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the telecommunication journal of Australia

Special Issue: Communication needs for the America's Cup Challenge

36/2

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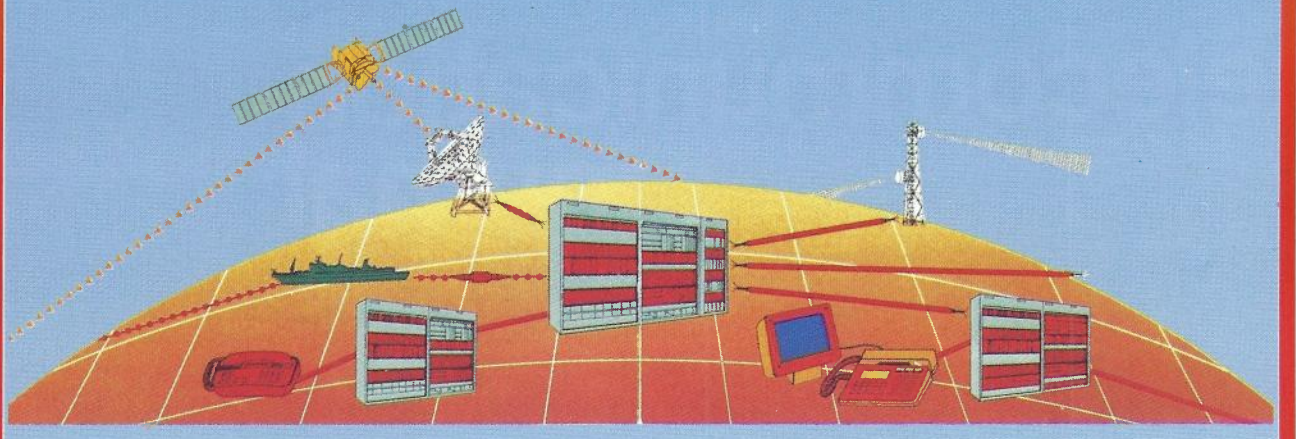

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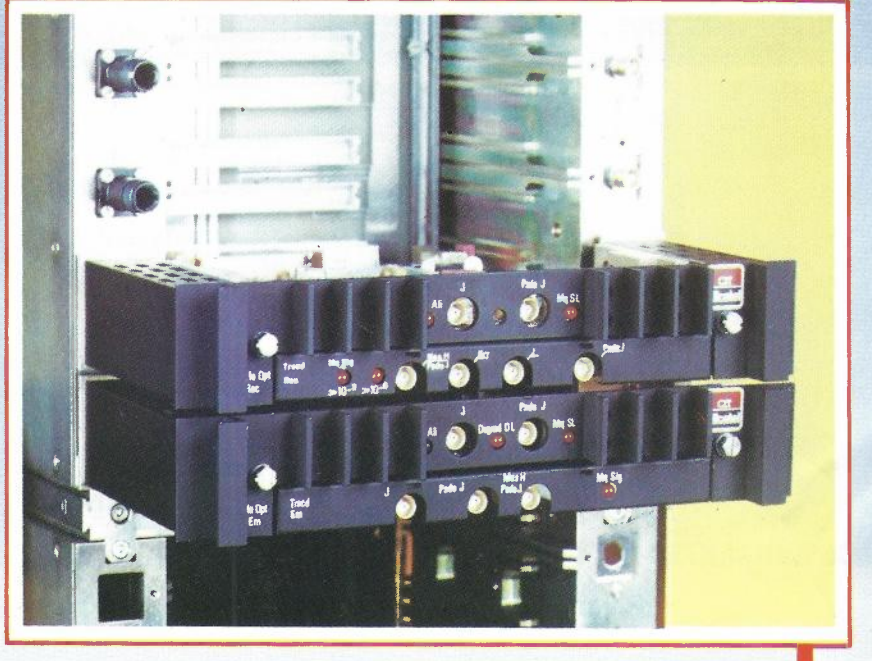

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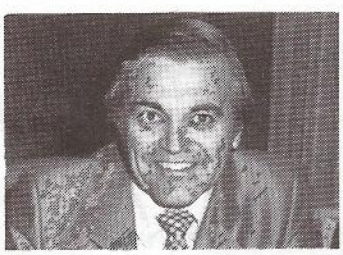

Andy Young, Chief State Engineer, Western Australia, photographer of the pictures appearing on the cover.

