Telstra's Future Mode of Operation

Network transformation between 1992 to 1993

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Abstract: The Australian & Overseas Telecommunications Corporation (AOTC), later Telstra, was established on 1st January 1992, as a government-owned corporation and as the national telecommunications carrier. At the same time the Australian telecommunications market was deregulated and network competition was expected to begin within several months. Studies had indicated that AOTC’s inter-exchange network was perhaps five years behind similar networks in the USA and uncompetitive with the network to be built by the incoming competitor, Optus Communications (Optus). AOTC's first Chief Executive Officer, Frank Blount, was an experienced senior executive of AT&T, one of the most respected telecommunications businesses in the world, which had been operating in the highly competitive telecommunications market in the USA over the previous eight years. Blount decided that one of his highest priorities, if not the highest, was a major transformation of the AOTC's inter-exchange network. Within seven months the AOTC board approved Plan D, an interim hybrid strategy which broadly achieved what was required for the network to be competitive. Within fourteen months the Board approved the Future Mode of Operation (FMO), a strategy to achieve a fully competitive, almost fully digital inter-exchange network which would approach world parity within five years. The FMO strategy would leap a gap close to ten years within five years. This is the story of the rationale and planning to launch Plan D and the FMO, the building of the first competitive telecommunications network strategy in the Postmaster General's Department (PMG), Telecom Australia (Telecom) and AOTC (Telstra) in over 90 years.

Keywords: telecommunications, networks, Telecom, OTC, AOTC. Optus

Introduction

In 1988 the Commonwealth Government released a statement on the future structure of the telecommunications industry: “Australian Telecommunications Services; a New Framework”. Over the following years to 1991, legislation, the establishment of a regulator (AUSTEL), and a number of inquiries by AUSTEL, would drastically change the
telecommunications market in Australia. The main outcomes of legislation and regulation to 1992 were:

- the *Telecommunications Act 1991* formalised the new telecommunications industry structure and related regulation, including a framework for licensing telecommunications carriers, maintaining the concept of a standard telephone service and related funding, the regulatory structure, and the powers of the new industry regulator (AUSTEL).

- the *Australian & Overseas Telecommunications Corporation (AOTC) Act 1991*, established AOTC (later Telstra) in 1992 with the merging of the Australian Telecommunications Corporation (Telecom) and the Overseas Telecommunications Corporation (OTC) and granted common carrier licences for providing landline and cellular mobile network services.

- the loss-making satellite operator, AUSSAT, was privatised and formed part of the package for a second common carrier licence (to AOTC's), which was awarded to Optus for providing landline, digital cellular network and satellite services.

- a third common carrier licence was granted to Arena (in addition to AOTC and Optus) for providing digital cellular mobile network services.

- GSM was selected to be the digital cellular standard for Australia, and services from all three licensed network service providers could be offered in 1993.

- AOTC was required to permit Optus to resell AOTC's landline network services and Optus and Arena to resell AOTC's Analogue Mobile Phone Service (AMPS) from January 1992, with wholesale rates to be determined by AUSTEL.

- Optus and Arena could commence the marketing of GSM mobile services on their own networks in 1993, with rates for interconnection with Telstra's networks to be determined by AUSTEL.

- if a later review assessed the 1989 de-regulation a success, full-scale competition in network services could be introduced by 1997.

- to make the two new mobile licences more attractive to bidders and to release radio spectrum, Telstra's AMPS network would be shut down when the three digital networks had sufficient coverage, so as not to disadvantage analogue customers. The date of the shutdown was later determined to be 2000.

Although Telstra could have provided GSM services in 1992 and was the first operator outside Europe to join the GSM club, in order to create a "level playing field" Telstra was prohibited from offering GSM services until 1st April 1993 when Optus was expected to be
ready. Telstra was later required to again delay its launch until 23rd April to meet the
government’s interception requirements.

Disclosure

This is not an academic paper; a more accurate description would be a reflective historical
paper about the eighteen months over which the plan for the FMO was developed and
implementation began. The paper provides some detail about Telstra's task as the national
carrier and its operations and culture, to afford a better understanding of judgements and
events.

The author is not an engineer and has no qualifications, training or experience in network
ing engineering. It is possible that this paper has technical errors which the author would
acknowledge.

The paper is supported by a number of records of the period, including business plans,
business cases, and trading statements. The records are incomplete but are sufficient to
support the points made. A number of these records no longer exist or are not easily
accessible such as those in the archives of Telecom and Telstra.

Opinions and judgments are the author's unless otherwise stated. Those of Telstra and
Telecom are expressed using standard private sector criteria including growth, market share,
customer service and profit, rather than using public service criteria.

The Telecom Network in 1991

In June 1991, Telecom's 8.1 million landline telephone services reached 95% of Australia’s
homes – up from 60% in 1975; the huge objective of providing almost every Australian and
the 800-900,000 businesses in the in the country with a telephone service was broadly
achieved. The network, by landline and satellite, reached every hamlet, tourist resort, mining
site, cattle station and aboriginal community in the outback. During the 1991 financial year
landline customers made 9.4 billion local calls, 1.8 billion trunk calls and 117 million
international calls.

Since 1984/5 Telecom’s Rural and Remote Areas program had connected 45,000 customers
in outback areas across some of the country’s most inaccessible regions. Almost every
Australian in the outback had access to a telephone service.

Some 290,000 customers, about 5% of Australians, owned a mobile phone, and the mobile
phone service covered over 80% of the Australian population. The number of customers had
increased by nearly 250% over the past year and during that time mobile customers made
158 million calls.
Telecommunications traffic nationally was in a transition from "voice" to data services including digital data, imaging and video access and transmission, and soon cable TV. Data services were well established and the number of customers was growing rapidly. Telecom alone provided 85,000 data modem services, 94,000 Digital Data (DDS) services, and 8,600 packet switched (AUSTPAC) services. The number of data points and the volume of data traffic were poised to explode.

There were 38,000 kilometres of optic fibre cable linking the exchanges of all of Australia’s capital cities and major towns across the nation. Over the past year 10,500 kilometres had been laid, and rapid expansion was programmed.

$3.3 billion in capital works were planned for 1991/2, at least 50% of this for the interexchange network.

The AOTC (Telstra) Network in 1992

The merging of the Telecom and OTC networks into the AOTC network began in August 1991. From January 1992, with the merged networks, AOTC was the third largest owner of submarine cables in the world, and the sixth largest shareholder and user of the 122-member international satellite communications consortium (INTELSAT).

AOTC’s network comprised four conceptual components: the landline network, the cellular mobile networks, the agreement with Optus to use the AUSSAT satellites, and the overseas cable and satellite networks linking Australia with other countries.

The AOTC network was highly complex. As with almost all advanced telecommunications networks in developed countries there were “legacy” problems: older technologies, network designs and network components – exchanges, transmission links etc – which were now obsolete and uncompetitive. Most of the legacy exchanges and links were still operating in rural and outback areas because of the lower revenue potential and the cost of upgrading equipment. However, older equipment was still in operation in many areas of the major cities and important regional towns. For example, in 1992 AOTC closed the last of the manual telephone exchanges (with switchboard girls, plugs and cables) at Longreach, Queensland, a significant regional town; museums from around the world sought to acquire the switchboard.

In addition, AOTC's network had other complexities. For example:

- there were three digital switching platforms: Ericsson AXE, Alcatel System 12 and Nortel DMS.
overlaid on the hybrid analogue/digital telephone network switching and transmission components were a number of dedicated networks performing a range of functions, including:

- the telex service,
- links for radio and TV designed for regional and interstate program distribution,
- the AMPS cellular mobile network,
- the new GSM network being constructed,
- the dedicated data networks; the Digital Data network (DDS), the packet switched network (AUSTPAC), and the ISDN network,
- a number of smaller specialised networks such as for electronic trading.

These complexities – the legacy analogue systems alongside the newer digital systems, the number of switching platforms and the overlay networks – were an inefficient use of network elements and capacity; were becoming more complicated to manage; and were more-costly to build, operate and maintain. They duplicated functionality, and required multiple network management platforms and operational support systems. In addition, they inhibited the range of services offered, compromised the reliability and quality of service, and inflated capital and operating costs.

Two studies of Telecom's network – in 1985 and 1991 – reported that Telecom's network was years behind advanced networks in many other first-world countries and poorly prepared for the competition due to begin in 1992.

The 1985 study

This study of telecommunications utilities in the USA, UK, Sweden and France by the General Manager Operations, George Hams, reported that Telecom lagged in key areas including employee productivity, deployment of digital switching, and the development of major operational information systems.

For example, Telecom’s staff per 1,000 services was roughly double that of the US, about 40% higher than Sweden and 20% higher than the UK; of the telecommunications businesses examined by British Telecom, Telecom was only ahead of Portugal and Ireland. The proportion of digital switching in Telecom’s network was low; Canada, France, Japan and Sweden were in the range 13-20% compared to Telecom's 1%.

All the utilities visited had a strong determination to reduce staff numbers and costs; to accelerate penetration of digital switching and optic fibre transmission; to reduce the levels
of management and supervision; to outsource areas where internal staff had neither the skills nor performance levels needed; and to align payment and incentives to performance and productivity.

A reasonable expectation from the study was that Telecom’s top management would immediately order task forces to rapidly improve performance, at least in the network and computer systems development programs, but no significant such actions resulted.

The 1991 study

This project, commissioned by Telecom’s Deputy Managing Director, Doug Campbell, was a comprehensive benchmarking study by Booz Allen Hamilton (BAH) of the network and the related information systems for operating and maintaining the network. The study compared Telecom’s performance with seven regional Bell operating companies (RBOCs) in the USA.

The study found that while Telecom ranked well in a few areas, there were potential savings of over $700 million per year in the network and the related information systems, accommodation and overheads. This scale of savings was considered credible as it was supported by the management involved in the study. Other findings were that the RBOCs achieved a superior performance in the key areas of network services, operating costs, and capital and labour productivity by more aggressive use of technology, stronger and more focussed management and related systems, and more disciplined management of the field force.

Examples were the more aggressive use of concentrators and pair gain systems; faster deployment of digital switching; and more remote control of switches, particularly electromechanical switches. Telecom’s proportion of digital switching was about 29% compared to the lowest RBOC, US West, with over 40%, unremarkable in the USA. Telecom was also considered to be underfunding information technology projects.

The consultant commented that, based on the US experience, when responding to competition in the industry, culture change in Telecom was slow; it was two to six years before real change emerged. Some 15 years after Telecom was launched, Telecom was perhaps five years behind an Australian competitor operating at the US level.

Finally, it was clear that Telecom had been slow in preparing the network for competition and the demands of a competitive market. AOTC’s network was years behind world parity, and except in some metropolitan areas the products and services offered were behind those offered in the USA and Canada. More urgently, AOTC's network performance was lower than what Optus, the incoming competitor, would achieve with a fully digital network. In almost all the important areas the new, simpler, more advanced Optus digital network would be
built with lower construction costs and could be expected to perform better with lower capital and operating costs.

A benchmarking study in June 1992 provided an updated and more accurate understanding of the status and performance of the network and the results were daunting – see later.

![Figure 1. 1992 AOTC Domestic Network](image)

Notes:
- The shaded area is the Network Products Group operation
- Not shown is the number of "overlay" networks in the interexchange network and the international gateways and satellite links

**The AOTC Chief Executive Officer**

AOTC’s new CEO, Frank Blount, appeared a close match with what AOTC needed. His education, training and experience in telecommunications, particularly in competitive markets, was impressive.

Blount was awarded a Bachelor of Science in Electrical Engineering at Georgia Institute of Technology in 1961, an MBA from Georgia State University in 1969, and a Masters Degree in Management Science from the MIT Sloan School of Management in 1971. Blount had been employed by AT&T for all of his career, advancing through the engineering stream. He served in various executive positions with AT&T, rising to be the Group President, Communications Products Group from 1989 to 1991.
Blount had observed the anti-trust suit pursued by the US government against AT&T from 1974; the resulting divestiture of the Bell System in 1984; the following change in the AT&T culture to be competitive; the competitors that emerged and their tactics after 1984; and AT&T’s loss of market share under full competition.

