational and institutional arrangements for PSAs vary between the Australian jurisdictions? What implications (if any) does this have for the way in which PSAs procure, operate and use communications services?*

- In the past, jurisdictions have been state based and have relied on state approvals and budget cycles
- Any approach to introducing emergency services technology improvements on a national basis must contemplate a long term approach to allow states and respective agencies to align funding arrangements accordingly
- However, just as the focus for the past decade or so has been on inter-operability of equipment, there is no doubt that voice and data communications standardisation will occur, just as some jurisdictions are trying to take a national approach to emergency data standards.
- PSA devices ideally should roam across jurisdictions, regions and borders, as one State's responder service could well be involved in an incident taking place in another State's geographical area.
- As has been pointed out in numerous Inquiries and Royal Commissions, clear and unimpeded communications must be possible between different public safety entities

within the same State, but also between the public safety entity of one State with those of another State (cross-agency, cross-border, cross-jurisdictional)

6. *What is an appropriate definition of 'mission critical' communication systems and capability for the purposes of this study? What metrics should be used to assess whether capability is being delivered to adequate levels during mission critical circumstances? What evidence is there that existing capabilities are satisfactory or unsatisfactory?*

- Mission critical communications systems and capabilities refer to the technology that provides the essential elements in the protection of life and property; protection of emergency services personnel; with the highest levels of resilience in adverse conditions.
- Traditionally, the MFB's prime example of a mission critical system has been the LMR voice radio system – the MMR (Melbourne Metropolitan Radio) network. This system provides the core mission critical communications via voice and provides high levels of in-building coverage. The radio system is not only crucial in despatching resources to fire grounds within the required 90 seconds, but is also crucial to providing updates on emergency incidents, both within MFB and to other emergency service agencies. Currently the mobile voice network is also crucial to functions such as firefighter availability, since we don't use pagers. While mobile voice coverage within the Melbourne metropolitan area is generally good, the MFB can now be despatched to assist in events outside this area and Victoria has many mobile voice blackspots. In the future MFB will be just as reliant on mobile data terminals and wireless meshed networks.
- The metrics for the network fall into the following categories which the MFB considers to form an "emergency services grade of service" as opposed to the purely commercial imperatives that might otherwise be provided:

    - Availability – very short outage times are allowed for the core network equipment
    - Redundancy – as part of the due diligence for the service, high levels of designed redundancy are expected in terms of core network equipment, inter site network diversity, base station coverage overlap etc
    - Responsiveness – the network service provider must meet strict responsiveness and restoration target
    - Coverage: across Victoria and across the VIC-NSW and VIC-SA borders; Indoors and outdoors; under bridges; inside tunnels; no blackspots and no dropping to a lower-speed broadband network.

7. *What applications do PSAs currently use on their LMR networks that are provided for mission critical purposes? Does this differ by jurisdiction?*

- LMR networks are traditionally voice networks, so it is not clear what is meant by " applications" in this context

- There are many aspects to the radios and the network that directly provide greatly increased safety to the firefighters. Some examples are:

- Radio devices are "Intrinsically safe" – the equipment carried by firefighters provides high levels of protection against risks of ignition and explosion hazard that might otherwise be caused by the radio itself.
- Duress – there is a prioritised alarm that provides an urgent notification if the radio user is at risk of physical harm.
- In-building network coverage – The network is built to maximise signal penetration into buildings.
- High power radios – these allow signals to be transmitted from less favourable locations and to provide longer range communications between radios out of the network coverage area.

In addition to the MMR radio network, Victoria also has a Rural Mobile Radio (RMR) digital network and a State Mobile Radio (SMR) Network.

8. *How often are PSA narrowband networks (such as LMR networks) renewed or upgraded, and to what extent are different jurisdictions at different points in this process? What are the costs involved in maintaining these networks?*

- Typically the network agreements are for 7 years or longer, with varied options for extensions. Longer periods are problematic in that the technology becomes unsupported or lacking in current features. Technology refreshes are essential regardless of how the services are delivered. The LMR network used by the MFB is provided as an end to end service and the monthly fees cover all maintenance activities.

