TOMORROW'S TECHNOLOGY STARTS WITH TODAY'S SPECTRUM PLANNING

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This is an edited version of the Opening Address by ACMA Chairman Chris Chapman at Radcomms08, held in Melbourne from 30 April to 2 May 2008. It explores new radiocommunication-based technologies and applications that increasingly require the sharing of limited spectrum. Associated with that it also discusses new approaches to spectrum planning in order to facilitate adoption and further innovation in this rapid growth sector. A postscript briefly updates events since Radcomms08.

Spectrum is an exciting field, albeit that it has been somewhat of a comparative 'sleeper'. Now its time has come as we (the government, the Department, the regulator and industry participants), collectively, embark on various initiatives, reforms and developments that will ensure that spectrum delivers for Australia the maximum benefit possible from a scarce national resource. ACMA is committed to delivering on this legislative objective.

At the last RadComms conference, I spoke of a typical day in my life and how it was affected by spectrum. In a similar vein, on this occasion I would like to look at the seemingly 'small' things my spectrum planners do and how these 'small' things may make a material contribution to enabling momentous change in the world of tomorrow: be it 10 or 20 years hence.

Please bear in mind that these are things I think **may** eventuate; there are no guarantees, nor are they intended as any pre-emption. In setting some context for discussions over the next few days, I simply wish to explore the role of spectrum and its management in the greater scheme of things. So, let's have some fun for a moment, cast ourselves into the future, and take a peek at the effect of today's decisions many years down the track.

SQUARE KILOMETRE ARRAY

Around the time of the last RadComms conference ACMA's engineers did a small but unusual thing. They embargoed an area (not a frequency band but a small geographical area) around a small cattle station called Mileura in the central west of Western Australia. This embargo was unusual because, with the exception of spectrum-licensed bands, it covered all bands in that area under 25 GHz.

The purpose of the embargo was to create a Radio Quiet Zone to protect the site for the proposed Square Kilometre Array ('SKA'), for which Australia has been short-listed to host, in competition now only with South Africa.

When asked at the time 'why ACMA would do this?' our Andrew Kerans said 'It's like getting a whole paddock of wheat from planting one seed – bugger all work for us but the potential is huge!'

Radio astronomy, like other services such as Satellite Earth stations, comprises expensive facilities that need deep levels of protection... and Fred Watson, (tomorrow night's speaker), will no doubt amplify the benefits of such protections in his highly engaging way. As time moves on and populations grow, it is becoming less and less possible to protect such facilities where they are established close to, or even in, populated areas. ACMA was therefore impressed that

the CSIRO had looked to the future and proposed a site for the SKA which was supportable in the long term.

Well, ACMA has done a bit more work since the radio quiet zone was first established: the engineers have written a licensing instruction (or RALI) that specifies the licensing arrangements around the embargoed area. The area itself has moved a bit as well; it is now centred on Boolardy Station (just a few km away), which in reality isn't much of a change in the grand scheme of things in WA!

Now the RALI is a comprehensive document, and it puts in place protections for the Radio Quiet Zone, which gives the Australian SKA bid some definite advantages. Indeed, let's just imagine what benefits could flow from hosting the SKA in Australia.

The SKA is now huge: in the WA component alone we have a square kilometre of radio telescopes.

The array spreads out to cover most of Australia, and even New Zealand in isolated sites, giving the telescope itself a gigantic effective aperture with which to collect faint radio signals from deep space.

The installation of this facility brought into the country not only dollars but also skills. Australia is now a world leader in antenna and array systems' design.

The communications grid which supports the SKA connects the port town of Geraldton with Kalgoorlie, Meekatharra and the surrounding townships to the Perth communications grid. Any suggestion of a digital divide for the people of rural WA long gone.

Maintaining the array is a significant task. An army of engineers, electricians, technicians and riggers is being trained from amongst the ranks of local people, providing opportunities never before experienced in these areas. The communications intellectual stock of the country is much higher as a consequence… which is starting to combine with other spin-off benefits from a smart digital economy.

The scientific discoveries from the SKA are prolific, putting Australia at the centre of the world radio astronomy map. The crowning glory is that perhaps the SKA is the first device to discover intelligent life in another galaxy!

ACMA is proud of the 'can do' people who saw this potential and decided that the amount of work they would have to do was minimal in comparison to the potential benefits that could arise. These are visions that the future is built on.