The AT&T divestiture forced one of the most drastic changes in corporate culture ever undertaken by a major American corporation. The old Bell System, as a regulated monopoly, had been largely insulated from market pressures for most of its history. Its culture venerated service, technological excellence, reliability, and innovation within a non-competitive internally-driven framework of taking the time and money to "do things right". The new AT&T had to discover and deliver what its customers wanted when they wanted it, in competition with others who fought for the same customers. AT&T began as a new company on January 1, 1984. Of the $149.5 billion assets the Bell System had the day before, AT&T retained $34 billion. Of its 1,009,000 employees it retained 373,000.

The long distance telephone service became an intensely competitive market. From a monopoly business, AT&T’s market share fell from over 90% in 1984 to around 50% ten years later. The competitive pressure and new technologies (primarily fibre optic transmission), caused prices to plummet, dropping by an average of 40% by the end of the 1980s. The volume of calls exploded. In 1984, AT&T carried an average of 37.5 million calls per average business day; in 1989, the equivalent volume was 105.9 million, and 270 million in 1999. In the 1990s, the growth of computers, and the emergence of the internet led to an increasing percentage of network traffic being data rather than voice. AT&T invested heavily to quickly transform and digitise its entire network.

AOTC in 1992 faced a similar situation to that of AT&T in 1984. On paper Blount appeared to have the skills, experience, credibility and tradition needed for the AOTC job.

Establishing the AOTC Structure

Blount retained the Boston Group to advise on the new AOTC organisation and Russell Reynolds to evaluate the top twenty or so senior managers of Telecom and OTC. Based on their advice the AOTC organisation was finalised in early January and the new management team was appointed by the end of January.

The new AOTC organisation featured five customer-facing retail business divisions, providing the services they forecast were required at retail prices – see Figure 2. A Network Products Division managed the inter-exchange network and supplied services to the customer divisions at negotiated wholesale prices and to the competing carriers, Optus and Arena, at regulated or negotiated wholesale and interconnect prices.
Notes:

- Five retail divisions – four customer divisions and an Enterprises Division – market at retail prices. Network Products Division markets to the retail divisions at wholesale prices and to interconnection carriers at regulated or negotiated interconnect prices.

**Network Products Division**

Blount assessed that AOTC’s most challenging task was to transform the inter-exchange network.

Network Products Division was the business unit in AOTC which owned, planned, developed, constructed and operated the core telecommunications network – the inter-exchange network – comprising about 5,000 exchanges around the nation linked by co-axial cable, optic fibre, radio and satellite networks. Organisationally Network Products did not manage the local loop and was only required to efficiently service the loop from the local exchange. Network Products also managed AOTC’s equity share in the overseas transmission links between Australia and other countries, including participating in the network planning, development, construction and operation of the links.

To ensure that the required progress was made and not hindered by other areas, the manager of Network Products reported directly to the CEO.

Network Products was a complex goliath; a new “green field” business built from the network components of Telecom and OTC. In January 1992 the initial estimate of the revenue at wholesale prices was $1.6 billion, of which $60 million was from interconnecting...
carriers. The division comprised about 21% of AOTC’s operating expenses at $1.6 billion, 39% of capital expenditure at $1.5 billion, 70% of its research and development costs, and 25% of staff at 18,600. The 18,600 staff were all sourced and relocated from other areas.

The organisation was fully operational by the end of February.

The Objective and Planning Approach for the Network

The overriding objective was to develop a network which was:

- competitive with Optus ahead of Optus’ network deployment in contested areas in terms of service range, quality, reliability, service delivery, operating cost structure and capital efficiency; and
- at world parity nationwide in those terms within five years.

To achieve those objectives the immediate imperative was to build:

- a business plan and trading statement within six months which achieved competitiveness with Optus; and
- a business plan and trading statement within twelve months which achieved world parity within five years.

It was already known that the old Telecom network was years behind, but the gaps were not fully defined and actions to bridge the gaps not fully effective or prioritised. Both Telecom and OTC had plans in place and projects in progress, but both fell far short of transformation. With the amount of research and related work needed to be done to build a sound planning data base, business plan and trading statement and the urgency for results, three factors became clear:

- improvement would continue in areas where the need was sufficiently defined and the priority was clear,
- the plan would develop through a series of iterations as more information became available, and meanwhile; and
- a number of “task teams” would “overlay” the formal organisation, the teams working in parallel on specific tasks to produce earlier results and to accelerate progress.

The general approach is outlined in a series of parallel actions.

Action 1: Build a Base Case Trading Statement within One Month

Producing the “base case” numbers for the business was a struggle. For large areas of the networks there was little relevant historical data to use for planning projections. In addition,
18,600 staff were transferred into the division; about 3,000 from Corporate Customer Division, 3,800 from Residential & Network Services Division, 2,000 from Country Division, 9,600 from Network Engineering Division and a small number from OTC. Many projects and more than 500 staff arrived unexpectedly without supporting funding, common in a public service situation. Additional costs and funding shortfalls continued to emerge from other areas over several months.

The division organisation and staff were operational within the first month, as were "first order" budgets, processes and systems. Operational arrangements with the customer divisions and competing carriers were operational a month or so later.

Table 1: Network Services - "First Order" Trading Projection - 1992-97

<table>
<thead>
<tr>
<th></th>
<th>92/93 (1991/92 prices)</th>
<th>93/94</th>
<th>94/95</th>
<th>95/96</th>
<th>96/97</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue (external)</strong></td>
<td>$m</td>
<td>193</td>
<td>227</td>
<td>318</td>
<td>326</td>
</tr>
<tr>
<td><strong>Direct Expenses</strong></td>
<td>$m</td>
<td>920</td>
<td>864</td>
<td>863</td>
<td>865</td>
</tr>
<tr>
<td><strong>Shared Resource Units Expenses</strong></td>
<td>$m</td>
<td>676</td>
<td>676</td>
<td>686</td>
<td>701</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td>$m</td>
<td>1,596</td>
<td>1,540</td>
<td>1,549</td>
<td>1,566</td>
</tr>
<tr>
<td><strong>Direct Contribution</strong></td>
<td>$m</td>
<td>1,403</td>
<td>1,313</td>
<td>1,231</td>
<td>1,240</td>
</tr>
<tr>
<td><strong>Capital Additions</strong></td>
<td>$m</td>
<td>1,479</td>
<td>1,406</td>
<td>1,350</td>
<td>1,355</td>
</tr>
<tr>
<td><strong>Cash Flow</strong></td>
<td>$m</td>
<td>2,882</td>
<td>2,719</td>
<td>2,581</td>
<td>2,595</td>
</tr>
<tr>
<td><strong>Staff</strong></td>
<td>16,225</td>
<td>15,392</td>
<td>14,595</td>
<td>14,181</td>
<td>13,818</td>
</tr>
<tr>
<td><strong>Ratios</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return on Assets</td>
<td>%</td>
<td>15</td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Cash Flow/Assets</td>
<td>%</td>
<td>30</td>
<td>27</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>

Notes:
- External revenue is wholesale revenue from Optus, Arena, and Telecom subsidiaries. At this stage revenue from the AOTC customer divisions was not included as the wholesale prices had yet to be calculated.
- Direct expenses were expenses incurred in supplying services to the customer divisions at transfer prices and interconnected carriers at wholesale prices.
- Shared Resource Units expenses were expenses incurred in using the services of corporate units such as information systems, accommodation etc.

The expenses and capital were projected on a “past rate of improvement” basis. The first attempt was a very crude consolidation with modest and obvious cost savings but, as expected, the scale of improvement was totally unacceptable – see Table 1.
Action 2: Launch a series of Specialist Teams overlaid on the Formal Organisation for Earlier and Faster results

New "greenfield" organisations take time to be implemented and focus on the task, particularly in a large organisation of some 18,000 people. Results could not be delayed by that time.

A number of specialist teams were formed to immediately tackle urgent and priority tasks. For example:

- the “Peel Off” team ensured that the staff, operating revenue and costs, capital, and assets transferred into the division from other areas were fully funded,
- a "Customer Services” team developed and agreed operational arrangements with the retail divisions and the interconnecting carriers.
- a “Finance and Accounting” team established an entirely new accounting code structure and set of accounts and developed first order, and later final, transfer and wholesale prices to charge the retail customer divisions and the competing networks,
- a “Network Performance Improvement” team produced a “first order plan” to rapidly improve the network performance by June.
- a "Benchmarking" team obtained world benchmarks for all significant operating areas - including product range and price packaging, service quality and penetration, network operating and construction performance and costs and industry supplier performance and prices. Using these benchmarks, the business plan would be revised to deliver world parity within five years. The results of the benchmarking study are provided later.
- “Process Re-engineering” teams used the process re-engineering technique to achieve transformational changes in key processes such as reducing the downtime of exchanges and reducing times for changes in tariffs.

In 1992 there were a number of well-known processes for achieving business performance improvement; for example, work study, systems analysis, “Total Quality Management” (TQM), “Just-in-Time”, and “6-Sigma”. Properly implemented, all produced results but usually steadily over years, too slow for a network transformation.

In 1990 Michael Hammer, a former professor of computer science at the Massachusetts Institute of Technology (MIT) proposed "process re-engineering" for "breakthrough". Process re-engineering aimed to radically restructure the
organisation by focusing on the ground-up design of the business processes to dramatically improve customer service, cut operating costs, and become world-class competitors. All forms of work that did not add value were eliminated.

"Breakthrough" appeared to be the only way for AOTC to transform the network in five years. Network Products launched a number of "breakthrough" projects which achieved astonishing results – see later.

- a “Systems Strategy” team produced a comprehensive and transformational plan to upgrade the interfaces to the customer systems – service activation, service assurance, charging and billing, and customer support – and the network operational systems,

- an "Incremental Revenue Generation" team produced a plan to increase revenue in the short term beyond current projections – first order” plan by June.

This included accelerating the introduction and deployment of new services such as high speed, secure data networks, pay TV (when authorised), electronic trading, open learning between schools and universities, image processing and retrieval, electronic mail, geographic information systems, and electronic funds transfer,

The "final" business plan would inevitably propose a significantly higher capital investment than allowed in the initial January 1992 budget. A higher short term revenue projection would facilitate support for a level of higher investment.

- a “Capital Investment Framework” team developed a process and model for evaluating, prioritising and programming investment proposals, including investments in the domestic network, international networks, and stand-alone domestic opportunities such as Pay TV.

- a "Network Transformation” team was a highly expert team to immediately assess the options for revolutionising the network. The members were instructed to be aggressive, innovative, and unbounded by history or institutional roadblocks.

- a “People Program” team was to produce a plan to drastically improve the customer and business focus and result orientation of the staff, retain the most valuable staff as the workforce was restructured and reduced, manage the unions, and draft enterprise agreements that would achieve transformation.

Some of the key issues that required negotiation with the unions included national (rather than largely state-based) network management and operation, nationally standardised work practices, larger exchange maintenance groups, and fewer management and staff classifications and levels.
At the end of the first month the most valuable high-risk staff had been identified, and these people were assured that their contribution would be crucial to the business. More were identified over the next few months.

- an "Industry Strategy" team produced a “first order” industry strategy by September which decided the key suppliers and the related Australian telecommunications industry plan to achieve transformation performance and comply with AOTC’s licence conditions.

Teams only existed for the time needed to complete their task. Some such as the "Peel Off", "Customer Service" and "Financial and Accounting" teams only worked for several months. Some such as the "Process Re-engineering" and "Network Transformation" teams were still operating after 18 months.

