GOVERNING BY LOOKING BACK: How History Matters in Society, Politics and Government

12 - 14 December 2007

VENUE: Manning Clark Centre, ANU Campus

Paper: Government as Good Guy: lessons for broadband investment
by Trevor Barr


With acknowledgment of the research assistance of Dr Viv Kelly

Professor Trevor Barr
Principal Investigator,
ARC Centre of Excellence for Creative Industries and Innovation
Swinburne University
John Street
Hawthorn, Vic 3122
AUSTRALIA

Tel: +61 3 9214 8106 Fax: +61 3 9819 0574
Mobile: 0408 800 928
Email: tbarr@swin.edu.au
The overall brief for this conference paper was to identify a substantial problem in contemporary Australian public policy and search through history to find insights and lessons that might constructively be applied to policy today. The policy area chosen here is Australian telecommunications; the contemporary focus within that major field is broadband policy; and the current critical problem identified is the paucity of action in relation to the proposed major investments for the introduction of much needed national high speed broadband infrastructure. The hypothesis here is that, looking back, the creation of, and capitalisation for the initial construction of the major new communications platforms throughout the past one hundred and fifty years, emerged from the unheralded long term value provided within the public sector and its associated remarkable individuals.

The contemporary problem – the lack of investment in high speed broadband infrastructure for Australia.

It’s difficult not to start a paper about vexed policy issues in contemporary Australian telecommunications without examining the role and behaviour of the principal industry player, Telstra, under its relatively new management.

The much awaited *Telstra Strategic Review*, announced by newly appointed Telstra chief executive, Sol Trujillo, on 15 November 2005, suggested that future fixed line business growth might be limited, that mobile communications was likely to continue to be an intensely competitive space, and that the future principal growth in telecommunications was with integrated IP based value added services. In the accompanying document, the *Telstra Technology Briefing*, the new Chief of Operations, Greg Winn, outlined the technological vision related to broadband on behalf of the corporation:

‘The sort of things that will be available are things like high speed internet, voice over IP .., the possibility of TV delivery over IP, telecommuting, video conferencing and video delivery of services in general… There’s really two dimensions key dimensions to access. What we are aiming to do is deliver a capability which is fast so speed is important. The second part of access is really
about capacity. As more and more customers use more and more of these sorts of products they start to demand more and more of the infrastructure and the dimension of their actual core network and the access network… So what are we transforming access to? Well first of all we are transferring it to a high speed broadband capability.¹

However, the announcement nine months later, in August 2006, of the discontinuation of negotiations between Telstra and the Australian Competition and Consumer Commission (ACCC) about Telstra’s proposed investment in a fibre-to- the- node broadband network appeared to contradict this vision statement. The corporation announced that ‘until Telstra’s actual costs are recognised, and the ACCC’s regulatory practices change, Telstra will not invest in a fibre to –the -node broadband network’. The new management team at Telstra defended their decision on the grounds that the corporation could not achieve adequate guarantees of regulatory certainty to justify such substantial investment.² Arguably, what underpinned this decision by the principal telecommunications carrier was a series of irreconcilable public policy problems, which were partly due to inherent and unresolved flaws in the post 1997 regulatory policy model centred on open competition. Briefly as background:

a. The federal government wanted a commercially successful Telstra. But the share price had become embarrassingly low, and there was a need to improve both the share price and dividend before the rest of the corporation could be sold. However having introduced open competition policy for the industry as a whole in 1997, the government also needed to ensure that new players in telecommunications were also able to achieve strong financial returns.

b. Telstra pointed then to its obligation post partial privatisation – satisfying formal shareholders – and argued that it must make highly commercial decisions. The new Telstra management alleged that the Australian regulatory system was one of the most repressive in the world, and it wanted the interconnection fees paid by

---

¹ Transcript from Telstra Technology Briefing released by Douglas Gratiot, Telstra Company Secretary, 17November, 2005
² D. Gratiot, Company Secretary, Telstra, Fibre -to –the-node talks discontinued, August 2006
competitors to access Telstra’s networks to be levied at what it considered to be ‘acceptable’ rates, otherwise the corporation would allegedly be cross subsidising its competitors.

c. **The new competitive carriers** (i.e. Optus, AAPT, and Primus) wanted a low cost access regime, dependent on interconnection to Telstra’s network, but which would allow them to compete with Telstra on prices charged to consumers so as to enable them to build profitable businesses. They widely perceived Telstra as being an obstructionist incumbent that had no intention of facilitating the growth of a group of strong profitable rivals.

d. The regulator, the **Australian Competition and Consumer Commission (ACCC)**, has the unenviable task of implementing the federal government’s competition policy. It still faces a thicket of competing vested interests, and is often dependent on data supplied from the many different industry stakeholders that is difficult to assess or validate.