INTELLIGENT TRANSPORT SYSTEMS

Intelligent Transport Systems or ('ITS') are an example of an interesting mix of different technologies all coming together to make driving easier and potentially safer.

Over the last two years, ACMA engineers have worked on spectrum arrangements to support a number of technologies that promise to make our day-to-day commute easier and safer. Some are obviously related to transportation; the impact of others is more subtle. Vehicular radar is maturing, it now has an 'interim' band to operate in, one I might say that not everyone is happy about because sometimes even international 'solutions' involve painful compromises.

So a future of collision avoidance and automated steering is not then a totally implausible scenario.

ITS are like the Internet of cars and Radiofrequency identification, (or RFID), is a technology that will perhaps affect our lives almost as much as the Internet does. RFID is a technology that we already use: it is used to pay your motorway tolls, prevent shop theft and is increasingly being used in inventory monitoring and control. But it is also one where the applications are only limited by our imaginations.

Then – let's look at my commute in 10 or 20 years time and see what changes have come about.

My car is now smart. Not only can it automatically keep its distance from the traffic in front, it constantly reports its speed, fuel status and destination to roadside ITS terminals. These terminals monitor all the traffic going past and the information is processed in a central computer.

Most traffic jams are caused by accidents. Vehicular radar has reduced the incidents of collision significantly. Since ITS can stop a car from running red lights, perhaps these collisions have all but disappeared as well.

And as ITS and vehicular navigation systems could ensure traffic is correctly spaced, it might begin to direct and monitor traffic flow before a problem develops, helping make traffic jams a thing of the past.

RFID will be your vehicle's registration. Your registration fee will be charged depending on what roads you use, the weight of your vehicle, its emission profile and the length of your trip. If you choose to travel in peak hour you will pay for it, and thus market mechanisms will be used to control traffic and pollution as well.

That short paragraph quite obviously skates over a whole range of social policy and subsidy issues – and I'm sure glad this is a battle ACMA will not have a role in. Graeme can deal with that one too!

So RFID systems will have a major role in our lives, in applications which range widely from car registration, (which I have just mentioned), to the automated ordering of your household groceries. At the moment RFID is limited to inventory control and some charging applications, such as motorway toll charges… but in the last two years, ACMA has been involved with GS1 Australia in evaluating the effect of a power increase for RFID systems on adjacent systems in the 900 MHz band. If the increase is feasible, RFID is set to become an even more powerful influence in our daily lives.

RFID tags on our milk will tell our fridge when the milk is out of date, and milk will then be added to our shopping list by the fridge as a part of the 'Internet of Things'.

All of the information about your food will be on its RFID tag. You will be able to see where it came from, its 'organic' history and its freshness, either on your own home system or on your PDA while shopping.

All of your groceries will be tagged. Your kitchen will monitor them, reorder as you use them and even dispose of them if they go out of date. Your automated ordering system will correct for underused items.

And if you're still one who likes the shopping experience, supermarkets will change, but not a lot. Reassuringly, human interaction with the product will still be important! Pricing will be updated and displayed electronically and your shopping trolley will have its own RFID reader. If you use an automated shopping list, the trolley will tell you where the next item is located. If you choose to just browse and impulse buy, then the trolley (connected to your PDA) will keep

a running total of your purchases and, as you leave the store, automatically debit them via your phone or PDA. No checkouts, no queues, Nirvana.

Your home electrical appliances will be registered on the Internet, identified by its RFID tag. If it is stolen, it will quickly be traced. If the ID tag is removed, then the network won't register it and the power system will refuse to supply power to it. This won't stop theft, but it will certainly make it less attractive.

RFID will open up a myriad of opportunities, some simple, some controversial. We already tag our pets; some day will someone suggest that we tag our children so we can trace them and make sure they are safe? There are already companies that manufacture RFID bracelets for kids so parents can keep track of them when they are out shopping, in the park or even at home. Again, this debate will continue well into the future.

THE INTERNET

Two years ago the Internet was something I logged onto at work or at home. Since then, it and I have moved on. I can now log on almost anywhere with my laptop using a device the engineers call a 'dongle'. I remember three years ago 'dongles' were things we put into laptops so they could connect to WiFi, so it is reasonable to expect the 'Internet anywhere' dongles to be built into the next generation of laptops in just a year or so.