**Action 3: Define a Base Case for the Network within two months**

The data from the Booz Allen Hamilton (BAH) benchmarking conducted in 1991 was supplemented by performance assessments of each element of the network. Some specific areas of underperformance were:

- many of the plans for improving the capabilities and performance of the network developed by Telecom’s customer divisions over the previous three years fell short, were not fully resourced and were behind schedule,
- service feature deployment was too thinly spread beyond the central business districts,
- the inter-capital transmission links were only 80% digital (60% on optic fibre).
- implementation of the future network architecture features was too slow; for example, Synchronous Digital Hierarchy (SDH)/Asynchronous Transfer Mode (ATM) which Optus was expected to implement at launch in 1993,
- inter-capital transmission performance was not meeting CCITT (world) specifications – about 10% of inter-capital paths failed to meet the monthly objective,
- while AOTC’s signalling (SS7 - World Signalling Standard 7) network was one of the largest, linking 300 switches and data bases in the IN, ISDN and mobile networks across Australia, conformance to the latest CCITT “Red Book” standard was less than 10%. The new standard was crucial to achieve advanced feature connectivity,
- a large proportion of transmission links comprised of analogue or early versions of digital technology and needed to be replaced, the error performance was
unsatisfactory and there were some single points of failure, mainly due to tele-power systems,

- network operating and management systems were state-based. These needed to be transformed to a nationally managed network from two centres – Melbourne and Sydney – and substantially upgraded for such as traffic management, performance measurement, service quality measurement, maintenance, alarm monitoring, fault detection and repair, and disaster management,

- network loss for local calls, long distance calls and international calls seemed excessive and vulnerable to superior performance by Optus,

- the hardware and software reliability and switch availability of the new computer digital exchanges was below best practice. Node events averaged about 2.5 per month and downtime about 10 minutes per month per node.

Establishing the accounts, collecting the resources and compiling a “first order” business plan for the base case network was a major task, achieved in less than two months. One concern among several senior engineering managers was the major risk in upgrading the operational support systems so quickly, and they emphasised that this needed to be planned carefully. Another concern was the union reaction.

The base case was updated with the results of the benchmarking study three months later – see Action 5.

**Action 4: Construct a likely Network Design, Feature Set, Performance and Rollout for the Optus network within two months**

The switch that Optus would use for its network – Nortel DMS – was known, as was the related feature set that would be offered. The prediction was that Optus would adopt an aggressive rollout for both the landline and cellular networks with network services assumed to be offered about mid-1993.

AOTC's business plan would cover the Optus feature set well ahead of the predicted rollout in all contested markets from the end of 1992.

**Action 5: Obtain World Benchmarks for all key performance measures by June**

Cresap, McCormack & Paget (CMP), a world respected consultant specialising in telecommunications benchmarking, was retained to report AOTC’s performance against operators in the USA – see later.
The results were used to upgrade the progress made from the base case (Action 3) and the related business plan.

**Actions 6+: Iteratively develop the Network Strategy, Business Plan and Trading Statement as better data became available**

The corporate planning requirement was for a budget to be available in April for the following financial year – 1992/93 – and a five year plan for the period 1992/97. Updates were required six months later.

After the base case in March there were a number of planning iterations to attempt to meet AOTC's commercial and financial requirements while battling with the prime task, establishing the business and network transformation. An indication of the iteration process is provided in Table 3 later.

The business plan and related trading statement for building a network to be competitive ahead of the rollout of the anticipated Optus network was achieved in July, 1992 and was named Plan D – see later.

An early plan and statement for a world parity network in five years was produced in early 1993 and was named the Future Mode of Operation (FMO) – see later.

With the market, competition, industry regulation and the key technologies changing so drastically, there was a range of issues to resolve in developing the business plan. For example:

**Issue 1: Competitiveness had to be achieved in the Contested Key Markets before 1993**

Optus was expected to enter the Australian telecommunications landline and cellular mobile markets market around May 1992, initially as a reseller of AOTC’s landline and AMPS mobile networks, and from about June 1993 marketing its own networks.

The Optus landline and mobile networks would be fully digital with Nortel DMS switches offering:

- a “state-of-the-art” product and service range;
- extensive price packaging;
- quick connection, service repair and restoration;
- detailed and flexible billing; and
- prompt and efficient customer support.
The transmission links between the switches in these markets would be optic fibre with huge capacity, world-standard reliability, and very low operating and maintenance costs.

Operation of the Optus landline network was predicted to begin about June, 1993 in Sydney, Melbourne and Canberra, and progressively extend to Brisbane, the Gold Coast, Adelaide and Perth by December, 1993. The Optus GSM network was expected to be deployed using roughly the same schedule.

AOTC’s revenue and profits were strongly centred on Sydney, Melbourne and Brisbane. Sydney alone contributed about 20% of profits, and the golden triangle of Sydney, Melbourne, Canberra and Brisbane generated over 70% of profits. The gross margin for long distance and international calls approached 80% of sales. The more advanced network services including data, intelligent and enhanced services were marginally profitable at best in the early years, but had high growth rates and served to weld the customers to AOTC’s network.

Resale of AOTC’s networks from about from about May 1992 to mid-1993, followed by the rollout of the Optus network, was expected to allow Optus to make long distance services available to 65% of Australia’s population by the end of 1993, 70% by the end of 1995 and over 90% by the end of 1997. By then Optus might cover over 70% of AOTC’s customers with both landline and cellular mobile services.

In addition to the customers attracted through resale, Optus would likely early target the direct connection of large business customers in the capital cities for long distance and international calls, data services and private networks.

Competition was assumed to be intense in the contested areas from mid-1993. Over the next five years Telecom forecast a market share loss of 35% for long distance calls and 41% for international calls.

Arena was expected to become a reseller of AOTC’s landline network and of the AMPS network in December 1992; little was known of its plans to compete with its own GSM network, but towards the end of 1993 seemed likely.

The Network Products business plan had to complete full digitisation of switching and transmission in the central business districts and the most vulnerable urban business concentrations in all the targeted cities by the end of 1992, ahead of the Optus roll-out.
Issue 2: AUSTEL's Regulatory Requirements to create a "Level Playing Field"

As an incentive for Optus and Arena to enter the market, AUSTEL, with the encouragement of the Labor government, made several decisions to provide a "level playing field" to give the incomers an easy, early and significant market share:

- a pre-selection process provided every AOTC customer with the opportunity to use Optus as their preferred carrier for long distance and international calls. During the pre-selection process AOTC and Optus campaigned area by area across Australia to be the preferred carrier for long distance calls. Customers who did not respond remained with AOTC. Those customers who did not choose Optus could still use Optus by dialling a "one" prefix.

- as previously noted, AOTC was required to permit Optus to resell AOTC's landline network services and Optus and Arena to resell AOTC's AMPS network services from January 1992, with wholesale rates to be determined by AUSTEL.

AOTC's network had to be prepared for both programs both technically (one prefix, billing etc) and commercially (service delivery, invoicing, collection etc).

Issue 3: the Uncertainties in Growth in Demand/Traffic over the Planning Period

Providing capacity for telecommunications services required estimates of the volumes of traffic over the planning period – the next five years. Noting the AT&T experience when competition was introduced in the USA, traffic growth would likely be unprecedented, demanding far higher expansion of network capacity.

AT&T's experience was that telephone calls exploded more than six-fold over five years. After pre-selection began in mid-1992 and when network competition began in mid-1993, telephone calls on AOTC's landline network might increase from a steady and predictable 7% pa to more than a factor of three.

The number of mobile calls was rocketing, but was still only 2% of landline calls; in five years mobile calls might reach 30-40% of landline calls.

Data traffic was also accelerating due to such as the emergence of higher rate local loop capacity in homes and businesses, corporate data processing networks, and the early usage of the internet (which emerged in 1992). Another potentially large traffic generator over the next five years was video for services such as for cable TV, which was likely to be introduced
within three years. While data traffic might only be 10-20% of telephone traffic now, it could overtake telephone traffic within five years.

**Issue 4: The Transition from Analogue to Digital Switching and Transmission needed to be greatly accelerated**

Digital technologies – such as used for computers, switches and transmission – were superior in almost all respects to the older analogue equipment being replaced. Digital equipment provided a wider range of services, allowed far faster computing and switching, far greater transmission capacities, greater reliability of operation, generated less heat (requiring less cooling), was more compact (requiring less floor space), and offered lower construction and operating costs.

For example:

- digital switches could be programmed to provide a wide range of new services including caller identification, number portability for mobile services, and virtual private networks.
- a digital line could carry all types of traffic simultaneously to the limit of its capacity, while an analogue line could only carry one type of traffic at a time – a telephone call, telex call, or video program.
- a digital switch required less than 10% of the floor area of an analogue switch.

AOTC, with its network monopoly, had been slow to introduce digital switching and was far behind the USA, Canada and the OECD in its deployment.

Telecom had three types of digital switches – Ericsson (AXE), Alcatel (S12), and Nortel (DMS) – which were concentrated in the central business districts of the main capital cities, and four types of analogue switches (SXS, ARK, ARF and ARE). An “overlay” network extended the services of these digital switches to provide a wider range of digital services to a limited wider area around the central districts to meet particular business demand. Outside these areas a large installed base of enhanced analogue ARE exchanges provided functionality to meet the needs of a majority of residential customers. Country exchanges outside the provincial cities and towns were obsolete and posed a problem because of their numbers (over 4,000) and size (more than 3,000 exchanges of less than 400 lines); there were no immediate plans to replace this type of equipment in most areas.

Telecom’s 1991 Annual Report claimed that all of the central business district exchanges would be digital (AXE) by 1993. “In the near term” a mixed approach using analogue (ARF ARK) and full digital (AXE) network intelligence (would) be developed to modernise the
country network. All obsolete analogue step-by-step equipment in urban metropolitan areas and nominated regional areas would be replaced by 1993. This program appeared well behind schedule.

Specific drivers of faster digitisation were:

- the crucial imperative to match the Optus capabilities – service range, service quality, network reliability etc – ahead of the Optus rollout. The timetable for digitisation was now set by the competition.
- digital equipment performance was rising rapidly and prices were falling. Digital networks were less costly to construct and had far lower operating and maintenance costs.
- with the deployment of digital switching and transmission, and the progressive digitisation of the network, the separate analogue telephone, digital telephone, ISDN, digital data and digital packet switched networks would evolve faster towards a single digital network.

These pressures might well cause the 29% level of digitisation in 1991 to be accelerated towards over 90% in year five, 1997, but whatever the rate there were two broad issues. Firstly, the technical (and funding) issue of replacing the analogue switches and links and managing the related operational support systems without affecting the performance of the network. Secondly, the industrial relations issue of maintaining service as the technical workforce was restructured and the numbers of people fell dramatically.

Issue 5: Switch Supplier Performance

As previously noted, there were three suppliers of circuit switch exchanges for the public network – Ericsson, Alcatel, and Nortel. In addition, packet switches were being used for the early packet switched networks.

The performance of Ericsson and Alcatel in supplying digital switching over the previous three years had been poor. Software and the following upgrades were often late, under specification and had operating bugs. One cause was that the Australian market was small and far from the suppliers’ headquarters in Sweden and France; the local subsidiaries appeared to have difficulty in obtaining the necessary support from their headquarters. Another cause was that Telecom had introduced a number of “local” requirements for the software which were peculiar to Telecom and differed from the North American and European markets. This complicated and slowed software development and testing which, in turn, increased the risk of failures in installation and operation, delayed revenue from new features, delayed cost savings, and increased construction and operating costs.
Nortel, the digital switch vendor for Optus’ network, was a North American manufacturer well experienced in delivering reliable software which provided advanced features demanded by the US and Canadian markets.

The intent was to remove as many of the "local" specifications as practicable and expect Ericsson and Alcatel to improve performance to reliably deliver feature and performance parity with Nortel and the North American market.

**Issue 6: The Deployment of Optic Fibre for Transmission**

AOTC had four main types of transmission links in the interexchange network; analogue radio, co-axial cable, digital radio and optical fibre – see Figure 3.

