RTT TECHNOLOGY TOPIC
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One Hundred Years in Telecoms
The Militarisation of Radio

This is the last of this mini series of Technology Hot Topics in which we have taken four reference points, twenty five years ago, fifty years ago, seventy five years ago and (this month) one hundred years ago to highlight underlying trends in the wireless industry.

Last month we talked about the politicisation of radio, this month we talk about the militarisation of radio and **the relationship between military conflict, political responsibility and regulatory responsibility.**

In December 1907 Theodore Roosevelt despatched 'The Great White Fleet', 16 battleships, six torpedo boat destroyers and 14000 sailors and marines on a 45000 mile tour of the world, an overt demonstration of US military maritime power and technology.

The fleet was equipped with ship to shore telegraphy (Marconi equipment) and Lee De Forest's arc transmitter radio telephony equipment.

Although unreliable, this was the first serious use of radio telephony in maritime communication and was used for speech and music broadcasts from the fleet - an early attempt at propaganda facilitated by radio technology.

In 1908 valves were the new 'enabling technology' ushering in a new 'era of smallness and power efficiency'. Marconi took these devices and produced tuned circuits - the birth of long distance radio transmission.

Our last reference year, 1933, was six years before the outbreak of the Second World War.

- 1908 was six years before World War One and the year in which Austria annexed Bosnia and Herzegovina, as significant an event in retrospect as the Reichstag fire in 1933.
- Other political events included the assassination of King Carlos of Portugal and his son.
- Oil was discovered in South Persia.

Technology events included the first Model T Ford and the issue of a patent to the Wright brothers for their aircraft design. Both of these were to have a profound long term impact on radio communications but in the shorter term events were to be dominated by a steady increase in political tension which prompted a steady increase in military spending which resulted in an increase in political tension - the rest is history.

In last month's technology topic we highlighted the historical argument that radio broadcasting technology or rather the mass propaganda made possible by radio broadcasting was one of the contributory factors that led to the outbreak of the Second World War.

It would be harder to prove any definitive linkage between the use of radio technology and the outbreak of the First World War.

Portable Morse code transceivers were used in battlefield communications and even in the occasional aircraft. Radio telegraphy was used in maritime communications including U boats in the German navy but radio communications neither caused the First World War nor decisively influenced its outcome.

However between 1908 and the outbreak of war six years later there was an unprecedented investment in military hardware in Britain, the US and Germany which continued through the war years and translated into the development of radio broadcast and receiver technologies in the 1920's.

These events established the close link between military hardware development and radio system development.

This relationship has been ever present over the past 100 years. Examples include the use of FM VHF radio in the US army in the Second World War (more resilient to jamming) and the use of frequency hopping and spread spectrum techniques used in the military prior to their more widespread use in commercial radio systems

However it is not unusual for innovation to flow in the opposite direction. Radio and radar systems in the Second World War borrowed heavily from broadcast technologies developed in the 1930's.

Long procurement cycles and a need to amortise costs over a significant service period can also mean that military systems remain in use for longer than civilian systems, sometimes as long as thirty years. If this coincides with rapid development in the commercial sector then military handsets can seem bulky and poorly specified when compared for example to modern cellular phones.

Additionally the development of a radio technology for military applications does not necessarily guarantee that the technology will be useful in a commercial context. Two examples are software defined radio and cognitive radio.

Software defined radio is used extensively in military radio systems, partly to overcome inter operability issues.

Translating software defined radio techniques to cellular radio has however proved problematic partly because of cost and performance issues including battery drain but also because in the commercial sector interoperability issues have been addressed more effectively through harmonisation and standardisation.

Cognitive radio provides another example. Cognitive radio, usually combined with software defined radio is useful in a military context because radio systems can be

made flexible and opportunistic. This makes them less vulnerable to interception and jamming.

Cognitive radio is presently being proposed for use in White Space Devices in the US UHF TV band.

There is however an important difference. In a military context it does not necessarily matter if cognitive radios interfere with other radio systems.

In a commercial context, a guarantee that radios will not create interference is a precondition of deployment.

Interference avoidance in the White Space World is based on a composite of location awareness and channel scanning to detect the presence or absence of TV channels and beacon detection to detect the presence of wireless microphones.

However robust these mechanisms might be, other users of the band, TV broadcasters, wireless microphones and more recently 700 MHz cellular operators at the top of the band will need to be convinced that White Space devices do not present a threat either technically or commercially.