9. *How do the different types of events that PSAs deal with affect their demand for communications capabilities? Can you provide examples or evidence to illustrate this?*

- The MFB, as with any fire service, experiences extreme peaks in demand. To cater for this, sufficient network capacity (and consequently spectrum) is required to cater for large peaks in demand. A catastrophic fire period can lead to these high levels of demand being sustained until conditions allow the emergency services to reduce their levels of activity.

10. *How, and to what extent, are PSAs using mobile broadband capability provided over commercial networks, and related products and applications, to support their operational activities? Are there any lessons or insights from these experiences, including the benefits that are being realised?*

- The current use of mobile broadband technology is via the commercial networks. This is not by design, it is simply a matter of the commercial carriers being the only source of mobile broadband data available.

- Lesson learned – bandwidth limitation. While peak data rates appear to be high on face value, the peak rates are rarely available and the burgeoning demand for mobile services regularly places high demands on the mobile data networks. Carrier based data spectrum is shared with public use and many users have multiple devices. Phones are now primarily data devices. The public use of data services quickly swamps attempts to send any potentially mission critical information over these

services. Dedicated spectrum is required for greater future use of smartphone apps, tablet apps and Mobile Data Terminal emergency services use.

11. *How do other large organisations (such as government and corporate organisations with certain requirements which may be similar to those of PSAs) currently use mobile broadband services provided on commercial networks?*

The only organisations that we are aware of that have involvement in fire management are DELWP and Parks Victoria. As far as we know, they also use the MMR radio network but may also rely on smartphone and tablet apps, in which case they would also rely on commercial mobile data networks.

12. *What lessons or insights can be taken from the previous trials of Telstra's LANES model, including during the G20 summit in November 2014?*

- The Telstra Lanes model trials during G20 provide an example of how a carrier might offer an emergency services solution, including the use of dedicated spectrum carrying solely emergency services traffic.

- The demonstration was also used to demonstrate to other industries, such as the mining industries, that might make use of the same services. This does not provide a clear picture of how exclusive the spectrum usage will be, given that the Telstra proposal assumes that all of the PPDR spectrum will be made available to provide these services.

- The demonstration was carried out using licensed, but unused spectrum in the 900 MHz band. This would be a worthwhile offering on a national basis, especially given that Telstra already holds licences for this spectrum. The PPDR could be used for additional bandwidth, or potentially for other services and/or providers.

13. *Can commercial network solutions that involve dedicated spectrum for PSAs (and prioritised capacity in other spectrum bands during emergency incidents) allow for interoperability between networks operated by other mobile carriers and/or for end user to roam across multiple networks? Are there any technical, institutional or commercial barriers that would prevent this outcome?*

- As an emergency service customer to commercial networks we have receive mixed messages relating to the question of priorities. While the technical advice appears to indicate that this may be available, there has been no offerings or products demonstrated where this would be delivered in real terms.

14. *What applications could PSAs use if they had access to PSMB capability? How could this be expected to vary across PSAs?*

Fireground information (Emergency Management Common Operating Picture)

Situational Awareness

Automatic Vehicle Location

Further information from the public

Hazardous Chemical information

Personal Accountability

Biometric monitoring

Breathing Apparatus location and support

Building plans for Urban Search & Rescue

3D walk through building models

Pre fire plans and procedures

Infra-red imaging from helicopter and UAV to the Scene

Infra-red and video imaging from the fireground via (eg) Go-Pro cameras

Body worn camera information

Data to in-helmet displays

Content derived from social media delivered to firefighters

Air monitoring

Damage Assessment

15. *To what extent could these applications replace or supplement the capability and systems currently used by PSAs on their narrowband networks?*

- Emergency services use of the PSMB would be the use of digital capabilities that provide the immediate multimedia capability currently experienced from commercial and social media sources.

16. *How important are communications between PSAs and the community during emergency incidents?*

- At the command and control level at incident, communications is critical.
- What is not possible at present is the ability to collect and share information that could be made available via broadband systems.
- A common operating picture is an essential part of managing large scale incidents. Access to broadband services allows relevant information to be distributed, and allows the prospect of a greatly enhanced level of information available, both from back end servers and information returned from the field.
- The communications to the community needs to be able to rely on the best information collected from the field and the best information captured as part of the common operating picture, as well as (increasingly) crowd-sourced information.

