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# Emergency management and disaster planning and remediation

4.1 Emergency management and disaster planning and remediation are key areas where smart ICT has, and will continue to make, significant improvements in government and public responses. The ability to predict emergency scenarios, model and manage responses, and remediate outcomes is essential to effective and coordinated responses to emergencies and disasters. In its submission, Transport for NSW noted that:

> Beyond disaster relief, governments around the world are beginning to implement smart ICT strategies to improve disaster planning, with significant developments using digital engineering for city precinct planning and management.
>
> Work is underway in a number of global cities, such as Singapore, Seoul and Vancouver, to break down existing data silos and improve access to current and accurate information for town planners and emergency services. The development of these precinct wide information models, or Virtual Cities, provide a trusted digital representation that can be re-used for response and scenario training, feed real-time monitoring data (video, audio, etc.) to emergency vehicles, identify access roads, egress points, highlight underground utilities, etc.[1]

## Current capabilities

4.2 The evidence presented to the Committee included a substantial list of areas where smart ICT is already contributing to emergency management

1 Transport for NSW, *Submission 33*, p. 20.

and disaster planning. The Australian Information Industry Association (AIIA) illustrated several examples including:

- NICTA modelling of the flow of water from a potential spill at Warragamba Dam in Sydney. This enable the authorities to make informed decisions on optimal evacuation paths for residents in affected areas.
- Rio De Janeiro has developed a central operations centre, integrating data from 30 agencies to enable analysis of weather, energy, building, transportation and water data in real time. It has allowed the prediction of flood events before they occur, reducing reaction times to hours instead of days.
- Victorian Bushfire Warning System: the IBM built One Source Message System provides a warning system for writing and sending bushfire emergency messages.
- Crowd tracker: developed for Tennis Australia by IBM, this app allows fans to track themselves , crowds and events within the Melbourne and Olympic Park precincts. 'By using social media ad GPS enabled devices, this solution is very relevant to dealing with crime spots (e.g. Kings Cross) or major security threats or catastrophes.'[2]

4.3 The University of Melbourne advised the Committee of recent developments in bushfire management. The Phoenix RapidFire computer program can map out where a bushfire is likely to spread within minutes of reporting 'helping managers decide if they should send firefighters or evacuate communities':

> Within seconds, the program crunches data on weather, wind, vegetation, the slope of the land and how dry the bush is. It turns this into a map of where the fire is likely to go, overlaid on Google Earth, and displays the results as a video. The program also diagnoses the type of fire—how hot will it burn? How high will the flames go? Where might embers land? Trained fire analysts monitor and act on the results … Hundreds of fire analysts have been trained to use it.[3]

4.4 Transport for NSW identified a range of technologies and systems that had been introduced to assist in disaster management and remediation, including:

- The use of Unmanned Aerial Vehicles (UAVs or drones) in the aftermath of Typhoon Haiyan (2013), in the Philippines, to survey the

2 Australian Information Industry Association, *Submission 7*, pp. 7–8.

3 University of Melbourne, *Submission 32*, p. 5.

landscape, locate missing persons and create 2D and 3D maps of the disaster zone. Other uses of UAVs have included:

- ⇒ Nepal Earthquake (2015)—Drones fitted with thermal imaging cameras to detect survivors in remote locations;
- ⇒ Papua New Guinea (2014)—use of drones to transport medical samples in remote locations.