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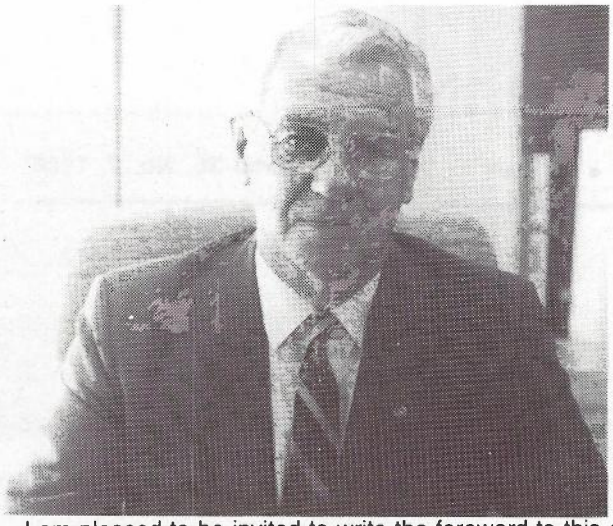


Editorial

W. L. Caudle

STATE MANAGER — W.A.
TELECOM AUSTRALIA

I am pleased to be invited to write the foreword to this edition of the Telecommunication Journal of Australia which is largely devoted to the communications aspect of the 1987 America's Cup events.

This 26th Challenge of the America's Cup is much larger than previous challenge series and Telecom was faced with its own challenge of commensurate proportions in providing the telecommunication facilities to support the event. The contents of this edition show how several of the issues were addressed. History will record the results of both challenges but determination to succeed has been a major feature of each.

Within weeks of the successful challenge in 1983 at Newport, Telecom Australia established early contacts with the Royal Perth Yacht Club and the State Government to ensure good communication during the preparation period. In this State a high level Steering Committee was set up to oversight Telecom's preparations and Headquarters nominated a contact to ensure the co-ordination of resources at the national level.

These arrangements enabled Telecom to respond effectively to the call by the Prime Minister and the Premier of Western Australia in May 1984 for the fullest co-operation and co-ordination at all levels of Government to ensure the Cup Defence in 1987 would result in maximum benefit to the Australian people. To this end Telecom has adopted a commercial approach in the provision of facilities additional to network infrastructure elements provided in advance of normal development.

As no firm forecasts of requirements could be obtained locally at the earliest stages, a Western Australian engineer was despatched on an overseas trip to see at first hand what had been done at Newport. The opportunity was taken to look at arrangements for the Los Angeles Olympic Games, Wimbledon Tennis Championships and the Admiral's Cup races at Cowes, England. A senior marketing executive also visited Newport and Sardinia, the venue for the 1984 World 12 Metre Cup Championships to assess the marketing opportunities offered by such events. This wide exposure to overseas experience allowed us to assess with greater confidence the telecommunications and media requirements which would be needed for the America's Cup Challenge in 1987.

The following timetable was established by the Royal Perth Yacht Club:

1. February 1986
   - World 12 Metre Cup Championships
2. October 1986 — January 1987
   - Elimination races to decide the challenger and defender.
3. 26 January 1987
   - Announcement of the successful challenger and defender.
4. 31 January 1987
   - The first race of the final seven races.
5. Early February 1987
   - Completion of the final seven races.

This timetable set February 1986 as the date when we needed to have a working Media Centre. The opportunity was taken to trial our various arrangements for an international media event under conditions of somewhat less worldwide interest than expected for the America's Cup. Sufficient facilities were provided for the World 12 Metre Cup Championships and the successful operation of the Media Centre proved that we were on the right track. Since February we have continued with our preparations for the full facilities for the America's Cup Challenge.

The establishment of communications facilities has been a joint effort by many organisations, with Telecom playing a major role. I record appreciation of the co-operation received from all of those organisations. I am also most grateful to our staff who have dedicated time and effort towards the commercial and technical success of Telecom's involvement, often working to seemingly impossible deadlines but nevertheless providing first class service and facilities, of which we are justly proud. I am particularly grateful to the authors of the papers who found the time to write down their experiences, often at the very time when under the most pressure to get the job done.

By the time this issue of the Journal is published and the elimination races are under way off Fremantle, I will have retired from Telecom Australia and assumed the role of interested spectator. I have been a member of the Telecommunication Society of Australia for over forty years and regard my association with the Society as one of those which I leave with fond regrets. Best wishes to the Society and to the TJA for your continued success into the future.

America's Cup History and Telecommunications Needs

B. R. HUME B.E. (Hons), M.I.E.Aust.

This paper briefly outlines the saga of the America's Cup and how the Twenty Sixth Challenge came to be held at Fremantle, Western Australia. The situation is considerably different to Newport, Rhode Island, both geographically and telecommunications-wise, and this latest challenge has many more challengers than any previous event. Telecom has had to develop the telecommunications facilities to meet all needs of syndicates, media and visitors.

THE ORIGIN OF THE AMERICA'S CUP

The saga of the America's Cup began in 1851, when a syndicate of members of the New York Yacht Club got together to build an advanced racing yacht called the America. They wanted to show off this yacht in England so they sailed across the Atlantic to Cowes, the home of the Royal Yacht Squadron. One thing led to another and a challenge was mounted between the America and the best yachts that the Royal Yacht Squadron could enter in the field. The race took place against fifteen English yachts, around the Isle of Wight, and the America was of such a superior construction that it beat the English yachts with ease. Thus the America's Cup was presented to the New York Yacht Club in recognition of this great event.