![Figure 3. 1991 - The Telecom Broadband Network](image)

The transmission capacity of optical fibre was rocketing; within twelve months 2.5 Gigabit/sec optical fibre capacity was expected to be available, and within four years 10 Gigabit/sec; equivalent to 32,000 calls and 131,000 calls respectively. Optical fibre was rapidly driving down the construction and operating costs of transmission and consequently the cost of long distance calls. Fibre was immune to electrical interference; there was no cross-talk between signals in different cables, and no pickup of environmental “noise”. It was safe to use for protecting communications equipment in high voltage environments, such as power generation facilities or metal communication structures prone to lightning strikes,
and could be used in environments where explosive fumes were present. Optic fibre cables were superior in every respect to the old transmission systems: wires on open poles, co-axial cable and microwave radio transmission.

The enormous capacity offered by fibre changed the design approach to transmission links. In 1992 the towns of Longreach with only 4,000 residents and Mt Isa with only a few thousand more, were linked that year by a standard fibre cable with the east coast. Overnight Longreach could make up to about 52,000 simultaneous calls to the outside world, compared to a dozen simultaneous calls on copper wires. If every fibre channel was activated, the capacity was far more than needed to link the whole of outback Queensland simultaneously. The fibres in the cable were such a minor part of these costs that it was uneconomic to install a lower capacity cable. At the same time the technical staff at Longreach was reduced to five; down to a fraction of the several dozen or so linesmen and engineers needed to service the region twenty years before.

By 1992 the main inter-capital routes were linked by optic fibre with some residual coaxial cable and radio links. Fibre also linked a number of the regional towns.

It was crucial to accelerate the fibre deployment to meet the expected higher growth in traffic and to match Optus' network performance, reliability and operating costs.

**Issue 7: The Influence of Local & Wide Area Networks**

The influence of the emerging LAN and WAN networks was unclear. LAN networks were a conceptual “loop”, usually of fibre, linking customers within a relatively limited area such as a building. WAN networks were a “loop” which covered a wider area such as a central business district, commercial or industrial suburb, or a corporate network within a suburb.

While these networks usually didn’t provide the range of features of a public network they were often more cost-effective and efficient without them. When they were not connected with the internet, they also provided advantages of privacy and security.

LANs and WANs could be constructed by a competitor or a large business customer.

In the early 1990’s it was not clear how important and pervasive these types of networks would be and what effect, if any, they would have on national telecommunications networks, particularly in CBD’s and business clusters in metropolitan areas.

**Issue 8: The Effect of Wireless Technologies**

By the end of 1992 the number of mobile customers on the AMPS mobile network was approaching 400,000 and climbing rapidly. Resale of Telecom’s AMPS network by Optus and Arena from about mid-1992 and GSM network competition from about mid 1993 was
expected to cause growth to rocket, perhaps reaching 3 million in 1996, year five. (In the event it reached 3.6 million).

Digital radio technologies could be used for a far wider range of services including security and remote services, and future technologies would likely hugely increase capacity for a given radio spectrum and potentially reduce access and call costs.

It was speculative how much traffic would enter the landline network through the mobile switching centres and to what extent radio would replace the landline networks.

**Issue 9: Local Loop Capacity**

A major generator of traffic growth would be the rapid growth in local loop capacity which would accelerate the already rapid demand for data services.

A number of large businesses were already connected by optic fibre over the local loop and, to anticipate the Optus rollout, AOTC would ramp up be the fibre connection of other large and medium businesses over the planning period, and particularly business clusters in the major cities.

Residential and small businesses were also expected to demand the range of new services such as database access with faster response times, faster download speeds, superior graphics, video downloading capability and soon cable TV. Such services would require far higher transmission capacity and digital capability in the local loop. Most of these customers were connected by single or multi-pair copper telephone cables and used data services through data modems, either conventional voice-band modems (such as 56KB/second or 128KB/second) or the emerging ADSL types of modems. ADSL modems were performing at 256 Kb/second and speeds substantially beyond 256kb were already in prospect.

The accelerating demand for data access, the rising capacity of new transmission technologies – HDSL, ADSL, VHADSL and digital radio – and the further deployment of optic fibre in the local loop raised two issues: the technical and commercial viability of Basic Rate and Primary Rate ISDN launched in 1989 which now seemed certain to be obsolete, and the acceleration in the growth of traffic through the local exchange to the network.

**Issue 10: Emerging and Transforming Network Technologies**

In the early 1980’s simple digital and packet switched networks were introduced mainly for private networks, such as those connecting bank ATMs, retail Point-of-Sale terminals and similar services. These were essentially “overlay” networks on the analogue telephone and data networks as previously discussed.
Towards the late 1980's far more powerful and efficient network concepts began to emerge based on international telecommunications standards such as Asynchronous Transfer Mode (ATM) for switching, Synchronous Digital Hierarchy (SDH) for transmission, and in the early 1990s the Internet Protocol (IP) for deploying the emerging Internet.

ATM was expected to be the switching technology to replace AOTC's existing 64kbit/s circuit-based switches, initially as a high-speed cross-connect function moving towards full narrowband and broadband switching from around 1995.

The IP standard was particularly interesting; every computer on the internet would have a unique IP address allowing a worldwide network of computers and computer networks to conveniently communicate with each other. While in 1991 less than 5% of the information flowing through the telecommunications networks was on "Internet-type" service, it might be that by 2000 this proportion could exceed 50%.

These new technologies offered enormous benefits and were key elements in building a future competitive and world parity network.

**Issue 11: The Interface between AOTC's Network and Commercial Operational Systems**

The AOTC network interfaced with five conceptual customer service systems for the four business units – sales, installation and repair of customer premises equipment; activation and restoration of network services; billing; and customer service.

The customer systems inherited by AOTC operated within an architecture which bordered on chaotic, and most were at least 10-15 years behind similar large private sector businesses, and were uncompetitive with the systems to be used by Optus and Arena.

A typical model systems architecture, and the model expected to be used by competitors, consisted of one set of customer systems operating with one product/service data base containing the complete product/service range; one customer data base containing all of the customers; and one transaction data base. AOTC operated at least five customer systems and related data bases – the telephone service order system (DCRIS), the telephone billing system (CABS), data services (eg. DDN and AUSTPAC), mobiles and directory publishing.

The telephone and data systems were uncompetitive, having been internally designed, developed and installed over 10 years before and urgently needed to be replaced within two years. The mobile and directory publishing systems had been installed some four years before and would likely be replaced in 3-4 years.
The network strategy would provide one interface with the current customer systems in the short term but anticipate the requirements of one new comprehensive system to be introduced over the next few years.

**Issue 12: Asset Re-valuation of the Network**

The AOTC network had been built over decades as a monopoly and was depreciated at leisure.

Network competition would render much of the network obsolete and seriously reduce the asset lives of the remainder. AOTC was now a trading corporation and could not escape the standard commercial asset valuation principles.

A complete and fundamental review of the asset value of the network was required over the next year.

**Issue 13: Funding**

Transforming AOTC’s networks would be expensive and capital intensive.

Table 2 is an indication of the "budget" inherited from Telecom and OTC for purchases of equipment, but was based on the "past rate of improvement".

An accelerated network transformation could increase this budget by more than 20%.

**Table 2: AOTC - Initial Estimates of Purchases - 1992/97**

<table>
<thead>
<tr>
<th></th>
<th>92/93 $ millions (1991/92 prices)</th>
<th>93/94</th>
<th>94/95</th>
<th>95/96</th>
<th>96/97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Network</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching (incl. mobile)</td>
<td>633</td>
<td>601</td>
<td>578</td>
<td>563</td>
<td>551</td>
</tr>
<tr>
<td>Transmission</td>
<td>488</td>
<td>440</td>
<td>420</td>
<td>430</td>
<td>410</td>
</tr>
<tr>
<td>Customer Access Network</td>
<td>479</td>
<td>506</td>
<td>542</td>
<td>578</td>
<td>641</td>
</tr>
<tr>
<td>International Network</td>
<td>138</td>
<td>118</td>
<td>47</td>
<td>144</td>
<td>123</td>
</tr>
<tr>
<td>Offshore operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,367</td>
<td>2,307</td>
<td>2,206</td>
<td>2,261</td>
<td>2,276</td>
</tr>
</tbody>
</table>

Notes:
- The figures were consolidated without analysis from Telecom and OTC.
- Mainframe equipment and software for all operations other than the network – commercial, supply, accounting, finance etc – are excluded.
- Network Services was not responsible for the Customer Access Network.

Network Products was due to propose budgets and business plans to the AOTC Board about May and September. Serious "write downs" in the value of the network together with a higher capital program to achieve a network transformation would be proposed. To be credible the business plan had to drive revenue growth and savings in operating costs.
beyond the current "inherited" projections to offset increases in capital investment; that is, the cash flow had to be roughly maintained.

**Issue 14: The Network Construction Business**

Telstra's Network Construction business was one of the largest businesses of its type in Australia. It built perhaps 80% of Telstra's capital program and employed about 7,200 people. Performance was hindered by the public service culture, obstructive work practices, serious overstaffing, and almost complete unionisation of the work force.

Large and rapid improvements needed to be achieved in construction capacity and flexibility and the quality of customer service, and construction costs reduced, perhaps by more than 20%. It was crucial to realise the potential and substantial savings early to contribute to offsetting increases in capital investment, and drive construction costs to at least at parity with competitors, if not lower. It was likely that this could only be achieved by drastic action, perhaps separation from AOTC and sale of the business.

**Issue 15: Satellite Services**

In the past satellites had proved useful to Telecom for remote telecommunications and for some broadcasting services. However, satellites did not appear to be as strategically important to AOTC in the competitive market for the next five years.

**Developing and Modelling the Business Plan**

A “first order” Optus-competitive network transformation plan was to be proposed by July and a World parity plan by the early 1993.

Deciding how to transform the network was challenging enough, but how would operating and financial performance requirements be achieved? How would operating costs be reduced by (say) 30%? How could tariff changes be made within 24 hours?

As indicated in Actions 6+, the “Network Planning Task Force” used an iterative modelling and planning approach. When the “base case” was constructed and as better information became available, a series of more ambitious plans were produced. With each new and better plan the network planners tested their confidence that it was practical, the risk controlled and manageable, and was a reasonable basis for the next better plan.

**Plan A** was the best guess the team could make about the inherited consolidated plan. The first year estimates for staff and costs continued to move upwards for several months as staff numbers continued to increase due to "offloading" from other areas. By May, 1992, more than 500 staff than expected arrived in Network Services. Even though staff numbers were
being reduced from the first month, the 1992/93 financial year began with 120 more people than the initial consolidation.

**Plan B** was the first attempt at achieving improvement above Plan A and the corporate ROE of 18%. The approach was the old Telecom “improvement as usual”. The result was not worth noting other than as a guide to how hard the transformation task was.

**Plan C** aimed to achieve world’s best practice in 1997/98 based on the old accounting rules. It showed some improvement but nowhere near enough. This plan was adopted for the budget and business plan for the next financial year, even though it carried a large risk as the implementation plan was not fully completed.

**Plan D** was available in early July, 1992, was a fundamental review, and was the first encouragement that progress was finally being made. The plan was fully market driven with the requirements of the retail divisions for services and wholesale prices, was competitive with Optus, and achieved a cost reduction over five years of 18%.