- Use of online tool Future Build, following the Christchurch earthquake (2010). This tool uses a form of GIS, enabling contractors to enter in consistent,, critical details about reconstruction works, including scheduling, delivery and access points. This promotes clash detection and program optimisation. It has also allowed agencies and other users to access a shared online view of linear infrastructure repair, planned buildings and other construction.[4]

4.5 Transport for NSW also noted that Sydney Trains had trialled the use of drones fitted with high definition cameras 'to inspect and record data on assets in hard to reach or high risk locations'.[5]

4.6 The Queensland Department of Transport and Main Roads (TMR) noted that it was 'currently utilising smart ICT solutions to deliver improved outcomes for Queenslanders through Emergency Vehicle Pre-emption (EVP) Technology':

> … an intuitive and dynamic ITS solution that triggers a green traffic light signal for emergency response vehicles in advance of their arrival at an intersection, reducing the number of times an emergency response vehicle crosses an intersection against a red traffic light.[6]

4.7 TMR is also 'currently undertaking extensive flood mapping across the state to further identify parts of the network vulnerable to extreme weather events'.[7] TMR believed that a greater level of system integration across multiple stakeholders will enable improved responses to events that impact the transport network.[8] TMR identified system resilience as 'a key strategic priority for the department in all future infrastructure planning and investment considerations'.[9]

4.8 Brisbane City Council identified a number of areas where it had made use of social media to improve emergency management at a local level:

4 Transport for NSW, *Submission 33*, p. 19.
5 Transport for NSW, *Submission 33*, p. 19.
6 Department of Transport and Main Roads, *Submission 45*, p. 9.
7 Department of Transport and Main Roads, *Submission 45*, p. 9.
8 Department of Transport and Main Roads, *Submission 45*, p. 9.
9 Department of Transport and Main Roads, *Submission 45*, p. 8.

> Council created a social media Facebook profile after The Gap storms in 2008. Council's social media channels have expanded considerably since that time and Brisbane City Council is now the most followed local council on social media channels in Australia.
>
> Social media provides the opportunity for Council to get to know its residents and businesses better and this modern style of interaction with the community serves to build Council's reputation, credibility and thought leader status.[10]

4.9 Social media was also used in the aftermath of the 2011 Brisbane floods 'to provide vital information to the community on sandbag locations, road closures, flooded areas and key service disruptions'; and to connect residents 'with tradespeople and cleaning groups'. In January 2013, 'Council implemented a crowdsourced map displaying information on incidents and road closures'.

4.10 Brisbane City Council now regards social media as 'a mainstream consumer technology that can be easily leveraged to communicate with residents anywhere, anytime on any subject', and urges 'digital leaders … to think strategically about how social media can play an active role in managing cities'. The Council also acknowledged the limits of social media, however, stating:

> During emergency events Council uses a multi-channel approach to communication. Social media alone has a dependency on the services from telecommunications carriers and in times of emergency these services become less reliable.[11]

4.11 A detailed case study of the use of smart ICT in emergency management and disaster planning was provided by the University of Wollongong's SMART Infrastructure Facility—the PetaJakarta project. PetaJakarta.org is a research project led by the SMART Infrastructure Facility in collaboration with the Jakarta Emergency Management Agency (BPBD DKI Jakarta) and Twitter Inc. PetaJakarta is 'a web-based platform which runs on custom built open source software, called CogniCity, which turns the geo-tagged Tweets by Jakarta's citizens into a real time flood map'. The PetaJakarta platform allows 'citizens to share flood information with social media peers while simultaneously providing BPBD DKI Jakarta with data to support decision making for disaster response'.[12]

4.12 The SMART Infrastructure Facility stated that:

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10 Brisbane City Council, *Submission 34*, p. 6.

11 Brisbane City Council, *Submission 34*, p. 6.

12 SMART Infrastructure Facility, University of Wollongong, *Submission 12*, p. 5.

> PetaJakarta.org has demonstrated social media's valuable niche within the disaster risk management information ecosystem, as an operational tool capable of providing decision support at the various spatial and temporal scales required by the different actors within city. It offered an innovative and inexpensive method for the crowdsourcing of time-critical situational information in disaster scenarios.[13]

4.13 SMART urged policy makers to 'embrace social media platforms as an avenue for gathering crowd sourcing data that can inform decision makers during emerging situations'. It highlighted the benefits of Twitter, stating:

> As the leading social media platform for real-time information sharing, Twitter offers a variety of functional elements that can be more thoroughly leveraged in the DRM sector. These functionalities include account verification, 'retweet validation' of citizen reports, Twitter Cards, programmatic reply functionalities, and the PowerTrack API Connection.[14]

4.14 One key element of success in platforms like PetaJakarta is the open availability of data. In its submission, SMART noted:

> The development of open source software (OSS) platforms are crucial for wide spread dissemination of real-time information.
>
> In the field of disaster management and remediation we believe a platform, that is open source and can harvest and display data in real-time, would be of invaluable assistance to decision makers and first responders. OSS should be designed for scalability and transferability with respect to the domain of application, the location, and the language of the users. Tools and platforms built for single-use applications are both costly and inefficient.[15]

4.15 Another important element is adopting or adapting metadata standards to the requirements of disaster risk management (DRM). SMART argued that:

> DRM OSS for social media integration should be built with the aim of complimenting existing institutional frameworks and offer an open API for further integration into DRM information ecosystems; when possible, the storage of social media-sourced data should adapt to standard metadata formats such as the Common Alerting Protocol (CAP).[16]

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13 SMART Infrastructure Facility, University of Wollongong, *Submission 12*, p. 11.
14 SMART Infrastructure Facility, University of Wollongong, *Submission 12*, p. 3.
15 SMART Infrastructure Facility, University of Wollongong, *Submission 12*, p. 3.
16 SMART Infrastructure Facility, University of Wollongong, *Submission 12*, p. 4.

4.16 Adopting simple metadata standards would allow efficient capture and store of information including datasets, software, projects and other resources. It also meant that 'seemingly unrelated information can be linked to, queried and discovered on a number of different platforms'. Well linked metadata would allow researchers from different disciplines to access information:

> This allows these researchers to join in on and add to the conversation as simple standards reduce technical or disciple specific barriers to information. Well linked open data is an essential part of information management. These links form a web of connectedness that promotes consistency across the infrastructure landscape and provides multiple access points to these datasets, collections and resources.[17]

## Future developments

4.17 The potential for smart ICT to improve emergency management and disaster planning and remediation was emphasised in the evidence presented to the Committee. buildingSMART believed that:

> As Governments increasingly focus on disaster preparedness, community awareness, capability development and disaster response and recovery, smart ICT solutions and the digital built environment will be able to play a strategic and sustainable role in addressing these major challenges to society. [18]

4.18 In its submission, Downer highlighted the breadth of activity where smart ICT is being engaged to solve issues of disaster planning and remediation, including 'management of biosecurity outbreaks, crisis management, emergency response, and recovery'. It noted that:

> Having complete and visible asset data on a common platform (e.g. remote monitoring of water flow, water quality and street light function) enables resources to target faults and expedite critical repair activities. Deploying wireless cameras, temporary lighting and temporary signals enables agencies to manage safety, security and traffic flows. Similarly, journey time modelling and matrix boards to inform motorists of changes and monitor the impact of traffic movements due to relocation of business

17 SMART Infrastructure Facility, University of Wollongong, *Submission 12*, p. 4.

18 buildingSMART, *Submission 10*, p. 9.

> operations out of the centre, are valuable tools during these times.[19]

4.19 Downer observed that 'a number of the above technologies have been employed as individual solutions', but there was also 'great potential to combine them as part of a structured response toolkit'.[20]

4.20 Brisbane City Council identified a range of areas where smart technology was expected to add to Council's additional disaster management capabilities, including:

- Improved options for multi-agency data sharing.
- Access to improved intelligence through the use of drones and rapid response aerial photography.
- More sophisticated real time modelling and event simulation.
- Better access to data from remotely sensed sources.
- Smarter mobile field services to coordinate response and remediation.
- More effective task coordination through improved schedule and despatch processes.
- Use of common operating pictures and dashboards.
- Use of predictive analytics and machine learning to activate early intervention measures (e.g. bushfire burns).
- Availability of digital building plans and electronic records for sharing and distribution.[21]