The letter of presentation which was sent from the Royal Yacht Squadron subsequently became what is known as the "Deed of Gift." The letter stated that "any organised yacht club of any foreign country shall always be entitled, through any one or more of its members, to claim the right of sailing a match for this cup." Over the past 130 years there have been 24 unsuccessful challenges to try and regain the cup from the New York Yacht Club.

OUTLINE OF SUBSEQUENT CHALLENGES

The first challenge was held in 1870, when the Englishmen set out to try and regain their cup, which they had lost to the America. In those days the challenging yacht had to sail across the Atlantic Ocean to challenge the New York Yacht Club at New York. These challenges were then held at irregular intervals up until 1980 and in total England mounted 14 challenges, Scotland 1, Canada 2 and Australia had 6 attempts to wrest the cup from the New York Yacht Club.

Many changes were made to the "Deed of Gift" from time to time as conditions varied and yachting designs advanced. The major change was that it was not necessary for the yacht to sail itself to New York.

Some highlights of the Challenges:

In 1930 the 14th challenge was held and the location of the races was shifted to Newport because of the congestion of shipping in the vicinity of New York.

In 1958, the 17th challenge, the class of yacht was changed to the 12 metre class for economic reasons. Over the previous challenges the yachts had become bigger and bigger and much more expensive and it was decided to rationalize to the 12 metre class.

In 1962 the 18th challenge was held and this was the first one where Australia challenged with the yacht Gretel.

In 1970, for the 21st challenge, trials had to be arranged between the foreign challengers to select the one to meet New York Yacht Club's defender. This was the first time that more than one challenger had made a simultaneous challenge and this time the Australian Yacht, Gretel II, beat the French entry for the right to make the challenge.

THE 1983 SUCCESSFUL CHALLENGE

The 25th challenge, held in 1983, was notable for the increased number of challengers. In fact, there were seven yachts entered from five nations so that an extensive pre-selection series of races was needed. The Royal Sydney Yacht Syndicate was selected as the Challenger of Record and many races were conducted over a 3 month period at Newport.

The yacht chosen to challenge the New York Yacht Club was Australia II, entered by the Royal Perth Yacht Club and owned by a syndicate headed up by Alan Bond.

There were four yachts entered to become defender of the cup for the New York Yacht Club. Over the same 3 month period trials were conducted by the New York Yacht Club to pick the best defender and finally Liberty, skippered by Dennis Connor, was selected.

The history of the challenge is well known, with Australia II being down 1/3 after the first 4 races and then coming back to level the score at 3 all. In the tradition of America's Cup there was plenty of controversy during these races. The final race was then won by Australia II to make it a 4/3 victory and the public and media attention was aroused as never before. It was realised that the New York Yacht Club had finally lost the cup.

REACTION IN WESTERN AUSTRALIA

The Royal Perth Yacht Club suddenly found themselves to be the possessor of the America's Cup and immediately set about preparing for a new challenge series. An avalanche of challenges was received by the Club and, at the time of paying the first deposit, there were 26 syndicates that said they were serious about challenging for the cup.

The W.A. State Government and the Royal Perth Yacht Club quickly decided that there was insufficient accommodation to cater for such a large number of challengers and a new marina was put on the drawing-board. With the large interest being generated over the America's Cup, it appeared that Perth and Fremantle were in for a tourist

invasion and careful preparation was needed to ensure that the 26th Challenge would be a great success.

It was realised very early by Telecom that extensive telecommunication facilities would be needed to support the 26th Challenge for the America's Cup. Early discussions were held with people who had been at Newport at the time of the successful challenge to assess the communication provisions and shortages at that time. These discussions showed the need to prepare a very extensive media centre to house a large number of media personnel who could be expected to cover the event. Similarly, television could be expected to place heavy demands on the infrastructure. To assess the situation at first hand the author visited Newport late in 1984.

THE SITUATION IN NEWPORT, RHODE ISLAND

Newport is about 200 km from New York, 50 km from Providence, the capital of Rhode Island, and in summer is the centre of a very popular yachting season. Several oceanic events start from Newport, including the famous annual Newport-to-Bermuda race. Newport is located on Narragansett bay, which houses 25 individual yacht clubs. The America's Cup challenge is just one of a series of racing carnivals to be held on Narragansett Bay during the summer.

Newport is historically orientated as many of its buildings date back to the 17th Century. The main street, Thames Street, feeds the shipyards, where the 12 metre yachts were docked and the area is so compact that it is ony 100 m from the pens to the main street. The media centre was located in Thames Street among the shipyards so that it was a short walk between any of the points of the waterfront. As the crowds built up Thames Street had to be closed to make it available for pedestrians.