As the world of infotainment grows, people will become more reliant on their mobile data devices (currently laptops, phones and PDAs) for their news and entertainment. A recent IT article in The Australian highlighted the take-up of mobile Internet, but it didn't touch on the spectrum required to deliver this 'anywhere, anytime' broadband connectivity.

In broad terms, the carriers to date have had access to sufficient spectrum to offer these increasingly sought after services. In the future, though, as customers demand more bandwidth, and as customer numbers grow, carriers will seek more spectrum for these applications. And as machines become part of the Internet, these demands will grow yet again.

Users (that is, people and machines) will want this connectivity everywhere. In the next few years, this will mean at least within the footprint of the larger cellular networks, but beyond that the word 'everywhere' may mean just that: on the land, on the sea and even in the air.

ACMA's spectrum planners anticipated this growing need, and more than two years ago commenced a process which looks at frequency bands and their potential for future broadband use. An important part of this study was examination of what was happening in spectrum allocations overseas; obviously a band that is used globally for Internet is one that logically we should be investigating for such possible use here in Australia. Having said that, let me squarely acknowledge major candidate bands that are potentially suitable in the short to medium term are already in use by other services. Responses to ACMA's two discussion papers to date on Wireless Access Services (or WAS) have raised significant objections and concerns surrounding re-planning or re-allocation of these bands - as well as arguments in favour. ACMA has had some pretty serious thinking to do to develop sensible ways forward – and we hope to have something to say about ways forward by around the middle of the year.

For now let's look at what ubiquitous broadband could deliver for the Australian economy.

Laptops will become 'connected' anywhere there is the population to sustain an economically viable connection. The government's recent broadband initiative promises this sort of connectivity

almost anywhere people live. That is an exciting prospect. Competition will affect price, and voice over IP will become a viable alternative to cellular telephony. Another plank in ensuring the digital divide does not divide us as citizens or consumers.

Devices will become connected, people with medical conditions can be remotely monitored and the early stages of a problem detected and dealt with. Perhaps medication may even be remotely administered through such implants. If the problem is larger, help may be dispatched. All of this, a small window on the complete transformation of the way government delivers its services – overwhelmingly online.

RFID will keep track of people and things; for example, airline passengers with an RFID boarding pass could be traced in an airport. The days of waiting for a passenger who has failed to board would be over!

Beverage and food containers will have inbuilt screens; they might show the news of the day to grab your attention, but they may also carry advertising to pay their way.

The possible applications of 'anywhere' connectivity may well be unlimited.

SENSING

There are so many ways in which radiocommunications will be by then a daily part of our lives but time this morning is short. Many technologies, like the Internet, or HD TV multichannelling, or the DAB digital radio you will be hearing more about later in this conference, are readily definable; others, though of equal importance, are not. Such a technology, or group of technologies, is remote sensing and control.

Climate change is an issue at the forefront of our minds, but can radiocommunications affect it? Even be part of the solution? The answer is 'quite possibly'.

Power generation is a major source of greenhouse gases, especially generation from coal-fired generators, which could be limited by controlling peak demand such that the peaks are smoothed and very little if no additional generation is needed to cover these periods.

This is where radiocommunications can help. As I touched on, the simple act of remote metering your car via a wireless link will save dollars and emissions by traffic smoothing. But taking this a few steps further and actually controlling appliances to smooth the load on power stations, promises significant reductions in required generator capacity and thus the sought after reductions in greenhouse gases.

Predicting the weather these days is a massive mathematical exercise. I was treated to a tour of how it is done at the Bureau of Meteorology. Like any big equation, the more data you have, the more reliable the answer.

The Bureau looks at what it calls 'the fingerprints of nature' and from that derives its forecasts. This is done from satellite, from balloons and aircraft, and from the ground.

Recently the Bureau approached ACMA's spectrum planners for support to protect a part of the 10 GHz band for space-based sensing. This was a difficult and complex question for our staff to tackle; after all, what is the value of the data derived from a foreign satellite imaging the Australian continent but provided to the Bureau at no cost? What is the impact of being able to predict the path of a cyclone? And how does it compare with the value of the band for other applications?

In the end, ACMA reached an agreement with the Bureau about protection for the band and we continue to work with them so that we better understand their needs and I hope they better understand the imperative ACMA has to manage the spectrum in the overall national interest.