<table>
<thead>
<tr>
<th>Plan</th>
<th>92/93</th>
<th>93/94</th>
<th>94/95</th>
<th>95/96</th>
<th>96/97</th>
<th>97/98</th>
<th>Change 92/98 (%)</th>
<th>Staff</th>
<th>Year 1/Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 92</td>
<td>Inherited consolidation</td>
<td>A</td>
<td>1,651</td>
<td>1,593</td>
<td>1,602</td>
<td>1,620</td>
<td>1,673</td>
<td>+1%</td>
<td>16225/13818</td>
</tr>
<tr>
<td>Mar 92</td>
<td>“First Order”</td>
<td>C</td>
<td>1,679</td>
<td>1,583</td>
<td>1,549</td>
<td>1,510</td>
<td>1,514</td>
<td>-10%</td>
<td>15918/12644</td>
</tr>
<tr>
<td>July 92</td>
<td>D</td>
<td>1,748</td>
<td>1,730</td>
<td>1,608</td>
<td>1,458</td>
<td>1,542</td>
<td>11,425</td>
<td>-18%</td>
<td>17527/11456</td>
</tr>
<tr>
<td>Nov 92</td>
<td>Indicative FMO</td>
<td></td>
<td>1,748</td>
<td>1,694</td>
<td>1,586</td>
<td>1,484</td>
<td>1,429</td>
<td>-20%</td>
<td>17527/10474</td>
</tr>
</tbody>
</table>

Note:
- The financials and staff include Network Construction even though the intention was to initially separate and then perhaps sell the business in year 3.
- The financials for 1992/93 show how costs continued to arrive for months after the Division was formed.

Two major factors greatly affecting cost projections were the reductions in values and write-offs for existing equipment and the accelerated rates of depreciation, both driven by competition.

Adopting Plan D for the 1992/93 business plan was a risk; as with Plan C, there were still implementation gaps. Implementation began immediately, ahead of Board approval in October.

While Plan D was now the standard, it was clearly not good enough – see "Plan D" later.

Meanwhile, the Network Planning team moved on to the next iteration, the FMO, which was available in early 1993, and would deliver world parity in market, technical and financial performance by year five.
Table 3 attempts to show the iterative approach used but is only illustrative. Numbers are only indicative.

**Plan D**

Plan D was first suggested by the project team in June 1992, some five months after the business was formed. The aims were to:

- maximise AOTC’s market share by moving to benchmark and covering Optus’ network and service rollout,
- increase the return on assets towards the corporate target of 18%,
- stimulate revenue generation opportunities to at least offset any additional costs and capital requirements,
- assess the true value of the network assets in the new competitive market.

The old Telecom strategy was unfocussed and wasteful of capital; if continued it estimated that it would provide a fully digitised network by 2002 at a capital investment of nearly $3 billion. The network would not be competitive with Optus in some areas for several years after Optus entered the market. There was minimal feature interworking between the domestic fixed network, the mobile network and the international network.

**Plan D had two stages and five steps** working in parallel and co-ordinated, see Figure 4.

Stage 1 consisted of three steps moving towards digitising the core network.

- **Step 1** accelerated the digitisation and simplification of the core interexchange network. This would be completed in two years.

  All existing analogue switching components would be removed making the core network fully digital one year after Optus began operations. The feature range, service quality and reliability would be competitive and construction and operating costs would be substantially reduced.

- **Step 2** connected all remaining analogue switches in the metropolitan areas to digital switches by optical fibre within the next two years at a cost of less than $40 million.

  Until these switches were replaced they could provide some features available on digital switches. This made feature provision competitive with the Optus network in all vulnerable metropolitan areas, increased revenue and further reduced construction and operating costs.
• **Step 3** extended the competitiveness and cost benefits of Step 2. It provided more digital functions and features currently available from the connected analogue switches within two years until those switches were replaced.

This was to be achieved by upgrading the software in analogue switches at a cost of about $20 million over two years, to be completed in three years, and digitising terminal exchanges.

Stage 2 consisted of two steps:

• **Step 4** accelerated the connection by optic fibre of business customers most vulnerable to Optus in the contested areas ahead of the Optus rollout.

Optic fibre improved the provision and restoration of services, improved call quality and revenue generation, and reduced construction and operating costs.

There were over 2,500 businesses with 30 telephone lines or more, with only a few connected by optic fibre. Almost all of these would be connected by fibre in the first year and another 1,500 connected in the next year. These customers were to be connected in order of revenue potential and vulnerability to Optus.

Customers with fewer telephone lines in those areas would be connected opportunistically or after the larger customers in order of revenue potential.

• **Step 5** integrated the service provision and operations across the four “intelligent” digital platforms, the domestic fixed, the mobile and the international networks. The customer features such as 1300 numbers and operational capabilities provided by each platform could then appear the same to customers, and service provision, restoration and billing could be integrated.

Optus, with one intelligent network platform from one switch vendor, Nortel DMS, would have this capability by mid-1993.

Interworking would increase revenue generation per customer, slow the loss of customers to Optus and reduce operating costs.

Plan D provided a hybrid digital network, not a fully digital network, but apart from this major flaw most of the other requirements of the plan appeared to be met:

• the projected growth in the customer base and the major growth in traffic under competition appeared to be covered,

• the product and service development demanded by the customer divisions would be delivered on schedule and covered the Optus range in the contested areas ahead of the Optus rollout,
• the network was simplified and fully digitised ahead in the contested areas,

• it even appeared that, with a more focussed investment, improved revenue generation, higher customer retention under competition, and declining operating costs and equipment costs, the business case might move towards cash flow neutral, at least in the first two years where the plan was clearer.

• AOTC was better prepared if the Labor Government relaxed the regulatory rules to further benefit Optus and Arena (later Vodafone), or if a Coalition government brought forward full network deregulation before 1997.

(Domestic Fixed) Network Strategy Directions

The shortfalls from benchmark and the main deficiencies against the Optus network were well known and there were still major challenges:

• in the areas yet to be contested charging and billing capabilities and the availability of the range of new services was limited. Apart from service provision being limited it was often inconvenient; a current customer connected to an analogue or stored program exchange who wanted some of the new "non-basic" telephone services had to accept a number change,

• the network management and operating systems still had to be transformed,
• the information systems for the network and interfaces with the corporate order
  processing, fault repair and billing had to be almost completely upgraded.

• the network equipment and software suppliers had to considerably improve on past
  performance,

• it was closer to benchmark network performance but there were still huge gaps,

• operating costs and capital equipment costs had to be reduced further to meet
  corporate requirements by as yet unknown amount, perhaps more than 15%,

• the unions needed to agree to major changes in the network workforce structure, job
  specifications, gradings and remuneration, and a reduction over five years of more
  than 3,000.

• Separate union agreements were needed to outsource more of the network
  construction work, make the construction business an arm's length subsidiary as a
  first step to perhaps sell the business and, as a consequence, reduce staff by perhaps
  2,000.

• while traumatic change was progressing, the culture of the business technical to be
  transformed from "public service" and preoccupation to an aggressive focus on
  customer service, service quality and profit.

Nationally, compared with the Optus network and benchmark, the AOTC network service
range, service quality and reliability levels were still markedly lower, operating costs were
considerably higher, and consequently the return on assets was lower.

Plan D's competitiveness and the move towards benchmark was an immense relief. For the
first time in AOTC the main players, even the engineers, could more fully understand the
threat from Optus and how it would be covered. However, the implementation risks were
huge.

The Future Mode of Operation

Plan D was intended to cover Optus and approach benchmark performance over the next five
years with known technologies but with a limited understanding of how world leaders were
tackling the network development task.

The best guess was that, based on the experience and progress in the USA and the
benchmarking studies done by BAH in 1991 and CMP in 1992, AOTC was operating in 1992
as an RBOC roughly in a 1986 timeframe. The CMP study also provided an understanding
and an indication of likely performance in the USA in five years. AOTC's challenge was to
achieve the projected US performance in year five within five years. That is, ten years progress in five.

Further, as mentioned, the Plan D network was a hybrid network, not a digital best practice network, and there were a number of crucial factors not achieved by Plan D:

- the network was not fully digital;
- the number of switching technologies were not reduced from five to one or two; and
- the number of transmission technologies would not be reduced towards two – optic fibre and radio. The skills required to design maintain and operate the analogue technologies would not be completely eliminated.

A "first order" network model for 1997 – the FMO – was proposed towards the end of 1992.

Crude representations of the network are provided in Figures 5 and 6. These are early, simple illustrations of the transition from the AOTC network in 1992 to the FMO network in 1997.

Figure 5. Target Network Architecture - 1992 to 1997

The FMO allowed a range of issues and variables to be examined, such as product and service range; revenue generation; traffic capacity against the expected huge growth in demand; deployment of new technologies such as ATM and SDH; operational systems for network performance and monitoring; cost reduction; benchmark achievement; etc; and the
model was modified as more became known and confidence developed. By early 1993 the FMO began to clarify sufficiently to suggest broad numbers for a business plan and related trading statement.

Some of the main elements of the FMO network were clear:

- a simple network structure with minimal technology types and locations. The switching architecture appeared to have two levels – Regional nodes and Sector nodes – which would replace the current telephone and overlay networks.

- the Regional nodes – perhaps two to four in each capital city and possibly one in other large cities – would provide gateways to other local and offshore carriers and large service providers.

- A Regional node might be co-located with a Sector node to reduce capital and operating costs.

- Sector nodes would integrate call switching for the mobile and fixed networks including narrowband (64 kbit/s) switching for the PSTN/ISDN and broadband services. Network Management Centres would usually be co-located with selected Sector nodes. All service moves and changes in the CAN would be performed remotely.

- a simpler transmission network and levels of cross connection to increase reliability and redundancy – eventually an all optical fibre and SDH interexchange network,

- Remote nodes, unstaffed, would replace the majority of the current local exchanges to concentrate traffic from the Customer Access Network (CAN). RIMs would be used to increase optic fibre penetration in the CAN although there seemed to be some work needed to ensure feature transparency.

- there would be fully automated processes for all services and no differentiation across market sectors,

- A common set of customer/commercial operational systems would support all business units and products with a single customer data base and customer contact structure – sales, installation, repair, activation, billing and customer service,

- common systems, processes and work centres for managing and operating the network across the fixed, mobile and international infrastructures.
While the theoretical 1997 network was becoming clear, how to get there was still a massive challenge. Three broad options were developed, with different speeds of implementation and risk; the faster the implementation the higher the risk. Some of the factors considered were full digitisation beyond the contested areas; IT evolution; property site shedding; switch vendor reduction; and involuntary redundancy (redundancy in Telecom and Telstra to this stage had been voluntary). The incremental expenses and capital required in the early years...
appeared to be low, less than $30-40 million per year, but the risks were daunting. For example:

- the network management and operating systems had to be rationalised and transformed,

- the information systems for the network and interfaces with the corporate order processing, fault repair and billing had to be almost completely upgraded.

- capital equipment costs had to be reduced by more than historic rates, perhaps more than 15%, to reach cost reduction targets,

- network equipment and software suppliers had to considerably improve on past performance,

- the unions faced unprecedented pressure in the face of staff reductions approaching 8,000 and huge changes in the workforce structure over five years.

- while the workforce was being reshaped and falling, the culture of the business would be forced to change from technical preoccupation and public service ethos to aggressive customer focus, service quality, productivity improvement and cost reduction.

This would be difficult. BAH had commented in 1991 that, based on the US experience, when responding to competition in the industry, culture change in Telecom was slow; it would be two to six years before real change emerged.

Figures 7 and 8 provide an indication of the some of the thinking in the FMO plan.

**Benchmarking and Process Re-engineering**

Cresap, McCormack & Paget (CMP), a world-respected consultant specialising in benchmarking in telecommunications, reported AOTC's performance against operators in the USA in June. The results were daunting.

Table 4 provides some of the results. The "1992/93 Target" column shows some of the performance improvements achieved in the early months.

A common claim in Telecom over its 16 years was that the network was "world class". CMP confirmed the 1991 study that, at best, AOTC’s domestic network ranked similar to an AT&T regional operating company in the USA about 1986.