Newport has hosted several challenges, which have all been very one-sided affairs. As the event has grown, Newport has been able to accommodate it with little effort. The seven challengers in 1983 were located within the existing harbour facilities. **Fig 1** shows the typical berthing arrangements which were temporarily converted for syndicate use. The large restaurant "Christies" was a favourite haunt for Australian supporters.

The local telephone company provides telephones at Newport. For the 25th Challenge they installed additional lines and telephones in the harbour area and in the media building. Telex services are provided by Western Union International using cable pairs provided by the local telephone company. Apart from these additional lines and augmentation of the circuits from Newport back to

FIG. 1. Waterfront at Newport near Australia II berth.

Providence, the capital of Rhode Island, there was little work needed by the telephone company. At that time there was no International dialling and all calls had to be placed through an operator. There was no paging or mobile telephone service available.

The major television networks in the United States largely ignored the America's Cup series. The local television station provided outside broadcast links to a boat, helicopter and the blimp and a video link from Newport to Providence. This station provided live coverage during the final series.

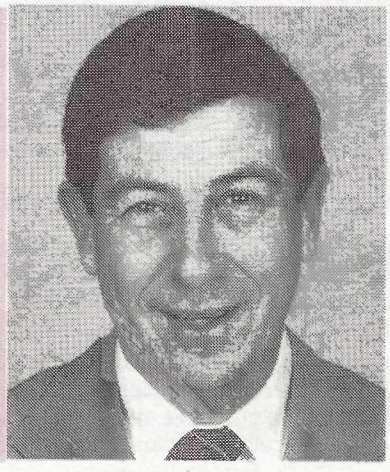
The only radio broadcast coverage was provided by the local Newport Radio Station. They used a reporter on a boat following the race and provided frequent updates on the contestants' positions during their normal programme.

The arrangements outlined above worked well during the elimination series of races and the first few races of the final seven. However, when Australia II won its second and then its third race there was a totally unprecedented increased interest in following the event. Suddenly Newport was deluged with media representatives who wanted to cover the final races and television stations were demanding live coverage of the event. Only the NBC network was able to get the live coverage because it has affiliations with the local television station in Providence. The local radio company was also able to sell its coverage of the America's Cup extensively throughout the United States, using dial-up STD circuits.

The overall impression of Newport was that they were not prepared for the huge increase in interest during the latter races. To avoid this situation at Fremantle,

BRIAN HUME has worked in PMG/Telecom since he graduated from the University of Western Australia with a Bachelor of Engineering, majoring in Communications in 1957. He has worked in a variety of positions including Country operations, Trunk Service, Exchange Installation and Planning.

In 1983, when Australia won the cup, he was Superintending Engineer of the Planning Branch, Western Australia. Here he controlled the planning of telecommunications facilities for the twenty-sixth defence to provide the basic switching, cabling and transmission infrastructure. In December 1985 he was promoted to the position of Regional Engineer, Metro Region where he now also controls the installation of the engineering plant to support America's Cup telecommunications.



telecommunications facilities would have to be augmented considerably.

COMPARATIVE SITUATION AT FREMANTLE

Fremantle is 16 km from Perth at the mouth of the Swan River and is the major port for Western Australia. It is also an historical site, being the point where the first European settlers landed here in 1829. The aim was to develop America's Cup facilities in a compact location to allow people to walk between the various facilities.

It became apparent that the Fishing Boat Harbour would be able to provide some facilities for the visiting syndicates. In fact two syndicates, Bond's Australia III and the New York Yacht Club, established themselves in this harbour at the end of 1983. Not all of the visitors could be accommodated in this area, so an additional marina called Challenger Harbour was constructed. **Fig 2** shows a panoramic view of the harbours during preparations for the elimination series.

The most suitable existing building for the media complex proved to be a hall owned by the Fremantle Port Authority **(Ref 1).** This is located about 400 m from the new Challenger Harbour towards the main Fremantle Harbour. **Fig. 3** shows the layout of the area and the location of the significant points together with berthing arrangements for the syndicates. The theatrette in the Fremantle Port Authority building was also designated as the media interview room.

The area selected is not as compact as Newport. This is to be expected as the Fremantle challenge will be a much larger event involving many more syndicates. There are several advantages at the Fremantle location as compared to Newport.

- the site is free of main streets and traffic will not be a problem;
- there is a railway skirting the area to provide access for large numbers of people without the necessity of providing parking space;
- the access from the marina to the America's Cup course area is very direct for the competing yachts;
- the main deep water port in Fremantle for overseas ships is within walking distance;
- the area is more open and will allow larger groups to be accommodated.