17. *What PSMB capability characteristics should be considered in this study?*

- The ability of PSMB to work in conjunction with carrier based services in a complimentary manner is essential to providing the maximum levels of coverage and the ability to obtain additional bandwidth from commercial networks as the situation demands.
- The LTE standards include the ability to cross connect networks, including the ability to authenticate and connect a device from one network to another. This would allow PSA

based devices to be centrally managed independently of the particular carrier's network the device was using.

- The interconnection capabilities provide the opportunities for connecting to a PSMB managed network via other networks. Not only can LTE connections be made via particular carrier, there appears to be an opportunity to interconnect PSMB LTE services across multiple carries while maintain independent security and authentication capabilities.

18. *How should 'national interoperability' be interpreted in this study? Does it include interoperability between networks, devices and applications used by PSA in different jurisdictions? Does it extend to integrating communications services between different local PSAs (for example, police, fire, ambulance and other responders)?*

- National interoperability needs to be viewed in terms of national governance protocols, common spectrum, compatibility of devices, ability to connect across networks, management of information within jurisdictions, agreed protocols for sharing information.
- It should include inter-operability between different PSAs within a State and between PSAs from different States (i.e., across-agency; across borders; across States/Territories).

19. *Does delivering a PSMB capability raise any new opportunities for achieving national interoperability?*

- If common platforms, common access to PSMB based services exist on a national basis then there is the opportunity for a national framework to develop agreed protocols between to allow interagency use with in jurisdictions, and also to allow protocol to be developed where agencies can respond from other jurisdictions entirely.
- An example of this is being able to provide significant resources to support a catastrophic event occurring interstate. There is an opportunity to configure the PSMB capability to allow PSA members to bring their own devices, interconnect them with the communications and services being managed on site, while maintaining connection with their own organisation. This point is particularly important for organisations with a volunteer contingency.

20. *Would the benefits, costs and risks of achieving national interoperability vary under different deployment options? If so, how?*

- *The key benefit is being able to deploy emergency responders with equipment they already have, and allow the necessary access to the networks and services that are available to the local emergency services.*

21. *What progress has been made in putting in place arrangements to better coordinate emergency communications within and across PSAs and jurisdictions?*

- The emergence of Emergency Management Victoria will no doubt aid better co-ordination between Victorian PSAs. It would seem that the coordination of all emergency services needs a national coordinated approach.

22. *What level of network coverage do the existing networks used by PSAs (for narrowband voice and low-speed data capability) currently provide? How does this vary across jurisdictions?*

- The existing radio networks that are dedicated for emergency services used are based on the operational boundaries of the organisations concerned.

- There a variations in the coverage footprints, and generally follow the factors that determine the emergency response capability in any given area e.g. population density, expected response capability, expected response times, risks across the jurisdiction and/or population, centrally managed vs. local communications, etc.

23. *What level of mobile broadband network coverage do PSAs require across metropolitan and regional Australia? Does this vary for different PSAs?*

- *The coverage required for critical data is equivalent to that required for critical voice communications.*

- *For the MFB this includes in-building coverage, additional coverage in buildings via distributed antenna systems, so that portable hand held devices can be used throughout the coverage areas.*

- *Since the 2009 Black Saturday fires the MFB is increasingly responding to rural areas across Victoria, and responses interstate. In these circumstances we respond under the management of other agencies. In these cases we would expect to get the coverage those services get and interconnect with the services we are responding with.*

24. *What is the most appropriate measure of network coverage for use in this study?*

- Network coverage in voice communications is defined for the MFB on the digital voice radio network in terms of a voice quality rating. To ensure that this can be objectively measured, this is translated into a signal level and data error rate that provides the required level of quality. The network is also aware that the terminal devices are not only present but have received the information required i.e., the voice call has connected. The information from the network allows the success of all radio calls to be ascertained and the quality of the network performance can be measured on an on-going basis.