The briefing of results of the study by CMP to the Division's senior managers was a sobering experience. As each parameter was raised the managers were asked to consider how they intended to bridge the performance gaps.
Table 4: Network Services - Rough Initial Benchmarks as at June 1992

<table>
<thead>
<tr>
<th>Key Benchmarks</th>
<th>1991/92 Expected</th>
<th>Target</th>
<th>1992/93 Target</th>
<th>WBP Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations $ per access line</td>
<td>70</td>
<td>65</td>
<td>58</td>
<td>12</td>
</tr>
<tr>
<td>Capital $ per Primary switched end</td>
<td>345</td>
<td>309</td>
<td>200</td>
<td>145</td>
</tr>
<tr>
<td>Capital $ per transmission</td>
<td>1556</td>
<td>1367</td>
<td>1000*</td>
<td>556</td>
</tr>
<tr>
<td>2Mb Ports $ per Operational Fibre km</td>
<td>800</td>
<td>746</td>
<td>700</td>
<td>100</td>
</tr>
<tr>
<td>Customer Downtime at Exchange (AXE) mins per year</td>
<td>116</td>
<td>82</td>
<td>88</td>
<td>28</td>
</tr>
</tbody>
</table>

Technology

<table>
<thead>
<tr>
<th></th>
<th>1991/92</th>
<th>1992/93</th>
<th>WBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of Board Failures (AXE) per 1,000 lines</td>
<td>9.9</td>
<td>5</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of Board Failures (DMS) per 1,000 line</td>
<td>8.1</td>
<td>5</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Network Congestion

<table>
<thead>
<tr>
<th></th>
<th>1991/92</th>
<th>1992/93</th>
<th>WBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro – AXE</td>
<td>89.6%</td>
<td>90.9%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Total</td>
<td>91.0%</td>
<td>91.1%</td>
<td>1%</td>
</tr>
<tr>
<td>Cable (Metro)</td>
<td>63.6%</td>
<td>64.3%</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

Transmission Performance

- % of inter-capital paths failing to meet CCITT objectives: 10.0% to be determined
- Unavailability of inter-capital paths: 5.0% 3.0%
Notes:
- "Expected" is the level inherited in the Telecom/OTC business plans for 1991/92.
- 1991/92 "Target" was the intent to be achieved in the current financial year after four months operation.
- 1992/93 "Target" was the intent for the next financial year.
- To be confirmed by CMP.

There was some dismay, for example, when the AXE exchange downtime was proposed to fall from 116 minutes per year to 28 minutes over five years but, after some discussion, the responsible managers accepted the challenge. After the meeting, the CMP managing partner observed that while the benchmark in 1992 was 28 minutes, AT&T was expecting 12 minutes for 1997.

The CMP benchmarks were progressively adopted into the business plan as credible implementation plans were developed.

Discussions with the AOTC, Network Products Management and People around Australia

Briefings of the business plan including Plan D and an early outline of the FMO were provided in all states, the first during two weeks in July 1992. The sessions were attended by the Network Products management, staff and union officials and any other AOTC people who were interested. The numbers varied from about 500 in each of Sydney and Melbourne to about 100 in Hobart.

Considering the issues involved all of the meetings were peaceful and even thoughtful. All appeared to understand the need for rapid and sweeping change; perhaps a majority agreed in principle with the plan, but understandably only a minority supported it in practice. A surprising number responded positively with guarded enthusiasm, but some were angry and some bitter. As expected, most were worried and some fearful of the effect on their careers and incomes as a result of drastic changes in technology, workforce structures and work practices, and a serious reduction in the workforce.

There was some bluster from the union officers but it was controlled and did not hinder the discussion of the main points. At several meetings the Australian Telecommunications Employees Association (ATEA) officials and members raised the elephant in the room – the possibility of industrial action to defend their career structures, conditions and jobs as happened in the late 1970’s and early 1980’s. This option for the union was openly conceded.

The union people were invited to compare those times with the current scene in 1992. The industrial action in 1978 was about introducing technology change just as was being discussed now; the ATEA objected to Telecom’s $2 billion plan to introduce stored program computer controlled (SPC) exchanges, and after a nationwide and painful industrial action,
gained major concessions. ATEA officers were reminded that their ATEA predecessors boasted that “the technology will be settled on our terms, not theirs”. A year or so later the ATEA fought for a $20 per week rise, which was substantially won, but this was one reason that AUSSAT, an alternative carrier, was established and the deregulation of the telecommunications market was now taking place.

The telecommunications market in 1992 was vastly different from that in the late 1970’s. There were alternative carriers to Telecom – Optus and Arena. Customers now had a choice. Their first chance to make that choice was during pre-selection which would begin shortly, and from June 1993 they would have a second choice when Optus launched its new “state-of-the-art” network.

The industrial action in the late 1970’s seriously and permanently damaged any faith that many customers – particularly the large and important business customers – had about the reliability of the Telecom network operated under a monopoly, and soon they would have another option.

The overwhelming argument for change in the network was the known plans of Optus. Optus would have a state-of-the-art network able to deliver a very attractive range of products and services, a high and reliable quality of service, and low construction and operating costs which allowed price packages lower than AOTC would offer. AOTC’s market was vulnerable in over 90% of Australia, particularly in the central business districts and business centres of the capital cities where work structures, and practices were the most restrictive.

Industrial action might win short term concessions, but inevitably a heavy price would be paid by all AOTC workers throughout Australia as competition strengthened.

The presentations provided AOTC’s staff and unions with the opportunity to assess the plan. The sense was that at least they appreciated candour, understood the rationale, had no illusions about the determination to implement the plan, and understood the consequences.

The AOTC Board

A presentation of Plan D and the emerging FMO was made to the AOTC Board in early October.

The network strategy was the most important issue facing AOTC. Within several months the board would be asked to approve the largest capital investment program the PMG, Telecom and AOTC had faced and this strategy was the broad rationale. There was a short briefing on the interexchange network, the Optus network rollout and its implications, and the performance gaps from benchmark performance provided by CMP.
Next was the strategy; coverage ahead of the Optus rollout, benchmark performance within five years, direct cost operating reductions exceeding 20% for a far larger network within five years, productivity improvement which would lead to workforce reduction from about 18,000 to about 13,000, about 30% in five years – 8,000 if Network Construction was sold.

The network would be transformed. It would be simpler, far more reliable and efficient, with substantially lower operating costs. The switching would be fully digitised in the areas of competitive risk and almost fully digitised within five years. All analogue links between trunk exchanges would be digitised. New intelligent exchanges would be introduced in high risk and high revenue potential areas to lead competitors and accelerate revenue growth.

The strategy carried enormous technical, supplier and industrial risks which had to be faced. The strategy was still evolving, the aim was for even stronger results, and the risks would be progressively reduced as the plan was clarified and the implications and risks better understood.

The board members accepted the outline without qualification.

**The 1993/98 Business Plan**

The tables in this section have been drawn from various sources, some of which were compiled at different times, so there is inconsistency between tables. The intention is to indicate processes and broad outcomes.

The 1993/98 business plan, including the outline of the FMO, was approved in March 1993, see Table 5.

This was the first trading statement and plan ever produced inside the PMG, Telecom and Telstra for a network which would be competitive and directed towards world parity.

The huge differences between the "first order" trading statement compiled in February, 1992 (Table 1) and Table 5 compiled in March, 1993 provide some understanding of the difficulty in obtaining a sound planning data base and matching changes in financial projections with a new iteration of the network plan.

There had been satisfactory progress since January 1992 but insufficient:

- the Optus rollout had been covered,
- Plan D was solid with partial transformation across much of the network,
- the FMO, the plan for benchmark parity in five years, seemed credible. There was still considerable detail to be clarified, major decisions to be made, risks assessed and managed, and detailed planning to be completed.
The trading statement was at future prices. Profit is only shown to keep pressure on revenue and costs; in practice the intent was to "breakeven" and distribute profits to the Telstra retail groups. The business plan includes Network Construction which was intended to be separated within the next year or so and perhaps sold.

Substantial reductions in equipment prices are partly offset by rising wages and redundancies. Major savings were expected in properties due a large reduction in the number of exchanges and smaller footprints for exchange equipment and computers. A substantial fall in the number of motor vehicles was also expected due to usage efficiencies and falling staff levels.

As previously noted, some of the consequences resulting from the new competitive market - asset revaluations, large write-offs, and faster depreciation higher capital investment - masked the large cost reduction projected over the period.

<table>
<thead>
<tr>
<th>Table 5: Network Products - Business Plan - 1993/98</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
</tr>
<tr>
<td>- Interconnect (Est)</td>
</tr>
<tr>
<td>92/93 93/94 94/95 95/96 96/97 97/98</td>
</tr>
<tr>
<td>$ millions (future prices)</td>
</tr>
<tr>
<td>Interconnect</td>
</tr>
<tr>
<td>65 222 316 602 709 757</td>
</tr>
<tr>
<td>QPSX</td>
</tr>
<tr>
<td>7 11 20 35 51 66</td>
</tr>
<tr>
<td>Internal Revenue</td>
</tr>
<tr>
<td>3748 3721 3655 3604 3617 3699</td>
</tr>
<tr>
<td>Total Revenue</td>
</tr>
<tr>
<td>3820 3954 3991 4241 4377 4522</td>
</tr>
<tr>
<td>Expenses</td>
</tr>
<tr>
<td>Direct Internal Expense</td>
</tr>
<tr>
<td>1060 1121 1054 1023 994 995</td>
</tr>
<tr>
<td>Redundancy</td>
</tr>
<tr>
<td>58 80 59 57 29 30</td>
</tr>
<tr>
<td>SRU</td>
</tr>
<tr>
<td>627 705 753 768 797 823</td>
</tr>
<tr>
<td>QPSX</td>
</tr>
<tr>
<td>5 8 11 16 26 33</td>
</tr>
<tr>
<td>Total Expenses</td>
</tr>
<tr>
<td>1750 1914 1877 1864 1846 1881</td>
</tr>
<tr>
<td>Other Expenses</td>
</tr>
<tr>
<td>Internal Coms</td>
</tr>
<tr>
<td>73 54 52 49 9 49</td>
</tr>
<tr>
<td>Product &amp; SRU</td>
</tr>
<tr>
<td>288 321 308 313 328 339</td>
</tr>
<tr>
<td>COGS (asset sales)</td>
</tr>
<tr>
<td>255 242 217 182 171 170</td>
</tr>
<tr>
<td>Depreciation</td>
</tr>
<tr>
<td>1000 1008 1024 1048 1104 1160</td>
</tr>
<tr>
<td>Total Expenses (exc Int.)</td>
</tr>
<tr>
<td>3368 3539 3478 3456 3498 3599</td>
</tr>
<tr>
<td>EBIT</td>
</tr>
<tr>
<td>454 415 513 785 879 923</td>
</tr>
<tr>
<td>Interest</td>
</tr>
<tr>
<td>308 347 351 352 348 339</td>
</tr>
<tr>
<td>Profit before Tax</td>
</tr>
<tr>
<td>146 68 162 433 531 584</td>
</tr>
</tbody>
</table>

Notes:
- Interconnect Revenue is revenue received at regulated or negotiated wholesale prices from other licensed carriers, specifically Optus and Arena. This revenue increased markedly as Optus begins network operations in April 1993, and Arena in November 1993.
- QPSX was a joint venture established between Telecom and a small start-up company, QPSX Communications Pty. Ltd, in 1987.
- Internal Revenue is that received from the customer divisions for services provided at wholesale prices. Although the range of services provided increases by over 20% and service volumes almost double over the five year period, revenue falls due declining wholesale prices.
- Direct internal Expenses are expenses incurred within the division.
• SRU expenses are for services provided by other AOTC areas such as information systems, supply, finance and accounting and human resources.
• Depreciation increases marginally as cost reductions fund a large share of the increase in capital investment.