Telecom Australia is in a much better situation to provide facilities for this event as it provides all types of communication facilities and is able to plan the complete facilities for telephones, telex, facsimiles, data, TV bearers, radio programme lines, mobile telephones and radio paging. The early selection of the basic plan enabled Telecom to move into the construction phase of the new facilities.

ASSESSMENT OF TELECOMMUNICATION REQUIREMENTS

Because of the long lead times to purchase telecommunication equipment, early advice of the requirements was needed. This proved impossible to obtain as those involved had not reached that stage of their planning. From discussions it appeared that the syndicates and the media complex would be the main focus for telecommunication efforts. The author's overseas visit included other locations which were related because they were all sporting events which aroused worldwide interest. The experiences of overseas organisations had then to be translated into what would be required in the Fremantle situation.

All the early planning work by Telecom was done by the Engineering Department as an extension of normal network development activities. The increased activity at Fremantle will require additional telephone services, causing greater traffic loads on connecting junctions. An additional 1000 lines of subscribers capacity was provided, together with augmented cable to the marina area and the media complex. Junction relief was a more complex problem requiring the earlier installation of an optic fibre cable, containing 10 fibres, from Perth to Fremantle. This cable is now providing circuits between the Wellington and Fremantle exchanges on a 140 Mbit/s bearer. Additional switches have been provided at coastal

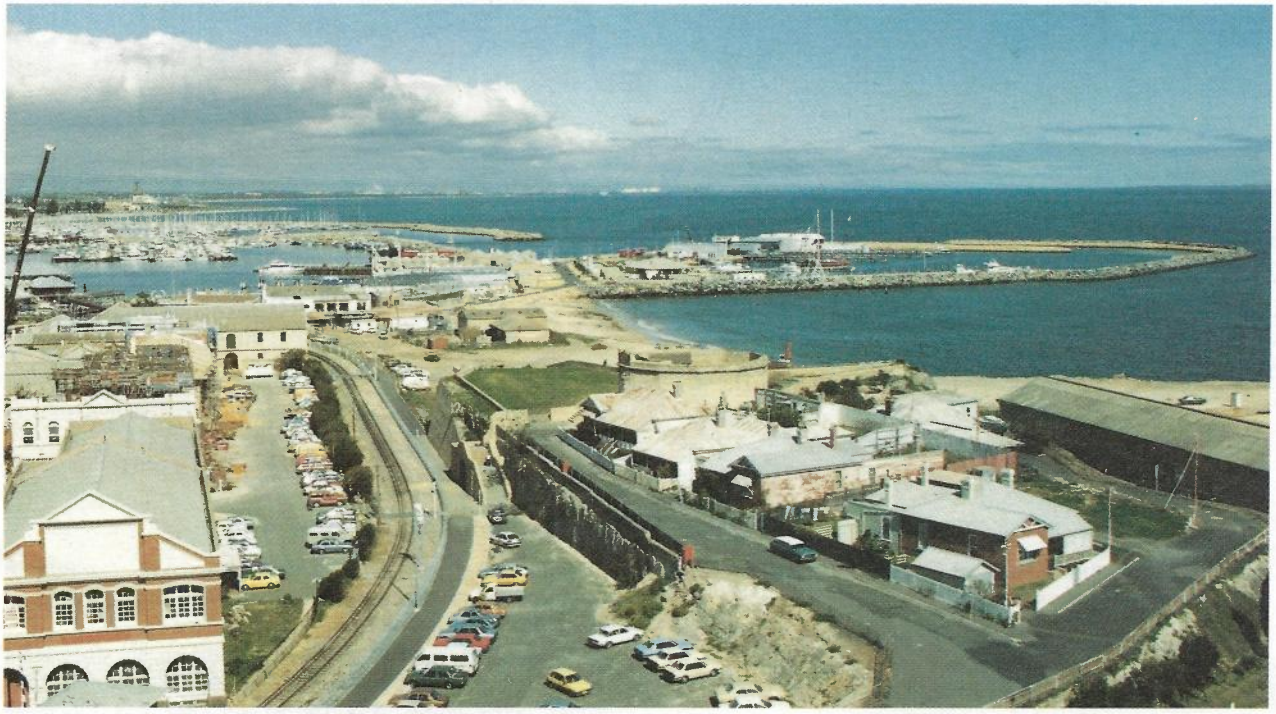


FIG. 2. View from Fremantle Port Authority Office of the harbours for the America's Cup.