- The equivalent expectations apply to the network coverage for a PSMB based service. We would expect that the coverage would be provided in a manner that provided the expected throughput and quality. The coverage would need to be sufficient to reduce error rates and retries to a level that allowed the quality to be maintained and the overall performance to be monitored.

- Network coverage needs to be provided in terms of operational boundaries of the emergency services.

25. *What options are there for extending the mobile coverage of commercial networks?*

- *There has been an examination of black spots across the country in terms of the provision of mobile services by carriers.*
- *The persistence of black spots after a number of decades indicates that the location of towers and associated infrastructure is not commercially viable in these area.*
- *While there has been discussion around potentially filling in these black spots it is not clear how the commercial imperatives of the carriers can be reconciled with the public's need for communications in these areas, let alone the emergency services requirements for coverage from a PSMB based service.*

26. *Would the benefits, costs and risks associated with achieving an acceptable level of network coverage for PSAs vary under different deployment options? If so, how? And with what operational consequences?*

- *The deployment options need to be explored in far greater detail.*
- *It is clear that there are key risks for the emergency services if they are not directly involved in the governance around PSMB deployment.*
- *Each emergency service has mandated responsibilities and the PSMB must be an enabling capability that the emergency services can use to achieve their respective operational obligations.*
- *The focus in terms of deployment of the **PS**MB must always be clearly related to the **P**ublic **S**afety requirements of those ultimately using it.*

27. *How could voice services — traditionally carried on narrowband networks — be integrated into a mobile broadband network capability? What challenges and risks need to be accounted for? Are the challenges at the local level (due to legacy factors) greater than those at the national level?*

- While PPT applications may be developed the LTE capability cannot match the reliability and availability of LMR voice networks. The standards associated with LTE are related to LTE as a data service, and voice related services have not reached any form of maturity in terms of standards and resilience.
- The very low power of LTE devices provides a severe limitation on these devices. There have been discussions and proposed standards relating to higher power LTE devices, but from the point of view of an emergency services point of view these need to not only be developed but realised in terms of product availability.
- In the long term the MFB will seek to use the PSMB as a major part of its emergency response capability. In the long term, the development of voice standards will allow the introduction of emergency services grade communications, hopefully with standards that allow higher power devices and standards directed towards back end network resilience.
- In the medium term, the MFB would take advantage of voice and data services over LTE to compliment or replace the narrowband services and provide options for less critical communications.

28. *What challenges or opportunities arise (from a technical, institutional and/or commercial perspective) from such integration, and would the benefits, costs and risks vary under different options for PSMB? If so, how?*

- *The challenges relate to the ability of the devices and the underlying network to match the required levels of performance delivered by narrowband voice services which have been built to international emergency services standards.*
- *There are challenges in providing network coverage that need to be addressed and the persistence of current black spots highlights how challenging this can be.*
- *There are greater opportunities in the major metropolitan areas given that coverage for LTE networks will be more readily provided from a cost benefit point of view.*
- *There are technical challenges in introducing very low power devices for use in adverse emergency service conditions.*

29. *The Commission understands that there is currently work underway to develop voice applications for 4G/LTE networks for use in mission critical circumstances. When are these applications likely to become available?*

- While the MFB has been made aware that these discussions might have commenced, it is not clear indications of how this might be realised in terms of our organisation's requirements.
- The key drivers for the introduction of LTE services appear to be towards commercial personal devices for the general public. There does not seem to be any equivalent levels of activity directed towards emergency services' use of these products and network capabilities.

30. *What factors are important in ensuring the integrity and security of communications for PSAs? To what extent does this differ for different types of PSAs?*

- *The security of the services is a critical part of the deployment of a PSMB solution.*
- *For sensitive areas, encryption must be an integral part of the solution with appropriate governance an protocols to ensure its integrity.*
- *Authentication of devices on the network is critical and there must be protocols as to how the agencies are able to connect to the network and the appropriate levels of security are provided.*

31. *Would the costs and risks associated with ensuring the integrity and security of communications differ depending on how a PSMB capability is delivered? If so, how?*

- The risks with authorisation centre around only permitting authorised devices to access the network. Allowing unauthorised devices on to a shared emergency services network is considered a high risk and will require a national approach, and allow for authentication of devices via the agencies within the relevant jurisdictions.