Telstra’s decision not to proceed with a fibre- to- the node was not an indication that it had abandoned the broadband space. Telstra’s more recent broadband growth was centred around offering ADSL and cable broadband at speeds generally around 1.5 Mps - speeds often criticized as putting Australia in the ‘slow lane’ by international comparison. However there was clearly substantial consumer demand for the current forms of broadband at lower speeds. The data presented in the Telstra 2005-2006 Annual Report showed that the growth in broadband and mobile services during 05-06 offset the $500 million decrease in revenue from the fixed line traditional telephone business. For the same period the number of Big Pond broadband subscribers increased by 620,000 to 1.48 million. Wholesale revenue (based on the extra 30,000 broadband subscribers from competitors iiNet, Primus, Optus, TPG, Amcom, Transact) jumped 77%, to $461 million.

Telstra subsequently faced a serious alternative bid to introduce high speed broadband from a collective of its key industry competitors. On May 31, 2007 an Optus led
consortium, which included Macquarie Corporate Communications and Primus called the G9, lodged a special access undertaking (SAU) with ACCC to roll out its fibre-to-the-node network to more than 4 million Australian households. Consortium leader Paul O’Sullivan said:

> The G9 believes Australia’s future is best served by a co-ordinated approach to building an open access network via an open tender process. The lodgement of the final SAU is the culmination of 14 months of intense work between G9 members, financiers, policy makers and the ACCC. It demonstrates the G9’s commitment to competitive and open access broadband. ³

So here is the nub of the problem. At the time of writing both the Telstra and the G9 plans to introduce broadband access, at about 12 Mps for many urban Australians, have stalled. Essentially little is happening to implement either of these proposed major industry initiatives. On July 6, 2007 Senator Helen Coonan, Minister for Communications, Information Technology and the Arts, announced the establishment of an Expert Task force that ‘would manage the assessment process for proposals to rollout a new high speed broadband network for capital cities and regional centres.’ She added that following this ‘open and transparent examination the government will legislate to ensure the nation is getting a top class service which is affordable and complements other aspects of Australia Connected’. ⁴ So, in the lead up to the national election on November 24, 2007 the Howard government parked the opportunities for major investments in the broadband network that Australia needed for the future with a government enquiry!

What an extraordinary and inexcusable loss to date for such major investments in Australian society - $4.7 billion for Telstra’s proposed investment in a fibre-to-the-node broadband network, and $4.1 billion for the G9 proposals alone. More widely overall investment in Australian telecommunications has only ranked twelfth in investment

---

⁴ ‘Expert Taskforce Terms of Reference’, Media Release, Minister for Communications, Information Technology and the Arts, 6 July, 2007
growth among the fourteen sectors of the economy, over the period 2005-07. Telstra’s Phil Burgess, Group Managing Director, Public Policy and Communications, adds:

If you subtract the substantial investments by Telstra, then the result is even more damming. Without Telstra, telecommunications has a negative -7.5 percent investment growth over the past three years – in a sector that should rank no 2 or no 3, given Australia’s distance from major world’s markets and population centres. 5

So let us turn now from possibly the worst bete noire of contemporary Australian public policy – the lack of investment in high speed broadband networks for the future- and seek to identify some possible lessons from Australia’s proud telecommunications history of achievement, and also examine some related international infrastructure accomplishments. Three historical case studies have been chosen;

• First, Charles Todd, the South Australian Government and the Overland Telegraph in the 1860s;
• Second, Communication Satellites and the National Aeronautics and Space Administration(NASA) in the U.S.A from the 1950s;
• Third, the origins of the Internet in the 1960s.

Note that this paper does not set out to make the case here for the desirability and importance of the introduction of widespread access to high speed broadband networks and services at affordable costs to Australians. There are other related studies that do this, including work by this author, as footnoted for reference.6 Australia’s major trading partners now focus on how to further implement high speed broadband infrastructure and services rather than commission economic studies about its possible viability.

---

6 For a reference list of studies about the economic and social benefits of high speed broadband see Martin Stewart-Weeks, To broadband or not to broadband, and also see Trevor Barr, Broadband: Towards understanding users, both presented at the Communications Policy Research Forum, Network Insight Institute, Sydney, 24 September, 2007 and both available at: http://www.networkinsight.org/events/cprf07.html/group/6#Papers%20from%20the%20Forum
Case Study One: Charles Todd, the South Australian Government and The Overland Telegraph

Charles Heavitree Todd (1826-1910) was born in Islington, son of a grocer, and became assistant astronomer at the University Observatory in Cambridge in 1849. In 1855 he married Alice Bell (after whom Alice Springs was named) and in May 1855 the couple sailed on the ship *Irene* to Australia, where Todd had been appointed Government Astronomer and Superintendent of Telegraphs for South Australia (salary £400 per annum). Even before arriving in Australia, Todd was possessed by the notion of an overland telegraph in Australia, and speaking at his wedding said that ‘one day he would like to see a telegraphic string stretching around the world, like the necklace of pearls around Alice’s throat’. The Todds arrived in South Australia in November 1855.

8 Thomson, p. 10.
First moves towards an international cable

In the 1850s there was a proliferation of entrepreneurial international telegraph companies. They had mixed fortunes: some grew, others went broke or were bought out, and some split up with changed names. In 1855 two British entrepreneurs, Brett and Carmichael, who had built the Channel cable, suggested to colonial governments the benefits of linking into a variety of proposed overseas cable lines. But it wasn’t till 1858 that the American promoter Lionel Gisborne approached the British Secretary of State for the Colonies with a scheme to connect the Australian Colonies with a proposed Dutch cable from Batavia to Singapore. But the remarkable story of the successful introduction of the overland telegraph to Australia was not accomplished by a private sector company with private sector capital.