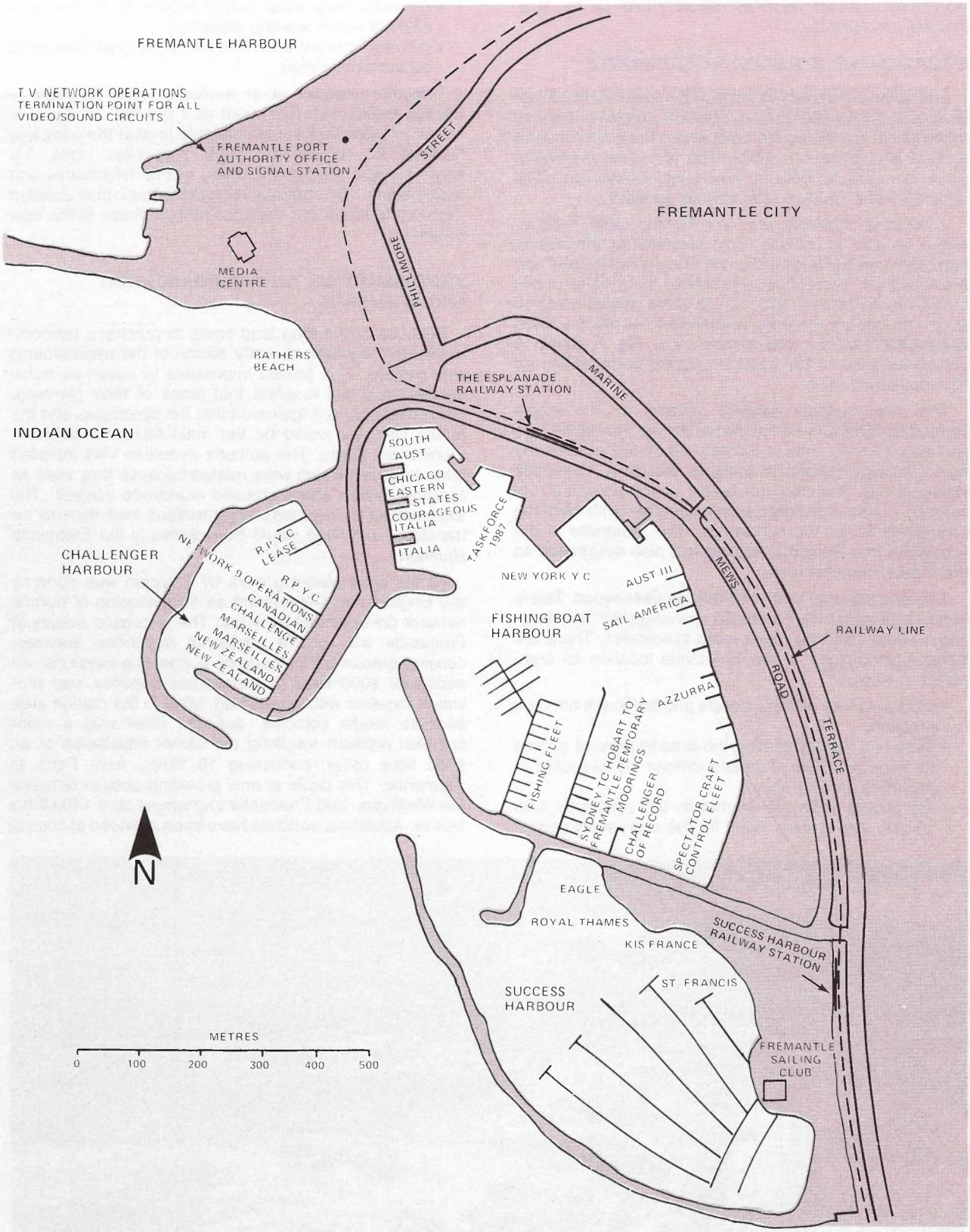


FIG. 3. General Layout at Fremantle, showing America's Cup Syndicate Sites.

telephone exchanges north of Fremantle to cater for the expected tourist influx.

The design and provision of facilities in the media complex was a special project and Reference 1 in this issue gives a description of this work.

The additional traffic load is expected to have a heavy interstate and international bias. We have planned to augment these routes by installing the 1987 normal circuit requirements by October 1986.

To meet the need for television coverage, six video links from Fremantle to Perth were planned using spare optic fibres. This figure was based on one link for each Australian network, with two for itinerant overseas

programmes. **Ref 2** shows how this early estimate has been augmented to meet later requirements.

Radio broadcast circuits were planned to be provided over 2 Mbit/s links from Fremantle to Perth. Again, the early requirements have had to be augmented as in **Ref 2.** This increased circuit loading has considerably exceeded the capacity of the Television and Radio Operating Centre which has consequently been re-arranged.

To coincide with the Cup, the Commonwealth Government brought forward the completion date of the new Perth International Airport building to October 1986. This required another optic fibre solution as the new building is remote from any telephone exchange. **Ref 3** gives more details.

Other increases have been made to the Mobile Telephone Service (500 customers), public telephones (coin and card), paging and telephony links to cruise ships which are expected to visit during the Cup period.