4.21 The City of Melbourne stated that in the field of disaster planning and remediation, 'we fully expect to benefit from a range of ICT attributes, including scenario modelling, assumption testing and instant, real-time and anywhere communication'. The City of Melbourne believed that 'smart ICT will allow us to be better prepared for emergency management and to better connect with the community during emergencies'.[22] Mr Austin Ley, representing the City of Melbourne, told that Committee that the council had been an IBM smart city grant:

> … to assist the city in better understanding how to encourage the community to anticipate and coordinate responses before, during and after extreme events that might impact on the health and safety and infrastructure of our city.[23]

4.22 In its submission, Transport for NSW noted that:

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19 Downer, *Submission 20*, p. 3.

20 Downer, *Submission 20*, p. 3.

21 Brisbane City Council, *Submission 34*, p. 6.

22 City of Melbourne, Submission 35, p. 9.

23 Mr Austin Ley, Acting Manager, Smart City Office, City Strategy and Place Group, City of Melbourne, *Committee Hansard*, 25 September 2015, p. 14.

> Access to smart ICT technologies can provide enhanced situational awareness through monitoring and controlling networks, more rapid assessment and resolution of physical and information network disruptions and better interoperability resulting in collaboration between agencies.[24]

4.23 Using the example of a major bridge malfunction, Transport for NSW observed that smart ICT gives agencies the capability to:

- rapidly identify the location and cause of the malfunction
- alert crews to the pending task and required parts/actions
- notify Transport Management Centre of the disruption
- potentially automatically develop and implement alternate routes or transport solutions
- communicate these through Intelligent Traffic Systems, smart vehicle control systems, GPS alerts/updates, apps, Variable Message Signs and social media.[25]

4.24 Despite these opportunities to use smart ICT in emergency management and disaster planning and remediation, a number of challenges were identified to the uptake and use of smart ICT.

4.25 Mr Geoff Spring, from the Centre for Disaster Management and Public Safety at the University of Melbourne, observed that one barrier to the uptake of smart ICT was the conservative culture of the emergency management sector. He stated:

> The emergency management sector should be a significant beneficiary of the availability of broadband communication technologies, smart ICT and the innovation in products and services it will bring; however, … the sector will need to overcome its traditional conservative nature in order to capture opportunities associated with broadband technologies and smart ICT. These opportunities will empower the sector to contribute to building a higher level of community resilience and social wellbeing and hence economic productivity across Australia.[26]

4.26 Mr Spring emphasised the importance of grassroots consultation with emergency services workers to establish effective systems—and these workers have to be aware of what solutions available in order to ask for them. He suggested that:

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24 Transport for NSW, *Submission 33*, p. 21.

25 Transport for NSW, *Submission 33*, p. 21.

26 Mr Geoff Spring, Senior Research Adviser, Centre for Disaster Management and Public Safety, University of Melbourne, *Committee Hansard*, 25 September 2015, p. 36.

> One of the things that I think the Commonwealth government and the state governments could do is invest in a trial broadband communications network so that people can experience it—I was going to say 'play with it', but that is too simple a term—and get used to what broadband technologies mean in the emergency management space, because we simply do not know at this point in time. It is all guesswork.[27]

4.27 Another key challenge to the adoption of smart ICT from an emergency management perspective is the growing dependence on 'power and telecommunications networks for safety and efficiency'. Risk convergence, the 'interdependencies between individual assets, transport networks and across sectors (Communications, Energy, Water, Transport etc.),' needed to be 'considered as a part of any incident, crisis and disaster planning'. Nonetheless, it was expected that smart ICT would itself 'contribute to the resilience of local, state and national networks'; and would deliver other benefits, 'including improved fuel efficiency, reduced travel times, avoidance of hazards and better awareness of incident impacts'.[28]