32. *What methods or metrics could be used to define and/or measure the level of security provided over a network that delivers mobile broadband capability?*

- *Segregation of traffic*

- *Protection from network 'scrambling'*
- *Encryption.*

33. *What additional security needs do PSAs have compared to other sectors with high security requirements for their communications?*
    - Protection from network 'scrambling'

34. *How should PSA demand for mobile broadband capability be estimated in this study, including their expected demand requirements into the future?*

    From the perspective of the MFB the demand will be estimated on the deployment of capabilities such as:

    - Fireground information (Emergency Management Common Operating Picture)
    - Situational Awareness
    - Automatic Vehicle Location
    - Further information from the public
    - Hazardous Chemical information
    - Personal Accountability
    - Biometric monitoring
    - Breathing Apparatus location and support
    - Building plans for Urban Search & Rescue
    - 3D walk through building models
    - Pre fire plans and procedures
    - Infra-red imaging from helicopter and UAV to the Scene
    - Infra-red and video imaging from the fireground via (eg) Go-Pro cameras
    - Body worn camera information
    - Data to in-helmet displays
    - Content derived from social media delivered to firefighters
    - Air monitoring
    - Damage Assessment.

35. *What methods or metrics could be used to define and/or measure the level of service capacity provided to PSAs?*
    - *There metrics used to define are base around the following:*
        - Priority
        - Availability
        - Redundancy – as part of the due diligence for the service, high levels of designed redundancy are expected in terms of core network equipment, inter site network diversity, base station coverage overlap etc.

- Responsiveness – the network service provider must meet strict responsiveness and restoration target.

36. What level of capacity will PSAs need for a PSMB capability, and how will this differ between business as usual activities and large scale emergency incidents?

- The demand in extreme conditions is that the increased demand on communications services is an order of magnitude higher than business as usual demand.
- Levels of activity can rapidly increase to levels that exhaust and potentially overload communications systems and stretch the physical resources of the organisation.
- In general, it has proved extremely difficult to estimate what the upper limits of peak demands might be, given that the scale of events varies so greatly.
- The strategy on existing systems is to secure a minimum available capacity, especially where resources are shared with other agencies. The overall dimensioning of systems and how they are used are based on operational scenarios.
- In terms of the PSMB the introduction of services will also need to be reviewed in terms of available capacity, based on the operational scenarios we are able to quantify.

37. How might the demand for PSMB capability differ between types of PSAs? How could competing demands amongst PSAs be managed? Should particular uses be prioritised?

- Prioritisation has been a problematic issue in shared networks.
- The general experience has been that it is extremely difficult to prioritise events within an agency, and even more difficult between agencies.
- There does however need to be protocols developed between the agencies to manage the available capacity.
- It is likely that once PSMB becomes a reality, there will be latent demand emerging across the emergency services sector which cannot be predicted to any degree of accuracy at this stage.
- The best scenario is to have the representation and protocols in place to manage capacity issues on an on-going basis.

38. How would the benefits, costs and risks of ensuring sufficient capacity vary under different deployment options?

- The capacity is ultimately limited by the spectrum available and the funding of the network behind the PSMB services.
- The service models that contain direct investment will have issues relating to funding the network infrastructure.
- The models utilising carrier provision and the like will either cause increased cost of network provision, either through capital build or opportunity cost of reducing commercial network use, which will be reflected back through increased service payments.

39. What level of resilience do PSA narrowband networks usually provide and how does this differ from commercial mobile broadband networks?