---

9 Moyal, pp. 36-37.
In 1858 nobody had crossed the continent: the desert was completely uncharted and there was still talk of an inland sea. Todd thought that it was impracticable at this stage to launch into an overland telegraph. Different interests favoured different routes and there was much competitive rivalry between the colonies: Victoria liked the route shown on the map above as Brett’s route (Ceylon to Western Australia, stopping at the Cocos Islands but New South Wales preferred Gisborne’s route. Understandably there were many sources of uncertainty. One was the evident fragility of the cables that were laid: between the UK and Europe in the early 1850s, and between India and Ceylon in the late 1850s, there were frequent interruptions because of damage to the cables, and technology clearly had some way to go before the service could become reliable.

The Governor of South Australia, Sir Richard MacDonnell, swiftly grasped the political advantages of hosting a telegraph route and favoured the overland route shown on the map as the Timor-Adelaide route. He consulted Todd about the proposed scheme, but at this stage Todd preferred an alternative route proposed by Gisborne- connection from Singapore to Port Essington in the Northern Territory, and then to Moreton Bay in Queensland.

**Todd starting to change his mind about the overland route**

In 1860, at the SA government’s request, Todd changed and drew up an estimate of costs associated with an overland line form Port Augusta to King George’s Sound (near Albany). While he did not dismiss the King George’s Sound option, he reported that he was ‘more than ever disposed’ to believe that ‘we shall yet connect ourselves with India by an overland line to the northern coast, and thence, by a comparatively short submarine section to Java.’ It was clear that the matter of an overland telegraph (and by implication an international cable connection) had occupied his thoughts and that his original preference for Gisborne’s proposed route through Queensland was shifting.

---

10 Moyal, p. 36.
12 Moyal, p. 38.
South Australian governor MacDonnell was a strong advocate for inland exploration, followed by settlement and expansion, and had ridden himself with a small party into the north of the colony in 1859, travelling 1800 miles in three months. He maintained that Sturt and Eyre were overrated as explorers as they seemed ‘generally to have a knack of getting into the most dismal places and finding barrenness from Dan to Beersheba’, but he promoted the efforts of John McDouall Stuart to cross the continent. In that same year, the South Australian government offered £2,000 to the first person to cross the continent and reach the north or north-west coast and Stuart had taken up the challenge. It took him three attempts, however, to complete the quest: it was not until his third attempt in 1862, and after much illness and hardship, that he was successful in reaching the north-west coast at the Mary River. The party arrived back in Adelaide in 17 December 1863, during a public holiday in Adelaide the following January to celebrate his achievement, ‘crowds lined the streets amid banners strung from buildings’.

In the preface to his *Explorations in Australia: the Journals of John McDouall Stuart* (published London 1864), Stuart attested the feasibility of a telegraph line through the interior. Todd also now became more positive about an overland route, despite the evident difficulties of establishing and maintaining it.

**Inter/intra-colonial telegraph infrastructures: the Queensland push and the SA victory**

By 1861 a relatively extensive telegraph network had been constructed. From the start, colonial governments in Australia ‘established their telegraph systems as public enterprises, constructed and maintained by officers employed in government-run telegraph departments’. Victoria and South Australia (and Tasmania, in fact) were keen participants: New South Wales took longer to get going. The northern part of the

---

15 ADB, *Stuart*.
16 Moyal, p. 39.
17 Livingston, p. 46.
18 Livingston, p. 47.
NSW colony separated to become Queensland in 1859: by then the telegraph was well established in the other colonies and Queensland moved quickly to build its first line (Brisbane to Ipswich), which opened in April 1861. The Queensland government soon saw the advantages of entering the stakes for an overseas cable connection and early in 1863, Queensland’s first superintendent of telegraphs, J.J. Austin, argued that:

by extending its telegraph lines to the far north Queensland could make the overseas route to India via Torres Strait the great highway between Australia and the East:

Let us determine to make provision for carrying out wires to the Gulf of Carpentaria, so as to be able to connect them with a sub-marine from Java . . . . If we falter or hesitate to undertake the responsibility of a work which at first glance appears too costly for a young colony, most assuredly the option will not be long left to us.

The prize was the overseas connection and, clearly, a sense of urgency was starting to appear. In 1866, W.J. Cracknell (who took over from Austin on the latter’s death as superintendent in telegraphs in Queensland), arranged for an exploratory expedition to survey the country between Cardwell and Normantown with a view to establishing a further cable join at Burketown on the Gulf of Carpentaria. Over the next few years contracts were let, work was started, and permission sought from the SA Government to build the overland connection across the Northern Territory (note that the NT was still at this stage governed from SA). Meanwhile, Queensland was well into negotiating with the British Australian Telegraph Company (BAT).