When the first syndicate arrived there was a necessity to set up a full-time Commercial Manager position to establish and maintain contact with all parties involved in the challenge. The occupant is Mr C. Herring, who has ensured that all Telecom groups coordinate their efforts to meet the needs as they arise **(Ref 4)**.

NUMBER OF SYNDICATES

As mentioned earlier there were initially 26 challenge syndicates. Our advice was that these would probably reduce to about 16. This has occurred and the withdrawals so far have brought the number down to 14 challenging syndicates. The Challenger of Record is the Costa Smeralda Yacht Club of Sardinia and they will be organising the elimination series to determine the best yacht to be the challenger. The large number of races required will need two or three race courses to be used simultaneously. These elimination series will provide plenty of match sailing experience for the challengers.

A similar story was experienced with the number of defenders which started off about 10 and has now been reduced to four. The Royal Perth Yacht Club will be conducting an elimination series to pick the best Australian boat to be defender. This series will be conducted at the same time as the challenger series. Whichever Australian boat is selected as the defender will be representing the Royal Perth Yacht Club and will seek to retain the Cup for that Club.

CONCLUSION

The 26th America's Cup Challenge is by far the largest in its 136 year history. It has grown to be a very prestigious event and the large entry will attract visitors from all around the world. The media coverage must be of a very high standard to satisfy the interests of people in many countries.

This article outlines Telecom Australia's preparations for communications for the America's Cup series. The advanced planning work has allowed ample infrastructure to meet the communications needs. The other papers in this edition of the Journal give more details of the facilities provided.

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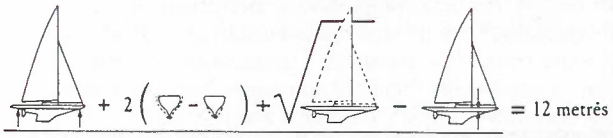
The 12 Metre Yacht

WHAT IS A 12-METRE?

It is a yacht which complies in every respect with the requirements regarding construction and equipment contained in the Deed of Gift and the Interpreting Resolutions applying to national origin of design and construction.

Bilges shall be kept as reasonably dry as possible while racing. No device shall be fitted or employed which would permit the tilting of the mast athwartship.

This class of racing sailboat is based on a mathematical formula which takes account of hull length, skin and chain girth, sail area and freeboard. When formula values are summed and divided by a mathematical constant the resultant rating (12 metres or 39.37 feet) should result.



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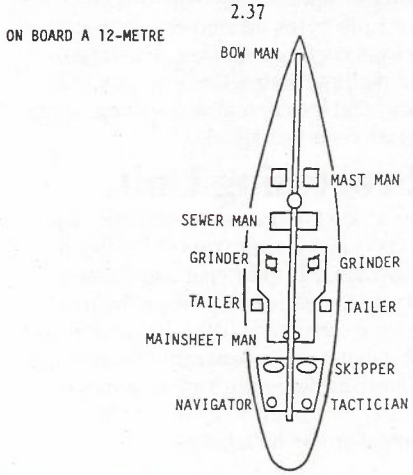

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The Honeywell DPS 90 and GCOS8 executive software system represent the latest generation of Honeywell computing expertise. The installation was a world first for equipment of this kind.

The system gives Telecom the advanced information management technology to handle the high volume information workloads of the commercial, engineering and research environments.

Consistently Available Service.

Reliability expectations are consistently met as a result of careful design and advanced technology. Hardware and software work together to detect, signal and correct or sidestep error conditions. Thus, the DPS 90 can be fully utilized, making information and online service consistently available to those who need it.

High Computational Performance.

Performance is pushed to new threshholds by the design and technology of hardware and software. The

Key Hardware Features.

The DPS 90 incorporates these features:

* Current Mode Logic (CML) circuitry manages logic states in the Central Processing Unit (CPU), the Main Memory Unit (MMU), the System Control Unit (SCU) and the Input/Output Processor (IOP). CML results in fast switching speeds, low power requirements, high reliability, and high density of logic gates per chip. CML is typically five times faster than conventional Transistor-to-Transistor Logic (TTL) circuitry.
* The DPS 90 models offer advanced performance for scientific and engineering computations. Floating point computations may be performed with single, double or quadruple precision. Each CPU has integrated vector processing capabilities that provide for high computational performance.
* High-technology, integrated multichip carriers called micropackages are compactly mounted. This modular packaging technique helps simplify onsite maintenance because a failing micropackage can be rapidly identified and replaced.
* The cache memory used for rapid access of instructions and operands has a capacity of 128k bytes divided equally between instruction cache and operand cache memories. The large-size cache, plus the use of multiple instruction streams, advanced pipeline architecture, and concurrent processing, significantly enhance instruction execution speed.

Central Processing Unit.