4.28 The Department of Communications observed that:

> … the effectiveness of new and emerging Smart ICT can be constrained within an emergency services context by issues associated with jurisdictional diversity, regulatory inconsistencies, the incompatibility of ICT systems, the capacity of networks and technologies to prioritise emergency communications, and the varying organisational capabilities and operational processes of individual emergency response organisations themselves.[29]

4.29 The Department noted that:

> These challenges present real and significant risks to network operators, policy makers, and emergency service organisations who remain focussed on ensuring (among other things) the efficient deployment of limited resources, funds for service and system upgrades are appropriately prioritised, and the highest possible level of protection to individuals is being achieved.[30]

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27 Mr Geoff Spring, Senior Research Adviser, Centre for Disaster Management and Public Safety, University of Melbourne, *Committee Hansard*, 25 September 2015, p. 39.

28 Transport for NSW, *Submission 33*, p. 20.

29 Department of Communications, *Submission 27*, p. 5.

30 Department of Communications, *Submission 27*, p. 5.

4.30 Despite these issues, the Department believed that 'the opportunities Smart ICT offers in providing service enhancements within the emergency service environment are undeniable'.[31]

4.31 Mr Andrew Dingjan, Director of the Australian Urban Research Infrastructure Network (AURIN), argued that with regard to emergency services and public safety, 'spatial data infrastructure such as AURIN and public safety communications need to be considered as national critical infrastructure'. He noted that 'public safety communications is no longer about voice, and there is now a greater focus on data and location'; and that 'investments in the AURIN and ANDS, the Australian National Data Service, projects have provided the basis for the national Intelligent Disaster Decision Support System'.[32] This system focusses on mission critical data in the management of events, using spatially enabled location based services and data analytics to covert mission critical data 'into meaningful information for the purpose of enhanced decision making supported by real-time simulation and visualisation at points of service delivery and coordination'.[33]

4.32 Mr Spring identified the need for investment in communications and computing infrastructure, noting that 'for the first time the public has a greater communications and computing capability than public safety agencies and the emergency management sector more generally'. He stated that:

> To redress this imbalance, public safety agencies globally are being provided with access to broadband technologies with dedicated spectrum and spatially enabled public safety applications to meet community expectations for service delivery.
>
> Public safety communications need to be recognised as critical infrastructure and be included in any national conversation regarding investment in Australia's infrastructure across all sectors.[34]

4.33 Mr Spring highlighted AURIN's proposal to:

> … establish federated urban data hubs across Australia to facilitate a range of research activities related to urban settlements links directly to mission critical public safety communications

31 Department of Communications, *Submission 27*, p. 5.

32 Mr Andrew Dingjan, Director, Australian Urban Research Infrastructure Network, University of Melbourne, *Committee Hansard*, 25 September 2015, p. 35.

33 Mr Geoff Spring, Senior Research Adviser, Centre for Disaster Management and Public Safety, University of Melbourne, *Committee Hansard*, 25 September 2015, p. 37.

34 Mr Geoff Spring, Senior Research Adviser, Centre for Disaster Management and Public Safety, University of Melbourne, *Committee Hansard*, 25 September 2015, p. 36.

> ecosystem, the next generation triple zero system, the proposed public safety mobile broadband capability and the use of open standards to capture the opportunity for harmonised data in interjurisdictional analysis at both the national and intrastate level.[35]

4.34 Mr Spring also urged greater collaboration 'between governments, industry and academia around research associated with the use of broadband technologies for disaster management and public safety'.[36]

4.35 In its submission, the Victorian Spatial Council also urged greater coordination between jurisdictions, and with private industry, in emergency management and disaster planning and remediation, stating:

> The focus should be to encourage and direct the development of a network of government agencies and private sector organisations that will work together under this framework to deliver coordinated and managed spatial information for emergency management.
>
> Such a capability should be based on ensuring participants are prepared and connected (ie always available), evidenced by:
>
> - availability and quality of relevant data
> - knowing that data exists
> - knowing who to contact to get it
> - knowing that it will technically fit with other data (ie compatibility of data and systems, and 'interconnectivity' to enable the exchange and sharing of data and products)
> - being able to achieve this in meaningful timeframes (hours, not days or weeks)[37]

4.36 Transport for NSW, recommended that the Australian Government fund 'research and development of new technologies for disaster planning, emergency response and humanitarian relief' and 'the establishment of Virtual Cities or Precinct Information Models in Australia'.[38]

4.37 The Queensland University of Technology highlighted the need for better spatial date on infrastructure as a critical element of emergency management, stating:

> Past disasters have highlighted the need for better information on infrastructure. Local events, such as cyclones in Northern

35 Mr Geoff Spring, Senior Research Adviser, Centre for Disaster Management and Public Safety, University of Melbourne, *Committee Hansard*, 25 September 2015, p. 37.

36 Mr Geoff Spring, Senior Research Adviser, Centre for Disaster Management and Public Safety, University of Melbourne, *Committee Hansard*, 25 September 2015, p. 36.

37 Victorian Spatial Council, *Submission 6*, p. 4.

38 Transport for NSW, *Submission 33*, p. 21.

> Queensland, have shown that lag of knowledge on asset location (ie road signs) cripples recovery and makes planning more challenging than it should be. Better spatial data is able to show scenarios of floods (i.e. 3D modelling of infrastructure and terrain) that identifies infrastructure that may lie in the path of a cyclone, and provides information on household sizes for evacuation plans that is crucial and needs to be current. If standardisation of access to such information can be achieved, emergency service and authorities can plan for events faster and more reliably, even across State borders.[39]

4.38 In a similar vein, AECOM recommended the creation of an online national disaster-related Geographical Information System (GIS) which can be updated with public and private infrastructure for disaster related planning and automated emergency warning purposes.[40]

4.39 In its submission, Orange Horizons urged governments to avoid a silo mentality in the development of smart ICT, particularly in relation to emergency management, utilising capacity and redundancy in existing systems to develop new ones. Orange Horizons suggested that the utilisation of existing capacity would significantly reduce the cost of developing a Public Safety Mobile Broadband (PSMB) system by accessing the capacity of systems with high levels of redundancy that were already in operation.[41]

## Committee conclusions

4.40 The principal focus of this report is the deployment of smart ICT in the design and planning of infrastructure. It is not possible for the Committee to consider all the many variables in the deployment of such technologies to emergency management and disaster planning and remediation. The evidence presented to the Committee, however, makes it clear that smart ICT has an important role to play in the development of systems which will allow better planning for and responses to emergencies and disasters.

4.41 The capacity to anticipate the impacts of flood and fire through modelling of scenarios, to map the predicted and actual course of events, to create systems which allow access to granular data in real time, and determine the allocation of resources in minutes, is already a reality. What is required is the coordinated development and dissemination of technology and

39 Queensland University of Technology, *Submission 19*, p. 2.

40 AECOM, *Submission 21*, p. ii.

41 Orange Horizons, *Submission 41*, pp. 1–3.

systems. The Committee supports the work of AURIN and the Centre for Disaster Management and Public Safety in this field. It also supports the position of Orange Horizons in urging governments to take a holistic approach to the development of public safety communications systems—incorporating the development of public safety communications into the broader development of communications infrastructure rather than in isolation. Public safety communications systems are critical infrastructure and should be recognised as such.

### Recommendation 4

4.42 **The Committee recommends that the Australian Government recognise public safety communications systems as critical infrastructure, and continue to support the development of these systems, including funding research, promoting implementation, and providing national coordination.**

### Recommendation 5

4.43 **The Committee recommends that the Australian Government continue to support the development of disaster planning and emergency response systems, including funding research, promoting implementation, and providing national coordination.**