This put the wind up the South Australian government. It was 1866: Stuart had crossed the continent three years before and then had returned home to the UK where he died. The SA government had done the preliminary work involved in Stuart’s exploration and discovered from his final expedition that there was indeed a way north overland, but then

---

19 Livingston, p. 48.
20 Livingston, p.49.
21 Moyal, pp. 39-41.
they had let matters lapse. Now there was a flurry of activity. The SA government, with Todd’s unequivocal commitment, entered into negotiations with BAT, promising, (a) that it would finance the construction of the overland line and, (b) that it would have the line ready for traffic by 1 January 1872 or if not it would pay penalties at the rate of £70 per day. The Port Augusta to Port Darwin Telegraph Bill, empowering the construction of the line, was introduced 8 June 1870.  

Construction of the line

The technology available for this great project was ‘experimental and rudimentary’. Todd was principally a scientist and public servant, and had no experience in the work he was engaged to supervise. His main guide was Stuart’s journals: these had been written eight years ago and told him nothing of the country adjacent to Stuart’s direct route. Todd records:

> How eagerly I read Stuart’s journals and with what feelings I tried to realise all I had to contend with, work out plans by which I could hope to overcome every obstacle and carry the undertaking to a successful issue.  

As Moyal has described:

> The equipping of these huge parties, ready by the end of August [remember the Bill went through only in June] was reminiscent of the great overland wagon treks across the wild west of the United States. The range of the men recruited testified to the self-supporting nature of their task. There were carpenters, blacksmiths, farriers, drovers, horsemen, labourers for cutting trees and building the stations and huts, storekeepers, cooks, linemen, telegraphists, overseers, surveyors, a surgeon for each section, and cadets. Transport was crucial. Everything except the tree poles had to be carted to the site. Bullock and horse-drawn vehicles carried the men and materials. In the central section, two camel caravans, in the care of two Afghans, joined the 15 horse wagons, 17 bullock drays, a bullock wagon, five express wagons, some 200 bullocks and almost as many horses . . .

---

22 Moyal, pp. 41-42; Thomson, pp. 50-53.
23 Moyal, p. 42.
24 Moyal, p. 42.
The imported equipment reached gargantuan size. Three thousand wrought-iron poles came from Britain to be used where suitable wood could not be found and . . . more than 1800 miles of single-strand galvanised wire was brought from Britain, together with insulators, batteries and other equipment.\(^{25}\)

Todd set down all the instructions himself, guiding each aspect of the expedition: care of horses, oversight of the men, care of the tools and instruments, how to plot the route, even where to find water. The line was eventually finished in August 1872, eight months overdue. According to the original agreement with BAT, this should have meant the payment of a large sum (nearly £17,000 – £70 each day from 1 January 1872) as a penalty. In fact, however, the overseas cable line laid by BAT in November 1871 failed soon afterwards (24 June) and was not restored until 21 October 1872, well after the overland telegraph line was completed. The issue of penalty payments lapsed.\(^{26}\)

**Whose vision and whose benefit?**

The great attribute of the project was that news could then reach Australia from Great Britain within a few hours rather than take three months by sea. Key beneficiaries in Australia of the telegraph were the colonial governments, the metropolitan press, and private sector commercial interests.\(^{27}\) The governments themselves were heavy users: in Victoria, government telegraphs accounted for between one quarter and one half of all telegrams in the first decade of the service (1854-64). The press also used the service extensively: overseas newspapers were delivered at Adelaide and there was considerable rivalry between agents to telegraph the contents to the eastern colonies from the telegraph station at Port Adelaide.\(^{28}\) A description of the competition runs as follows:

> When the telegraph was first made available for sending the English news through from Melbourne, the competition of the different colonial journals to get the first news led to a most insane expenditure. There were nearly half a dozen different

\(^{25}\) Moyal, pp. 44-45.  
\(^{26}\) Moyal, pp. 51-53.  
\(^{27}\) Livingston, p. 51.  
\(^{28}\) Livingston, pp. 50-51.
agents employed, who not only had a scramble for late newspapers on board the mail steamer, but who had rival whaleboats to land without delay at the jetty at Glenelg, and relays of race horses, mounted by professional jockeys, to carry the reporters’ notes to the nearest telegraph office.\(^{29}\)

The hunger for up-to-date news from ‘home’ must have been huge. In 1862 a newspaper editor in Sydney pointed out that faster ocean mails, and the link provided by telegrams from the UK to transmitting stations in the Middle East and Australia, made it possible to publish news that was only thirty-two days old rather than one hundred days.\(^{30}\)

There is no doubt that Todd himself had a vision of international telegraphic communications even before he came to Australia. The SA Governor, MacDonnell, seems also to have had a real and substantial influence over the decision to go with the north-south line. But it was of course the government that enabled the vision to be realised, as the parliamentary extracts make clear.