This is familiar territory. Are White Space Devices a threat or opportunity?

White Space is presently being proposed as a cost economic option for broadband access particularly in rural areas where other alternatives including copper and fibre are relatively expensive.

However this is only true if White Space spectrum is made available at significantly favourable terms.

This is unlikely to be welcomed by cellular operators who have recently invested in the 700 MHz band or are presently contemplating future 'digital dividend' investments.

Which brings us back to the lessons that can be learnt from one hundred years of radio history.

Military conflict is a symptom of political failure and an extreme form of unregulated competition.

Short term gains for one side translate into long term loss for both sides.

Military spending may be a source of invention and innovation but this in no way justifies war as a mechanism for achieving technology progress.

Political failure is normally the consequence of unequal unfair treatment of one party over another and is usually prompted by a dispute over geographically specific assets.

Regulatory failure is similar in that it is normally the consequence of unfair treatment of one party over another and is usually bounded by a dispute over geographically

specific assets - in this case, spectrum. Short term gains for one side translate into long term loss for both sides

In this context, market mechanisms are not an adequate substitute for fair and equitable regulation.

The job of a regulator is to arbitrate between competing interests and actively encourage collaboration rather than competition. The task is analogous to the duty of politicians to work towards a peaceful resolution of disputes and or more proactively to avoid or mitigate social or economic disparities that are likely to provide cause for dispute in the future.

Competition may be a necessary precondition for market efficiency but it is not an effective mechanism for allocating finite resources either efficiently or fairly. Whether competition creates or destroys value is dependent on the boundaries and context within which competition is allowed to exist.

Letting the Market decide is therefore inappropriate particularly when existing users are delivering services with intrinsic long term rather than short term value.

The 700/800 MHz 'digital dividend' band provides a topical and typical example of this 'law of conflicting interest'.

Existing incumbents, terrestrial broadcasters, wireless microphone and specialist radio users are discomforted by cellular operators who are presently being given the option to lease significant amounts of 700 and 800 MHz bandwidth.

Cellular operators can however legitimately claim that long term social and economic gains will be realised through the deployment of new 700 and 800 MHz mobile broadband networks.

Existing incumbents, terrestrial broadcasters, wireless microphone and specialist radio users and cellular radio operators are discomforted at the prospect of internet service providers being given preferential access to 700 and 800 MHz White Space spectrum.

Internet service providers can however legitimately claim that long term social and economic gains could be realised through the deployment of new 700 and 800 MHz 'White Space' broadband access networks particularly in rural areas.

However destructive competition between these interest communities will make it hard for anyone to realise the widely anticipated 'digital dividend dividend'.

This is not simply an issue of sorting out RF interference. The social political and economic dividends realisable from the repurposing of UHF are potentially substantial but critically dependent on a common long term interest being established between all participating parties.

It is naïve to expect that market forces can achieve this. Collaboration rather than competition is likely to be the only way in which genuine long term value will be

realised. Collaboration tends to realise long term rather than short term gain and often requires active encouragement - the role of 'honest broker' regulation.

To rework a military saying, your enemies are your future friends - treat them well.

A note about the 'Living Memory' Wireless Heritage Project

As part of a UK based Wireless Heritage Project which we are undertaking in association with the custodians of the Pye Telecom Historic wireless collection, we are putting together a series of articles written by engineers who have been actively involved in radio system design and implementation over the past fifty (or more) years.

The first of these articles has been written by John Davies. John joined the Lancashire Wireless Workshops in 1948 as a radio engineer. He retired in 1984 and lectured for a number of years on private mobile radio system design and implementation.

He remains exceedingly active and has maintained a very close interest in radio engineering including recent involvement in a local radio planning enquiry.

In this article he describes the pioneering work undertaken by Lancashire Constabulary on wide area coverage systems and the parallel evolution of mobile and portable transceivers.

The innovations introduced by Lancashire had very tangible benefits in terms of operational efficiency.

John's story, a mix of personal and professional observation, provides a fascinating insight into forty years of radio design experience.

This article (with some wonderful archive photographs) is available as a download.

Contact RTT

If you are interested in contributing similar articles to this collection do please contact us.

RTT, the Shosteck Group and The Mobile World are presently working on a number of research and forecasting projects in the cellular, two way radio, satellite and broadcasting industry.

If you would like more information on this work then please contact

geoff@rttonline.com

00 44 208 744 3163