- *The narrowband network used by the MFB has very high levels of resilience. Although it is provided as a service contract, the underlying network must have redundancy, high availability core switches, base station overlap coverage, minimum available capacity, link path diversity to all sites.*
- *The deign risk and delivery of the service is the entire responsibility of the contractor, but there are reporting services, KPIs, service levels and an abatement process in place to ensure not only that the service levels are being delivered, but also that its levels of resilience are maintained.*

40. *What methods or metrics could be used to define and/or measure the level of resilience provided by the networks used to deliver PSMB?*
    - *The methods employed must not only describe the traffic handling capability of the network, and its potential overflow into services provided over a carrier network, there must also be transparency regarding how the resilience of the PSMB service is achieved.*
    - *There needs to be a reporting mechanism, with its own KPIs, to ensure that PSBM users are informed in relation to the integrity of the service.*
    - *There must be reporting of loss of diversity and redundancy and rectification KPIs need to be in place to ensure that such losses are restored as soon as possible.*

41. *What priority should be given to the capacity to stand up a replacement service within a specified timeframe in the event of a physical or network based disruption?*
    - For mission critical services, the expectation is that the redundant and resilient parts of the service would provide continuity of service in the event of a single point of failure, with no outage experienced by the service users.
    - Given that all of the "eggs are in one basket" for all emergency services, there will need to be a high priority and should timeframe for the restoration of the fully redundant and resilient service.

42. *Are there any barriers (for example, institutional, informational and/or technological) to, or challenges associated with, delivering a resilient PSMB capability? How might this differ between different deployment options?*

    - The barriers to the components of a PSMB that relate to direct investment and carrier related service models relate to the cost of the resilience with in the core equipment and diversity required in linking the communications sites.
    - The service models that contain direct investment will have issues relating to funding the network infrastructure.
    - The models utilising carrier provision and the like will either cause increased cost of network provision, either through capital build or opportunity cost of reducing commercial network use, which will be reflected back through increased service payments.
    - Carriers are extremely reluctant to share information regarding how networks are configured.
    - Carrier network failures have demonstrated the high levels of concentration of services and the major outages that can occur, even to other carriers, if services are lost in critical locations.

43. *How could future developments in technology, or growth in demand for mobile broadband services and capacity, affect the sustainability of PSMB capability under different deployment options?*
    - *The demand on broadband services is increasing exponentially including the global amount of data. The answer is that the levels of demand will increase, but the levels cannot be estimated.*

44. *How will the convergence of voice and data services affect the sustainability of PSMB capability under different deployment options?*

    - *Voice itself may not add a great deal to the bandwidth requirements, however data and video will affect it greatly.*

    - *The issues raised earlier regarding emergency services communications standards and the terminal technical and safety standards also apply.*

45. *What challenges are involved with delivering a mobile broadband capability to PSAs by 2020? Do these differ under alternative deployment options?*

    - *Given the time frame suggested in the question, it is very unlikely that a complete purpose built network on a national basis would be funded and built.*

    - *A staged approach is the most likely outcome, with carrier involvement, but this also comes with issues relating to security authorisation, capacity management and network resilience.*

    - *The issue of black spots needs to be addressed.*

46. *What potential obstacles exist to a mobile broadband network being fully compatible with a range of end-user devices? Does this depend on the network deployment option?*

    - *The end user devices are a critical part of deployment for the MFB.*

    - *The need for higher power devices has an impact on how the network is designed and configures and may have an impact on the design/configuration of the network and its performance.*

    - *The devices that are currently available for emergency services use are not developed for the 800 MHz band proposed in Australia. It is not clear what devices would be available in Australia or what premium might be required for devices produced in lower volumes for this band.*

47. *How does the method of ensuring interoperability impact on the cost of the system to PSAs?*

    - *If interoperability requires separate equipment to ensure the appropriate levels of authorisation, encryption and security, then this will represent an additional cost.*

48. *What detailed options should be evaluated in this study? What underlying assumptions and key parameters would be associated with each option?*

- *The options need to include:*
  - *Carrier proposals*
  - *Use of carrier spectrum in Lanes product*
  - *exclusivity of use of the spectrum,*
  - *network resilience,*
  - *Mixed network models*
  - *Reference designs*
  - *Transparency of network resilience*
  - *Performance measure relating to resilience.*

49. *What (if any) assumptions or parameters should be 'common' across all options?*

- *The PSMB must meet the mission critical requirements of the emergency services using it.*
- *The emergency services determine access, security and capacity management.*

50. *What are the sources of costs relevant to this study?*

- *Not known*

51. *In what ways could delivering a PSMB capability affect non PSA users? How would these effects differ across deployment options? What methods could be used to estimate these effects?*