Table 6: Network Products - Revenue by Customer Segment - 1992/98

<table>
<thead>
<tr>
<th></th>
<th>92/93</th>
<th>92/94</th>
<th>93/94</th>
<th>94/95</th>
<th>95/96</th>
<th>96/97</th>
<th>97/98</th>
<th>97/98</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Total</td>
<td></td>
<td>3 Est</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td>40</td>
<td>1520</td>
<td>1620</td>
<td>1614</td>
<td>1607</td>
<td>1623</td>
<td>1670</td>
<td>37</td>
</tr>
<tr>
<td>Commercial</td>
<td>20</td>
<td>738</td>
<td>570</td>
<td>568</td>
<td>572</td>
<td>591</td>
<td>627</td>
<td>14</td>
</tr>
<tr>
<td>Corporate &amp; Government</td>
<td>24</td>
<td>892</td>
<td>954</td>
<td>927</td>
<td>912</td>
<td>904</td>
<td>906</td>
<td>20</td>
</tr>
<tr>
<td>Enterprises</td>
<td>10</td>
<td>387</td>
<td>336</td>
<td>314</td>
<td>281</td>
<td>270</td>
<td>267</td>
<td>6</td>
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<tr>
<td>International</td>
<td>1</td>
<td>29</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>34</td>
<td>1</td>
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<tr>
<td>ITG</td>
<td>3</td>
<td>120</td>
<td>208</td>
<td>201</td>
<td>200</td>
<td>198</td>
<td>196</td>
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<tr>
<td>Carrier Revenue</td>
<td>2</td>
<td>68</td>
<td>221</td>
<td>316</td>
<td>602</td>
<td>709</td>
<td>757</td>
<td>17</td>
</tr>
<tr>
<td>QPSX Sales</td>
<td>0</td>
<td>7</td>
<td>11</td>
<td>20</td>
<td>35</td>
<td>51</td>
<td>66</td>
<td>1</td>
</tr>
<tr>
<td>Total Revenue</td>
<td>100</td>
<td>3761</td>
<td>3952</td>
<td>3992</td>
<td>4241</td>
<td>4378</td>
<td>4523</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 7: Network Products - Capital Investment Framework - 1993/98

<table>
<thead>
<tr>
<th></th>
<th>92/93</th>
<th>93/94</th>
<th>94/95</th>
<th>95/96</th>
<th>96/97</th>
<th>97/98</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Est) $ millions (1992/93 prices)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growing revenue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth Basic Services</td>
<td>739</td>
<td>625</td>
<td>605</td>
<td>603</td>
<td>563</td>
<td>525</td>
</tr>
<tr>
<td>Growth Advanced Services</td>
<td>107</td>
<td>94</td>
<td>83</td>
<td>82</td>
<td>77</td>
<td>70</td>
</tr>
<tr>
<td>Maintenance Revenue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Modernisation Accelerated</td>
<td>160</td>
<td>135</td>
<td>70</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Analogue Rationalisation (Plan D)</td>
<td>-</td>
<td>41</td>
<td>16</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Number Retention (Plan D)</td>
<td>-</td>
<td>11</td>
<td>22</td>
<td>24</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Network Transformation Post Plan D</td>
<td>-</td>
<td>2</td>
<td>31</td>
<td>88</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>AXE Upgrade</td>
<td>13</td>
<td>9</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SDH Strategic Investment</td>
<td>3</td>
<td>9</td>
<td>29</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DSPN Phase 2</td>
<td>-</td>
<td>22</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Network Performance Improvement</td>
<td>59</td>
<td>16</td>
<td>22</td>
<td>29</td>
<td>24</td>
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<tr>
<td>Design Labour</td>
<td>17</td>
<td>23</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Other Revenue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Communications Plant</td>
<td>-</td>
<td>73</td>
<td>62</td>
<td>52</td>
<td>43</td>
<td>40</td>
</tr>
<tr>
<td>Constructed by Others in AOTC</td>
<td>217</td>
<td>45</td>
<td>37</td>
<td>40</td>
<td>40</td>
<td>33</td>
</tr>
<tr>
<td>Non-Communications Plant</td>
<td>-</td>
<td>91</td>
<td>68</td>
<td>54</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>Total Capital</td>
<td>1,325</td>
<td>1,196</td>
<td>1,081</td>
<td>1,005</td>
<td>961</td>
<td>902</td>
</tr>
</tbody>
</table>

Notes:
• Basic Services include telephone access and calls, operator services.
• Advanced services include Centrex, Virtual Private Networks, ISDN
• The program only includes notional funding of FMO elements.

Table 6 shows the revenue projections for the Telstra retail divisions and the interconnecting carriers. After the first year or so the forecasts were speculative, but the trends were interesting. The Consumer sector projections assume that losses from the pre-selection
The process would be manageable. The Commercial (small and medium business) sector expects a fall in revenue while the Corporate and Government sector plans to hold revenue. These losses are partly offset by the revenue from the interconnecting carriers which moves from 2% of revenue to 17%.

Table 7 illustrates the capital investment framework and provides a very rough outline of the investment program. The figures are very early and tentative and would be considerably refined as the FMO program was further developed and the related investment was clearer.

Table 8: Network Products - Some Business Plan Services and Capability Objectives - 1993/98

<table>
<thead>
<tr>
<th>Service</th>
<th>93/94</th>
<th>97/98</th>
<th>97/98</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plan D</td>
<td>FMO</td>
<td></td>
</tr>
<tr>
<td>Customer Capability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLI Penetration</td>
<td>80%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>CLASS Capable Lines</td>
<td>35%</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>Number Retention</td>
<td>0%</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>Digital Access</td>
<td>0%</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>Ten Digit Numbering</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Electronic Metering</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Key Feature Transparency across</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic PSTN Activation</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Network Capability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital Lines</td>
<td>46%</td>
<td>72% (80% metro)</td>
<td>100%(metro)</td>
</tr>
<tr>
<td>Core Network Digital</td>
<td>70%</td>
<td>100% (by June, 1995)</td>
<td></td>
</tr>
<tr>
<td>Exchange Sites</td>
<td>4,963</td>
<td>4,650</td>
<td></td>
</tr>
<tr>
<td>Core PSTN Switch Stages</td>
<td>436</td>
<td>200 (220 by June, 1995)</td>
<td></td>
</tr>
<tr>
<td>AXE Variants</td>
<td>9</td>
<td>3 plus GSM</td>
<td></td>
</tr>
<tr>
<td>DMS IN Modes</td>
<td>8</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>ISDN Nodes</td>
<td>25</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Common Channel Signalling</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange Operations Regions</td>
<td>16</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Lines per EMG</td>
<td>120,000</td>
<td>1 million</td>
<td></td>
</tr>
<tr>
<td>Workforce Classifications</td>
<td>7</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Network Management Centres</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration between Core &amp; Network Systems</td>
<td>Low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Software Reuse</td>
<td>Low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Standard Interfaces</td>
<td>Low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Network Performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXE Downtime - mins per customer per year</td>
<td>110</td>
<td>25 (95/96)</td>
<td></td>
</tr>
<tr>
<td>AXE Fault Rate - per 100 lines per year</td>
<td>7</td>
<td>1 (97/98)</td>
<td></td>
</tr>
<tr>
<td>Inter-capital Unavailability</td>
<td>4%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Major Transmission Unplanned Outages - minutes per month</td>
<td>35</td>
<td>10 (97/98)</td>
<td></td>
</tr>
</tbody>
</table>
Note:
- These objectives were set in March 1993 and were expected to improve significantly as implementation proceeded with Plan D and with progress in finalising the FMO.

Tables 8 and 9 attempt to provide an idea of the huge transformation of the network. Note that the tables cover different time frames – 1993/98 and 1992/98 – and so are not comparable.

The transformation produces a radically simpler almost totally digital network.

Major savings would be made in switching accommodation; fewer switching and management centres released a significant number of exchange sites for sale, and in the exchange sites that would be retained, the footprint of the new exchange equipment was perhaps 10% of the old, leaving 80-90% of the floor areas unoccupied.

**Table 9: AOTC Network Transformation – 1992/98**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switching Infrastructure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Trunk Exchanges</td>
<td>25</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Network Group Switches</td>
<td>71</td>
<td>71</td>
<td>86</td>
</tr>
<tr>
<td>Minor Switching Centres</td>
<td>246</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro Tandems</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Group Switches</td>
<td>186</td>
<td>163</td>
<td>114</td>
</tr>
<tr>
<td>Independent Analogue Switches</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td>722</td>
<td>361</td>
<td>-</td>
</tr>
<tr>
<td>Minor</td>
<td>3,347</td>
<td>1,673</td>
<td>-</td>
</tr>
<tr>
<td><strong>Transmission Infrastructure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct Analogue -Analogue Circuits</td>
<td>67,310</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Trunk Routes</td>
<td>17</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td><strong>Overlay Switches</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISDN</td>
<td>25</td>
<td>35</td>
<td>44</td>
</tr>
<tr>
<td>IN</td>
<td>8</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Mobile</td>
<td>13</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td><strong>Competitors’ Switches</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optus</td>
<td>4</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Arena</td>
<td>-</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>3</td>
<td>?</td>
</tr>
</tbody>
</table>

Note:
- Table 8 was compiled early 1993, while this table was compiled about September 1992 when Plan D was becoming clear.

In Tables 8 and 9 the ISDN component was uncertain. The demand in 1993 was unconvincing, which might require the program to be levelled off and eventually terminated.

Network Products had come a long way in a year as indicated by the successive plans in Table 3. The accounting and planning people in the business made a giant contribution in
establishing the accounting system, aggregating the revenues, costs, capital and other resources from a large number of sources, validating this data, and building through a series of iterations and network planning refinements this outcome.

The Workforce and Industrial Relations

Table 10 shows the staff projections in the business plan. Staff totals are shown including and excluding Network Construction.

Broadly, including Network Construction, direct staff costs would fall by about 30% at constant prices and 18% at future prices. Staff numbers would fall from about 18,000 to about 12,000, about 6,000 (about 30%). Productivity in terms of Services in Operation (SIOs) would rise about 44%.

<table>
<thead>
<tr>
<th>Table 10: Network Products Business Plan - Staff Projections - 1992/98</th>
</tr>
</thead>
<tbody>
<tr>
<td>92/93</td>
</tr>
<tr>
<td>Network Engineering</td>
</tr>
<tr>
<td>Network Operations</td>
</tr>
<tr>
<td>Network Construction</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total excluding Construction</td>
</tr>
<tr>
<td>Direct Staff Costs</td>
</tr>
<tr>
<td>(92/93 prices)</td>
</tr>
<tr>
<td>(future prices)</td>
</tr>
<tr>
<td>Staff Productivity (per 1000 SIO's)</td>
</tr>
</tbody>
</table>

Note:
- Direct Staff Related costs include labour, training, fares and travel allowances.

The huge reduction in staff and the consequent redundancies might seem too callous. In fact, it is a classic case study of the effect of competition on a monopoly which delays or compromises the deployment of new technology over many years.

Over the previous 15 years, Telecom’s management and the unions persisted with the leisurely introduction and deployment of new technologies and persisted with inefficient work structures and practices. The result was slower and later delivery of new products and services causing lower revenue growth, a lower quality of service, and higher prices resulting from higher operating and construction costs. The capability and competitiveness of Australia’s infrastructure was compromised and Telecom/AOTC was more vulnerable to competition when, inevitably, the market was deregulated.
In Network Operations there were seven technical grades compared to Optus’ three. The range of wages was similar. Working hours were 36.75 hours per week compared to Optus, 38 hours. Most AOTC staff were full time, with few casuals.

In Network Construction the average weekly wage of external staff was $485 per week at a weekly employment cost of $564, compared to Optus staff $368 and $444. The average weekly wage of AOTC’s more technically qualified internal staff was $688 and a weekly employment cost of $800; Optus equivalents were $600 and $655. Telecom performed almost all of its construction with a dedicated work force. Optus sub-contracted almost all of their construction with flexible work forces and lower travel and accommodation costs.

In the previous three years in Telecom and the first year or so in AOTC redundancies were voluntary, which was unavoidable in the reigning industrial situation in Telecom. The policy was damaging as the best qualified and most valuable people were more motivated to leave, confident that they could build better, more highly paid careers in the new competitive telecommunications market. The redundancy conditions were generous by any standards, but more so for the times; 79 weeks maximum against Optus’ 40 weeks.