Economic rationalism was not a term in vogue in Australia in the 1850s, but had it been someone would no doubt have pointed out that Todd estimated the full cost at establishing the overland telegraph at £120,000,\(^{31}\) but this amount eventually blew out to £479,174.\(^{32}\) And it is interesting to compare the amount set aside for the telegraph with some other items of expenditure for the South Australian government at that time:

- the civil list (£15,800)
- charitable institutions (£55,444.18.10)
- telegraphs (£12,275.14.11)
- railways and tramways (£104,525,10.4)
- roads and bridges (£27,820.8.10)

These documents suggest that total government estimated expenditure for 1870 was £736,160.5.0. Hence the overall expenditure for the overland telegraph infrastructure was as high as 60% as a cost to one of the state government’s annual budget. (Contrast this

\(^{29}\) Livingston, pp. 51-52.
\(^{30}\) Livingston, pp. 58-59.
\(^{31}\) Moyal, p. 41.
\(^{32}\) Moyal, p. 55. This figure was arrived at in 1884.
today with the Telstra fibre-to-the-node $4.7 billion broadband proposal that would cost the Commonwealth Government, in 2007 data, about *four months revenue* - *not of its overall annual income* - *but merely its surplus*!

What too might be the multiplier effect of this brilliantly visionary project to South Australia and eventually the nation as a whole? Not only ‘come eth the hour come eth the man’ but come eth an extraordinarily brave and clever set of decisions within the then public sector.

**Case Study Two: Communication Satellites and the National Aeronautics and Space Administration (NASA).**

The U.S.A has a long proud history of being the most highly privatised media, information technology and communications sector in the world: in its telecommunications industry the gigantic American Telephone and Telegraph company (AT&T) dominated the industry for most decades of the twentieth century. However, the remarkable innovation of communications satellites, vital major communications infrastructure around the world today, do not owe their origins within the private sector but rather to strategic initiatives taken by the American government during the 1950s.

As early as 1945 Arthur.C.Clarke (then an RAF electronics officer) had proposed in an article in *Wireless World* the use of manned satellites in 24-hour orbits whose purpose was to distribute television programs. Subsequently, in 1954, John R. Pierce of AT&T’s Bell Telephone Laboratories anticipated that a communications satellite could carry as many as 1,000 simultaneous telephone calls. (The transatlantic cable at the time could carry 36 simultaneous telephone calls.)

The history of building communications satellites started with the launch of Sputnik by thee USSR on 4 October 1957. The successful launch of Sputnik precipitated a crisis in the US, which, forced to realise that it was not pre-eminent in this sphere, then launched a

---

powerful program intended to make good this deficiency. The NASA account of what happened is as follows:

The Sputnik launch changed everything. As a technical achievement, Sputnik caught the world's attention and the American public off-guard. Its size was more impressive than Vanguard's intended 3.5-pound payload. In addition, the public feared that the Soviets' ability to launch satellites also translated into the capability to launch ballistic missiles that could carry nuclear weapons from Europe to the U.S. Then the Soviets struck again; on November 3, Sputnik II was launched, carrying a much heavier payload, including a dog named Laika.

Immediately after the Sputnik I launch in October, the U.S. Defense Department responded to the political furor by approving funding for another U.S. satellite project. As a simultaneous alternative to Vanguard, Wernher von Braun and his Army Redstone Arsenal team began work on the Explorer project.

. . .The Sputnik launch also led directly to the creation of National Aeronautics and Space Administration (NASA). In July 1958, Congress passed the National Aeronautics and Space Act (commonly called the "Space Act"), which created NASA as of October 1, 1958 from the National Advisory Committee for Aeronautics (NACA) and other government agencies.35

So the immediate response from the US Government – including the establishment of NASA and all that flowed from that – had more to do with political and public imperatives than scientific considerations. And certainly more than commercial imperatives.

The initial focus of the NASA program was space exploration rather than communications development, but the two were obviously linked (Kennedy mentioned communications satellites in his famous Man on the Moon speech) and, even today, satellite communications constitute the only truly commercially successful space

35 ‘Sputnik: the fiftieth anniversary’, at http://history.nasa.gov/sputnik/
technology. In the early days of communications satellites, NASA saw the space shuttle program itself as a way of developing the comsat market, because of the growing numbers of satellites being launched or planned. The satellites first had to be launched and then, because of the shuttle’s capacity to mount manned flights, it could repair or perhaps even retrieve satellites. All these functions were considered by NASA and offered ways in which the space program could actually generate funds instead of simply absorbing them. Oddly, though, because NASA had been established through legislation as an R&D organisation, and not as a commercial operation, it was unable easily to capitalise on its assets in this way. Bromberg says:

NASA representatives . . . had no expense accounts for taking potential customers to dinner. They had no authority to meet demands that foreign governments were making for offsets. NASA scrambled for ad hoc arrangements to get around such drawbacks.

Perhaps this was because the comsats had been a kind of by-product to a much larger program although it was certainly recognised early on that communications satellites would be enormously important in all kinds of ways. But Bromberg does seem to imply that the government was hardly alert to the extent or depth of commercial opportunities arising from the NASA program. In terms of commercial success, Whalen points out:

Thus far in the 1990s, the average number of communications satellites launched annually has been twenty, at an average cost of more than $50 million for the satellite and another $50 million (or more) for the launch vehicle. The average spent annually on communications satellites is in excess of $2 billion.