- *If the LANES product is utilised, the primary effect on non PSMB users would be expected to be a loss of service to public users in the areas affected by large scale incidents or catastrophic events.*
- *A solution that exclusively used only PSMB spectrum would be expected to have no impact.*

52. *Is it appropriate to consider option values as part of the cost benefit analysis in this study? If so, how? What information or data is relevant?*

- *The key issue is being able to compare "like for like".*
- *There may not be sufficient information available from carriers to directly compare costs.*
- *Carrier pricing models may not reflect underlying costs, either positively or negatively.*
- *The risks pertaining to each option would need to weighed up.*

53. *Are the network cost elements identified in box 4 relevant for this study? What specific cost items would fall within these categories? What other network costs should be considered? What is the nature and materiality of these (and other relevant) costs under alternative PSMB options?*

- *The network costs are all relevant.*
- *The issue is being able to quantify the overall costs in terms of available terminals and underlying network complexity.*

54. *What method(s) should be used to estimate the network costs of different deployment options for delivering PSMB? What studies should inform the Commission's thinking in this area?*

- *The availability and cost of terminals will need to be determined including those suitable for firefighting operations.*
- *There may need to be reference designs and service delivery models developed to provide the basis for cost estimations.*

55. *What network cost components are interdependent with other costs, or other parameters (such as assumptions about the amount of spectrum allocated)? What is the nature of these interdependencies?*

- No response.

56. *What data sources could be used to estimate expected PSMB traffic requirements, and the network infrastructure elements required to deliver PSMB capability under different deployment options?*

- *The traffic requirements will need to me modelled according to the expected use by the agencies.*

57. *What data sources could be used to estimate the cost of the infrastructure, equipment and operation in delivering PSMB capability under different deployment options?*

- *The traffic requirements will need to be modelled according to the expected use by the agencies.*

58. *What is the appropriate approach (or approaches) to model the opportunity costs of spectrum under different deployment options? What issues does 'spectrum sharing' raise for estimating these opportunity costs, and how might they be addressed?*

- *The Radio communications Act clearly identifies the priorities in relation to emergency services.*

- *If the Spectrum Sharing referred to under the Lanes approach refers to the potential sharing of PSMB spectrum with other users, then this is not an acceptable risk.*

- *If the "sharing" refers to the overflow capacity on to the commercial Telstra connection, then it would be considered as use of the carrier services spectrum. However, this model has drawbacks previously alluded to (can't authenticate you until logged on and can't log on without knowing your presence).*

59. What data sources could be used to estimate the opportunity costs of spectrum under different deployment options for PSMB?

- *Not known*

60. What is the appropriate discount rate, or range of discount rates, to use in this study?

- *The Discount rate used by your agency or the Commonwealth Government at the time of the analysis*

61. How far into the future should costs and benefits be measured?

- *Costs need to be measured in terms of the overall agreements and lifecycles of these services.*
- *The time period is typically not less than 7 years, but extensions are always factored in.*

62. What are the sources of benefits relevant to this study?

- *The benefits will be estimated in terms of community expectations, overall emergency services capabilities and effectiveness; community satisfaction and so on.*

63. How can the potential benefits of PSMB capability (in terms of PSA outcomes) be estimated? Is scenario analysis useful? How should scenarios be constructed to reflect an appropriate range of situations faced by PSAs?

- *Operational scenarios are essential in determining the overall benefits*
- *Individual agency and multiagency scenarios are recommended*
- *Participation by key emergency services personnel is required*
- *A national approach is needed.*

64. Can you identify any trials or pilot programs of PSMB capability? Are there any insights to draw from these experiences about potential benefits (or costs)?

- *No*

65. *Can you identify evidence or examples that illustrate the effects of PSMB capability on PSA outcomes?*

- *No*

66. *What method(s) should be used to value the effects of PSMB capability on PSA outcomes?*

- *A Proof of Concept, or Trail from which you can compare 'befores' and 'afters' in terms of positive outcomes.*

67. *Is there research that considers how the costs of responding to natural disasters, crime or other events could be affected if PSAs had access to mobile broadband?*

- *Not known*