In both the operations area and construction areas the workforce rundown was thought to be achievable. In operations the network changes and workforce structures were already in action in digital networks in competitive markets in the USA. In the construction area the workforce structure and conditions were intended to be similar to large construction businesses in Australia such as Leighton and Lend Lease.

The intention was that AOTC would negotiate two enterprise agreements – one for each of network operations and network construction – covering the restructure and redeployment of the workforce and the large-scale redundancies.

The Network Operations agreement was expected to increase costs by about $60 million over five years and produce savings of about $220 million. The Network Construction agreement is discussed later.

The task of moving the staff towards customer-first behaviours, best management and working practices, and a performance culture with accountability was daunting. A flatter organisation, mass training in new technology and skills, large scale redeployment, outsourcing for non-core activities, all while implementing a complex and large network restructure, was a huge task.

**Network Construction**

Telstra’s Network Construction (TNC) business was probably the largest and most technically competent of its type in the southern hemisphere. It operated nationwide serving
both AOTC, government broadcasting policy for radio and television, and the ABC and SBS broadcasting networks. In the future it was capable of serving markets in the private market sector for telecommunications and broadcasting networks and infrastructure. The business employed over 7,000 highly-trained people located across Australia and thousands of items of construction equipment ranging from bulldozers to cranes and vehicles. It built perhaps 80% of Telstra’s capital program.

The business was a major problem for AOTC. The quality of customer service and construction flexibility had to be urgently and greatly improved. There was almost complete unionisation of the work force, with unions historically reluctant to allow improvements in productivity. This resulted in large, deeply entrenched, obstructive working practices and serious overstaffing which, together with a public service conditions and culture, inflated operating costs by over 20%. The management skills were largely technical with little business skills and experience.

While operating within AOTC it was unlikely that an enterprise agreement would allow performance and construction costs to become competitive with Optus and others within five years. Further, the scale of cost reductions would not free sufficient savings to assist in funding the expected higher capital investment likely required for transforming the network.

The only way to achieve rapid improvement within (say) two to three years was to move the business away from AOTC and progressively expose the business to open competition. Separating the business from Telstra as a subsidiary was a necessary but not sufficient step. To effectively focus the management and the workforce, allow industry norms for workforce operations and wages, and reduce obstruction by the unions, the business needed to be fully exposed to the market.

This could be achieved in two stages. Firstly, competition could be encouraged by seeking quotes for another (say) 10-20% of the construction work from both TNC and outside contractors over the next two years. This would allow TNC the opportunity to become more competitive, and would be a strong and practical signal to the construction business and others in Network Products that drastic change was expected. Secondly, when TNC’s operations were sufficiently commercial and competitive, and with some guarantees of future work, it could be attractive to buyers. By that time there might be no strong rationale for Telstra to continue to own TNC.

Selling the business would fully expose it to the market; the management and the workforce would be more focussed on customers and profits, enterprise agreements which reflected industry norms for workforce operations and wages would be more likely, and obstruction by the unions would be less. Within five years competition between the divested business and
other construction businesses used by AOTC should ensure that construction costs were at least at parity with competitors.

Table 11 shows the business plan which includes the benefits of separation but not sale.

A huge improvement was projected in productivity – direct expenses to climb from 24% of expenses to 48% – and reduced overheads.

**Table 11: Network Construction - Business Plan - 1993/98**

<table>
<thead>
<tr>
<th></th>
<th>92/93 Est.</th>
<th>92/93 $ millions (1992/93 prices)</th>
<th>93/94</th>
<th>94/95</th>
<th>95/96</th>
<th>96/97</th>
<th>97/98</th>
<th>Cum Var (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Expenses</td>
<td>24%</td>
<td>276</td>
<td>244</td>
<td>190</td>
<td>189</td>
<td>157</td>
<td>144</td>
<td>48%</td>
</tr>
<tr>
<td>SRU Expenses</td>
<td>11%</td>
<td>75</td>
<td>71</td>
<td>70</td>
<td>67</td>
<td>64</td>
<td>61</td>
<td>19%</td>
</tr>
<tr>
<td>Total Expenses</td>
<td>19%</td>
<td>351</td>
<td>315</td>
<td>260</td>
<td>256</td>
<td>221</td>
<td>205</td>
<td>42%</td>
</tr>
<tr>
<td>Staff</td>
<td>41%</td>
<td>7216</td>
<td>5933</td>
<td>5592</td>
<td>5000</td>
<td>4750</td>
<td>4500</td>
<td>-38%</td>
</tr>
</tbody>
</table>

As previously mentioned, it was intended to attempt to negotiate a construction enterprise agreement to operate after the transfer of TNC into a separately incorporated subsidiary. The new agreement was expected to incur about $120 million in additional costs over five years, mainly redundancy payments, and produce savings of the same order.

**So What Happened?**

**By June 1992**, after four months:

- Network Products had been fully operational for three months including operating processes and accounting systems.
- Network performance began to markedly improve in a number of areas – see Table 4 (Target) – and was aggressively projected to continue improving.
- Benchmarks from the USA had been established for the network and actions begun to bridge performance gaps.
- Plan D was becoming clear and implementation begun.
- TNC was well on the way to becoming competitive.
- The headquarters was in premises located remotely from AOTC, had full accounting separation, with commercial accounting, estimating and quoting systems, was accounted for as a stand-alone business, and had a manager recruited from the private construction sector.
• the commercial and technical regulatory arrangements for the pre-selection process were operational for Optus to resell AOTC's landline and mobile network services. Arena appeared to be uninterested in mobile resale at this time.

**In September 1992**, after nine months:

• Plan D was finalised sufficient to cover the Optus service quality and product and service range ahead of the expected rollout but would not achieve world parity within five years.

• Implementation was proceeding, including the connection of the largest business customers in vulnerable areas by optic fibre.

• the FMO, a largely digital network which would perform at world parity within five years was becoming defined in concept.

**By December 1992**:

• Plan D was being implemented as quickly as the risks could be managed.

• Almost 2,000 of the 2,500 businesses with 30 telephone lines or more in the CBDs and in most of the metropolitan clusters in Sydney, Melbourne, Brisbane and the Gold Coast, were connected by optic fibre.

• the commercial and technical arrangements for Optus to interconnect with OTC's landline and mobile network services were operational ahead of schedule. Arena (later Vodafone) appeared to be uninterested in discussing interconnection at this time.

**In May 1993**:

• Optus began marketing of the Optus landline network.

• By this time the Telstra network had full service and feature deployment coverage of the Optus network for at least six months ahead in the CBDs and in most of the metropolitan clusters in Sydney, Melbourne, Brisbane and the Gold Coast.

• The six months margin was higher in other capitals and major regional cities such as Canberra, Geelong, Newcastle and Wollongong.

• All of the 2,500 businesses with 30 lines or more and 1,500 of the next largest in order of revenue potential and vulnerability to Optus were connected by optic fibre. Most of these businesses were located in the CBDs and the business clusters in Sydney, Melbourne, Brisbane and the Gold Coast.
• Customers with fewer telephone lines in those areas were being connected opportunistically after the larger customers in order of revenue potential and vulnerability to Optus.

• there was full interworking across the four “intelligent” digital platforms – the domestic fixed, the mobile and the international networks – for service provision and operations.

• Customer features such as 1300 numbers and operational capabilities provided by each platform could then appear the same to customers, and service provision, restoration and billing could be integrated. Interworking increased revenue generation per customer, slowed the loss of customers to Optus and reduced operating costs.

In June 1993:

• due to the difficulty in establishing an accurate trading statement, cost savings for the full financial year could not be accurately be determined, but likely exceeded $200 million.

• for the same reason above, revenue had been increased by an unknown amount due to the faster deployment of advanced services and other actions.

• major improvements in performance had been achieved. For example:
  ▪ call failures on local, trunk and international calls were reduced by more than 60%,
  ▪ the number of outages of major exchange fell by 40% to 22 minutes as did their duration,
  ▪ the number of major outages of major transmission links also plummeted; some were caused by the Optus construction crews cutting AOTC’s inter-capital optic fibre cables as their own were laid.

• some of the process re-engineering projects had achieved remarkable results.

• One project reduced the time for a national change in call tariffs from approaching one year to initially less than two months. Another reduced the downtime of an AXE exchange from about 116 minutes per year to about 28 minutes per year.

• Staff in Network Products at 30 June, 1993 fell from about 18,600 to about 17,300 a reduction of about 1,300 (7%) as well as the unexpected arrivals of some 500 from other divisions.
• detailed planning for implementing Plan D was completed.

• The complexity of Plan D was apparent as, for example, analogue links were replaced by optic fibre, the related operational support systems adjusted, and the analogue workforce relocated or run down.

• increasing the amount of construction work to be contracted out through competitive tenders from TNC and other contractors was about to begin. The business would likely be incorporated in about one year with the practicality of sale considered a year later.

• negotiation of enterprise agreements for operations and construction had begun.

There remained a number of major issues to be resolved. For example:

• the full design and detailed planning of the FMO, including the operational support systems and related customer interface systems, would likely be completed within the next 6 months.

• However, progress was sufficiently advanced that implementation had begun.

• hard core industrial relations issues had yet to be resolved. For example, the limit of 30,000 lines per EMG to be lifted to at least 150,000 lines,

• full national, active management of the network from the two national management centres would be operating within several months,

• 10 digit conversion,

• commercial and billing arrangements for network resellers such as AAP, Pacific Star, Qnet and British Telecom,

• completion of a review of exchange and other properties to begin the sale of unused real estate,

• switch vendor performance and rationalisation from three to preferably one vendor.

After September 1993, implementation of the FMO proceeded, but the author has no knowledge of the progress made. Network Construction was not separately incorporated and consequently not sold during the next 10 years.

**Conclusion**

The story of Telstra's network transformation which lead to Plan D and the FMO is of managers and staff working well beyond their comfort zone. They agreed to accept a task which, on any analysis, was highly challenging and on a scale and complexity that none
before in the PMG, Telecom or Telstra had faced; transforming the network to be competitive ahead the rollout of an incoming competitor using the latest technology and bridging in five years a network development gap approaching ten years.

Plan D, an analogue/digital hybrid network, was conceived within six months. The plan met the challenge from competition in the contested areas at least six months before competition began. The FMO, an almost fully digital network, was conceived within 12 months which would achieve world parity within five years.

All of the management and staff were from Telecom and OTC except for one person, the new manager of network construction recruited from the private construction sector.

The key people included the market and technology forecasters, Bob James and Peter Gerrand; the manager of product and service development, Leo Tyrrell; the leader of the "Future Network" team, Andrew Day who, with others in Network Products, developed Plan D and the FMO concepts; the strategic and financial modelling and planning team lead by John Stanhope; the network operations manager, Ross Marshall and the network construction manager, Bob Pentecost.

There have been a number of large telecommunications projects in Australia since the launch of the telegraph network in 1854. Such include the completion of the Overland Telegraph in 1872, the deployment of the telephone service from 1880, the consolidation of the colonial telephone and telegraph business into the Post-Master General's Department from 1901, the establishment of Telecom Australia in 1975, the deployment of computer controlled exchanges and optic fibre transmission beginning in the late 1970's, the deployment of the cellular mobile network from 1987, the de-regulation of Australia's telecommunications market from 1992 and the establishment of AOTC, the launch of the Optus networks from 1993, the launch of cable TV from 1995, and lately, the deployment of the National Broadband Network (NBN) from 2009.

In terms of complexity, scale, technical ambition, timetable and risk, and the early, major results achieved by the Network Products team over just 18 months, the FMO arguably ranks with these and was one of the triumphs of telecommunications engineering in Australia.

References

AOTC. (1992a). Network Products Business Plan discussion with the CEO. 7 April 1992