---

36 Whalen, ‘Communications Satellites’, p. 1
38 Bromberg, p. 112.
This would certainly seem to bear out Bromberg’s argument that NASA, a public agency, ‘has influenced the formation and sustenance of new industry’.\textsuperscript{40} The Communications Satellite Act of 1962 established Comsat (the private Communication Satellite Corporation), which was responsible for the US part of an international satellite system. This was followed in 1965 by Intelsat (the International Telecommunications Satellite Consortium).\textsuperscript{41} Although Comsat was a private company, it was under strict government control.\textsuperscript{42}

As early as 1965 comsats had demonstrated their competitive advantage, bearing out John Pierce’s earlier hypotheses. Early Bird, the first operational communications satellite, launched in 1965, not only had ten times the capacity of the submarine cables of the time, but was available for one-tenth of the price.\textsuperscript{43}

Cohen and Noll point out that after the \textit{Challenger} explosion (January 1986), the shuttle had become a ‘costly, non-competitive system without the performance capabilities initially envisioned’.\textsuperscript{44} The political atmosphere had changed, too: whereas in the 1950s and early 60s there was a pioneering spirit abroad (and a widespread fervent desire to knock the Soviets on the head), by the end of the 60s both politicians and public were becoming more sceptical and less likely to approve huge expenditure on space exploration. An ambitious plan submitted by NASA during 1969 for a manned voyage to Mars (incorporating the establishment of lunar-orbital and earth-orbital space-stations, a lunar base, and an earth-to-orbit shuttle system) was refused by Congress and condemned in public polls.

\textbf{Whose vision and what did this cost?}

NASA’s proposed \textit{annual} budget for this plan was between US$6 and US$10 billion, exceeding their previous annual maximum (US$5.25 billion) by US$.75 billion. NASA

\begin{itemize}
\item \textsuperscript{40} Bromberg, p. 4.
\item \textsuperscript{41} Cohen & Noll, p. 151.
\item \textsuperscript{42} Helen Gavaghan, \textit{Something New Under the Sun: Satellites and the Beginning of the Space Age}. Copernicus, New York, 1998.
\item \textsuperscript{43} Whalen, ‘Communications Satellites’, p. 4.
\end{itemize}
took a sharp reality check and subsequently, in 1971, commissioned an economic report on the space shuttle program – the first time NASA had been forced formally to consider cost-benefit issues.\(^{45}\)

Cohen and Noll claim that the space program, which had blasted off with such passion and commitment (political, moral and economic), really had no clearly planned purpose beyond the Apollo mission. This objective – to get a man on the moon – was achieved in July 1969 when Neil Armstrong took his ‘small step’ onto the moon’s surface for all to see back on earth via a communications satellite. Who could have imagined then the subsequent communications spin offs enabling McLuhan’s global village; Ted Turners’ 24 hour news channel broadcast from America to 180 countries, Rupert Murdoch’s Sky Channel for Europe and Star Television for Asia and South East, and the BBC going global with its television news. Although further Apollo missions undertook various scientific projects on the moon, nothing had been planned. The Nixon administration inherited a program which ‘lacked a clear understanding of its subsequent plans for the 1970s and beyond’.\(^{46}\) It should not have surprised NASA when it was announced in 1971 that its annual budget was to remain fixed at US$3.2 billion – of which the space shuttle was scheduled to cost around US$1.8 billion per annum.\(^{47}\)

During the 1970s NASA increasingly made its launch service available to other countries and organisations and during the period 1969-1978 successfully orbited 96 payloads for other organisations, (including the US Navy, Western Union, France, the Netherlands, the European Space Agency and Intelsat), most of which were weather and communications satellites.\(^{48}\)

The ATS (Applications Technology Program) was the part of NASA that ‘pioneered advances in satellite technology, laying the groundwork for applications in television transmission, satellite tracking and data relay, communications with ships and aircraft,

\(^{47}\) Cohen & Noll, p. 183.
\(^{48}\) NASA Historical Data Book Volume III, Chapter One, at [http://history.nasa.gov/SP-4012/vol3/ch1.htm](http://history.nasa.gov/SP-4012/vol3/ch1.htm)
and direct broadcast satellites. Despite widespread acclaim, the program was cancelled in 1973’ according to Cohen and Noll for basically political reasons.⁴⁹

Cohen and Young’s classic assessment of the history of a wide range of government supported R&D commercialisation programs concluded that ‘on the basis of retrospective benefit-cost analysis only one program- NASA’s activities in developing communications satellites- achieved its objectives and can be regarded as worth the effort’.⁵⁰

⁴⁹ Cohen & Noll, p. 149.
⁵⁰ Op cit, p.365
Case Study 3: Origins of the Internet

(Joseph Licklider)

The origins of the Internet do not reside with great entrepreneurs located within major corporations prepared to risk huge capital investments in technological innovation, to gain market competitiveness. Rather the beginnings of the Internet came from brilliant people working for a United States government agency and their links with academics in the discipline of computer science within a few American Universities. Without such outstanding innovation within the public sector, the world may never have had an Internet as we know it today.