What this sort of sensing means for the future cannot be understated. If global warming continues, then we know that weather patterns will continue to change. Being able to predict the changes, perhaps to track the first cyclone to hit Sydney, to be able to predict and maybe even redirect flood waters, could save the nation billions of dollars.

Information provided to future aircraft and ships could save lives, information provided to coastal cities could enable smart buildings to prepare defences while making the best use of the prevailing weather to generate power, store water or heat or cool ourselves.

Arrays of small sensors, joined together in a mesh architecture, will be able to provide more and more information. This should enable us to better control our valuable water resources, predict which crops will be viable and, when necessary, evacuate in good time towns and cities. This too will require spectrum and though sensor spectrum is indeed a new issue for us, it is one we increasingly have our eye on.

CONCLUSION

The spectrum arrangements that ACMA makes, and the services spectrum can deliver, have such a widespread influence that they continue to surprise me. We are constantly scanning the environment, digesting signs of change here and overseas, so that we can do our bit to ensure Australia benefits from new technologies.

We understand that spectrum is increasingly valuable for both incumbent users as well as for future uses. When we work through proposals for change we will listen carefully to all sides of the debate; but ACMA will in the end always strive to ensure that spectrum is put to the use that best serves Australia's national interest, now and in the future.

All of this (and a lot more) that may be conjured up 20 years from now won't happen if we don't start about today… something about a long walk starts with small steps.

Shortly after I arrived at ACMA, I challenged the management team to identify the steps that would make us the world's best communications regulator by the end of 2010. At this conference you will be hearing about some of the early dividends from that challenge.

Two papers in particular, the draft 5-year rolling spectrum outlook and the draft spectrum management principles, have their origins in ACMA's program of transformation. Along with public events such as this conference and a revitalised formal consultative committee (the Radiocommunications Consultative Committee, or RCC), ACMA has resolved to make its spectrum work program more transparent to the industries that rely on the spectrum; also to demonstrate its 'first actionable steps' to emerging demand pressures.

This is a key goal of the draft 5 year spectrum outlook – to publish, and to keep current by regular updates, ACMA's understanding of emerging demand pressures and also to give an indication of ACMA's forward work program for addressing those pressures. The program is of necessity indicative and, when you read the chapter on ACMA's forward work program, you will find the disclaimer that it is subject to three things:

- Resources;

- Government (or Ministerial) priorities; and
- Unanticipated changes in the environment.

I make no apology for the disclaimer, which merely acknowledges the realities. But to ensure industry as far as possible enjoys the regulatory certainty required to facilitate investment decisions, we have committed to keep the document current through annual updates and to consult each time before we finalise it. The result, I hope, will be an unprecedented shared understanding of the pressures for change building in the spectrum environment and of the regulator's indicative thinking (on a more iterative basis) about how to respond. All of this, of course, is no substitute for detailed consultation on individual issues before decisions are taken that affect players in the spectrum space, rather it is something in addition, something new: the beginning, I hope, of a much more open discourse about what the priority issues are in spectrum regulation.

And transparency about priorities invites greater transparency about methodology and underlying philosophy. To this end, ACMA has also articulated in draft form its Spectrum Management Principles, a document not intended to supplant the legislative objectives that govern ACMA's exercise of its powers and discretions but which should go some way to explain how we will approach those objectives.

You will have noticed that one of those ACMA proposed principles is indeed that we will do our work with appropriate transparency and opportunity for consultation.

But this conference is not simply about ACMA initiatives – in framing the agenda, we have sought to balance government voices telling you about what we are doing with industry voices, so that information flows both ways.

EDITOR'S POSTSCRIPT

Radcomms08 was not all that long ago. Already since then responses have been received to the Spectrum papers intended to guide future spectrum management arrangements in Australia. Consistent with its announced intention to be more iterative in its dialogue with stakeholders, ACMA has announced a Brisbane 'Spectrum Tune-up' as well, where one of the matters it will be commenting on is the 400 MHz Band.

The third meeting of the refined Radiocommunications Consultative Committee has since been held and work continues on evolving the operation and composition of that Committee.

A key observation that has emerged from all this is a new era of stakeholder collaboration in Australia that will help ensure the nation's ability to encourage innovation and readily exploit advantages of many new and emerging radiocommuication technologies for the benefit of all Australians.