In 1957 the United States government established the Advanced Research Projects Agency (ARPA) within the Department of Defense (DOD) to ‘direct or perform such advanced projects in the field of research and development as the Secretary of Defense shall, from time to time, designate by project or by category’. 51 ARPA, together with the

---

51 Federal Communications Commission, The Internet: A Short History of Getting Connected, Congressional Digest, 2007
National Aeronautics and Space Administration (NASA) were both created in response to the then Soviet Union launching the Sputnik satellite, in an attempt to regain technological superiority for the United States.

Internet historians pay great credit to the great foresight of the first two Directors of ARPA’s Information and Processing Techniques Office (IPRO): Joseph Licklider, recruited from MIT in 1962, followed by another academic in Bob Taylor who headed the IPRO from 1964. Licklider, an MIT professor, was fascinated by psychoacoustics, the study of how the human ear and brain convert air vibrations into the perception of sound.

Licklider shifted the orientation of computer and network research away from machine information processing and storage, into behavioural factors, especially interactions with the users. In so doing he put his indelible stamp on the IPRO projects. In 1960 he had written:

It seems reasonable to envision, for a time 10 or 15 years hence, a 'thinking center' that will incorporate the functions of present-day libraries together with anticipated advances in information storage and retrieval.

The picture readily enlarges itself into a network of such centers, connected to one another by wide-band communication lines and to individual users by leased-wire services. In such a system, the speed of the computers would be balanced, and the cost of the gigantic memories and the sophisticated programs would be divided by the number of users. 52

One biographer of Licklider wrote:

In response to this revelation, in 1957 Licklider spent a day measuring the amount of time it took him to perform the individual tasks of collecting, sorting, and analyzing information, and then measured the time it took him to make decisions based on the data once it was collected. He discovered that the preparatory work took about 85% of the time, and that the decision could then be made almost immediately once the background data was available. This exercise had a powerful effect, and convinced him that one of the most useful long term

52 Licklider, J.C.R. 1960 Man –Computer Symbiosis, IRE Transactions on Human Factors in Electronics, p4-5
contributions of computer technology would be to provide automated, extremely fast support systems for human decision making.53

As IPRO Director, Licklider’s mantra was to support and fund projects that facilitated interactive computing for large numbers of users. When Taylor followed Licklider he said that he became ‘heartily subscribed’ to the same version of interactive computing. From his office in the Pentagon, Taylor had teletype terminals to each of three ARPA resourced time sharing computer systems - at Universities MIT, SDC at Santa Monica, and at the University of California at Berkeley.

Taylor wrote:

Three different terminals. I had them because I could go up to any one of them and log in and then be connected to the community of people in each one of those places … Once you saw there were three different terminals to these three distinct places the obvious question that would come to anyone’s mind (was) why don’t we just have a network such that we have one terminal and we can go anywhere we want? 54

Whose vision and what did this cost?

So what might the foundational costs of the Internet have been? Following the creation of ARPA in 1962, the Department of Defense issued a mere $US19,800 contract on December 6, 1967, for a four month study of the ‘design and specification of a computer network’ based on the principles that had emerged under the leadership of Licklider and Taylor. This was an astonishingly small amount considering that in those days a computer cost between $US 500, 000 to $ US 3 million. A subsequent ‘cost effective’ follow-up in 1968 was the awarding of a contract with the ‘purpose of designing, constructing, installing, testing and maintaining four interfacing message processors (IMPS) for $US 563,000. The four computers to be linked were located at the Stanford Research Institute, the University of California –Santa Barbara, the University of California –Los Angeles (UCLA), and the University of Utah. Subsequently, on October 15, 1969, the IMPS installed on the computers at SRI and at UCLA connected for the

53 http://www.livinginternet.com/i/ii_licklider.htm
54 From Roberta Taylor, interviewed for the History of the Internet, a video tape commissioned by Bolt, Beranek and Newman to celebrate the twenty fifth history of the building of the ARPANET.
first time, giving new meaning to the words ‘log in’. This contract promised that the outcome would be ‘a unique prototype of futures communications systems’ and it was. Thus ARPANET (Advanced Research projects Agency Network) was born from which the Internet as we know it today subsequently emerged.

The key factors in creating the initial phase of the Internet were not only the resources made available for research during the Cold War by the Department of Defense, and the great management leadership by Licklider and Taylor, but also the positive contribution of many academics within the scientific and computing communities of universities. The user-centred development philosophy that came from the top of APRA found synergy with the academic desire for decentralisation of organisational authority; their acceptance of the need to share ideas, and the desire to build new telecommunications networks that provided greater openness and access to information carried on the networks. All were centred within the public domain.

In the context of relatively new funding models for contemporary Australian academic research, such as Centres of Excellence and Cooperative Research Centres, it is interesting to look back to the early days of the Internet and examine some of the tensions and complexities of project funding. Given that ARPA was funded by the Department of Defense, there were inevitable tensions about the applicability and relevance of the work of ARPANET to national security. Abatte has argued:

> ARPA’s upper management became adept at buffering the agency’s researchers from congressional scrutiny and from demands that they provide explicit military justifications for their work. 55

There were many congressional discussions about Internet budgets in this context. ARPA was funded by Defense in 1968 at about half of the entire budget compared with that of the National Science Foundation which had a much wider charter for scientific national development. Montana’s Senator Mike Mansfield’s explored what he perceived to be this

---

55 Abbate, J., 1999, *Inventing the Internet*, Massachusetts Institute of Technology, page 75
anomoly with the funding of scientific projects in an exchange with John Foster of ARPA in a congressional hearing typical at the time:

Senator Mansfield - Is the answer partially due to the possibility that it is easier to get money for research and development in the Department of Defense than it is in any other department of the government?

Dr Foster (ARPA – No, sir; I believe the reason is deeper. I believe the reason is that we are required to provide for national security. These amounts of money are required to provide assurance of an adequate technological capability. (US Congressional hearings 1969, p 2305)

A double game of justification had to be played; on the one hand ARPA management argued that ARPANET would make ‘a factor of 10 to 100 difference in effective computing capacity per dollar among the users’ but on the other hand it argued that the project was of major significance on the grounds of national security. This is where some of the myths about the early purpose behind the development of the Internet came from; notably that it was to be built as an alternative telecommunications network for America for use in the aftermath of a nuclear attack on the U.S.A. Several members of Congress believed this in the 1960s, but no one in ARPANET or University project related researchers did, and no credible Internet historian does now.

Fortunately several early pioneers of the Internet remain alive today to see the extraordinary range of new economic and social practices and benefits emerging from ‘their’ platform as it is progressively becoming globally accessible.
Conclusion

This paper set out to show that the creation of, and capitalisation for, the initial construction of the major new communications platforms throughout the past one hundred and fifty years, emerged from the unheralded long term value provided within the public sector and its associated remarkable individuals. Of all of the areas of R&D government investments in industry projects, the field on communications appears to be the leader in terms of long term cost effectiveness and national strategic value.

Three related conclusions can be drawn. First, research and commentary related to communications infrastructure is commonly grounded in notions of technological determinism, sometimes expressed as ‘build the networks and they will come’. Yet what emerged during this research process was that in all three case studies offered here a prime consideration of the creators at the conceptualisation stage were the likely benefits for users if and when the communications platforms were developed. Whist we talk today about ‘user centred design’ of a ‘user environment’ we might well remember that the pioneer of putting the users first in our thinking about new communications services was Charles Todd in the 1860s.

Second, another lesson from one hundred and fifty years of telecommunications history that appears not to be widely acknowledged is the critical role played by the public sector. It was the public sector that provided the organisational framework and for the seeding funding for the creation of each of these three major communications platforms—Australia’s overland telegraph, communications satellites, and the beginnings of the Internet. There can be little doubt about the amazing long term successful ‘cost benefit analysis’ in all three cases. Moreover, had the formulative development factors as outlined in this paper, different though they were in each case, not existed within the public sector, together with the brilliant individuals who could implement the vision, these platforms and their successors might not exist today.

Third, an even longer bow could be drawn to assert that if the centrality of the public sector as investment incubator had been preserved, then the broadband networks needed
today, as described at the beginning of this paper, would have been built by now or would be well advanced in construction. But history also shows us how difficult it is to unscramble telecommunications policy omelettes. For the past twenty years or so there has been widespread international acceptance of the paradigm that ‘best government is the least’ and there is a related telecommunications policy presumption that a more privatised, deregulated and liberalised policy model will always now be the best way to go. Yet in the context of the major investment needed in broadband, so widely agreed as vital to the future of Australia, we have an essentially dysfunctional contemporary telecommunications policy model.

A glimmer of hope resides within the Australian government’s Future Fund, created in 2007 to secure payments for some long term government liabilities and currently holding $60 billion. Might not just some of these funds, or perhaps the annual interest accrued from these investments, be used as the embryonic capital kick start for the new infrastructure we need? The great pioneers of the past described in this paper had no such comparable funds available to them, but they achieved more than we ever seem likely to at present in the context of broadband roll outs. Why can’t we use today such public money from a Future Fund for long term investment in infrastructure? After all, if there had been no overland telegraph, or no communications satellite, or no Internet developed initially in the public sector during the last century, there might never have been a Telstra to privatise in the new century to create such a Future Fund.
REFERENCES

Monographs

Abbate, J., *Inventing the Internet*, Massachusetts Institute of Technology, 1999, USA


Parliamentary Papers

Debates in the Houses of Legislature of South Australia for the following sessions:

- Legislative Assembly 1869
- Legislative Assembly 1870
- Legislative Council 1870
- Legislative Assembly 1871
- Legislative Assembly 1872
- Legislative Council 1872
Online:


Chronology of Sputnik/Vanguard/Explorer Events 1957-58, at [http://history.nasa.gov/sputnik/chronology.html](http://history.nasa.gov/sputnik/chronology.html)


‘Timeline of Selected Events in the Development of Satellite Communications’, at [http://history.nasa.gov/SP-4217/app-b.htm](http://history.nasa.gov/SP-4217/app-b.htm)


---

56 All online sources accessed October 2007.