The CPU decodes instructions; executes arithmetic, logic and vector operations; and processes interrupts. Pipelined processing is performed by the CPU. The size and arrangement of the cache memory speed data retrieval and help reduce data computation time. In structure, the CPU consists of two cabinets, a CPU logic cabinet and a separate Power Supply Unit (PSU). These cabinets package the logic features including LSI micropacks, cards and boards, as well as fans, power module, power controller and bulk power.

System Control Unit (SCU) and Main Memory Unit (MMU)

The SCU controls data and command and interrupt traffic among central system components. The unit contains interfaces for communications among the CPU, IOP and MMU and provides a variety of system availability, maintenance, and diagnostic functions. One or two SCUs are used depending upon the system configuration.

The MMU is packaged with the SCU and is a high-speed, large capacity storage unit, using Metal Oxide Semiconductor (MOS) circuitry. The MMU uses double-bit error detection and single-bit error correction techniques. Should a part of the MMU suffer uncorrectable failure, that part is deconfigured through a maintenance and diagnostic programme called the Maintenance System Operating Supervisor (MSOS). The MSOS operates in the IOP to maintain the continuity of system operation, and initiates memory deconfiguration in conjunction with GCOS8.

Input/Output Processor.

The IOP is connected to an SCU and is a computer in itself. The IOP contains the peripheral control software and the Maintenance System Operating Software. The IOP has three basic functions:

* To control data transfer to and from peripheral equipment and main memory.
* To perform system test and diagnosis.
* To provide system reconfiguration during recovery.

System Control Centre.

SSC functions are driven by two identical microprocessors, one of which controls the Service Processor (SVP), which has a built-in fixed disk and a port for remote maintenance. Service Processor features provide:

* Support for scan-path and hardware tracer.
* Support for error logging for CPU, IOP, SCU and MMUs.
* Remote maintenance connection.

series of scientific and ever installed by Telecom.

circuitry provides increased switching speeds. Integrated vector processing capabilities contribute to high computational performance for both research and engineering needs. In the area of scientific analysis, for example, the DPS 90 can handle more than 20 million floating point operations per second. Meanwhile, advanced pipeline processing enables the system to handle larger, concurrent workloads with peak efficiency.

Increased Productivity.

GCOS8, the operating software for the DPS 90, is now enhanced by another side of the system – graphics, modelling, query and display facilities contribute to increased productivity for the knowledge worker. Data processing personnel can also continue to rely on enhanced on-line services and solutions, including GCOS8 Development Centre productivity tools and data management utilities. The DPS 90's power, capabilities, and accompanying software can support every sector of a large-scale organisation as a central source for a responsive information service.

Key Software Features.

The DPS 90 operates under control of the GCOS8 executive software. This efficient, versatile, multi-dimensional operating system is designed to provide computing sophistication with a minimum of human intervention.

Data management facilities include Data Management-IV (DM-IV), a CODASYL-compliant system that features Integrated Data Store/II (IDS-II) as its data manager, and DM-IV Transaction Processor for information control between terminal users and the computer.

Standard language processors incude COBOL, FORTRAN, PL/I, BASIC, Pascal, APL, LISP, RPG II, and "C".

User facilities include transaction processing, the Time Sharing System (TSS), batch processing, and remote job entry.

Honeywell's Solution Centre end-user productivity software tools and Develpment Centre data processing productivity tools are supported on the DPS 90 system including the following.

* **MAGNA 8** – Allows DPS 90 users to access stored information without needing computer programming skills. The manager or knowledge worker can query the database, update it or produce reports using simple English-like commands.

MAGNA 8 can also pass information to Honeywell's new range of IBM-compatible personal computers, for use with popular PC packages such as LOTUS 1-2-3.

MAGNA 8 also serves the programming department, automating much of the routine work in programming and causing a quantum jump in productivity.

* **HONEYWELL COMPUTER GRAPHICS ENVIRONMENT** – Provides the full range of graphics, from simple business applications through the full scientific and engineering graphical display.
* **VUE** – Project Management System gives project managers the ease-of-use features normally found on personal computers, backed by the power of the DPS 90.
* **FORUM 8** – A system which mimics meetings, without needing all participants to be in one geographical location, or one time zone. Researchers who wish to swap information on any topic with fellow researchers around Australia or around the world will find FORUM 8 an invaluable aid.
* **SOFTOOL** – Allows administrators to keep track of changes made to any type of data file, recording who made the change and why. Changes which turn out to have introduced errors can be 'rolled-back' to a previous correct version.

With such a new and powerful system – there's a lot to tell. If you would like to know more, call Dan Price on (03) 420 5828, or Margreet van de Werfhorst-Ward on (02) 923 9754.

Together, we can find the answers

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FIRST AUSTRALIAN DEFENCE THE AMERICA'S CUP 1986-87 WESTERN AUSTRALIA

RACE PROGRAMME

13 CHALLENGERS – 6 COUNTRIES

LOUIS VUITTON CUP

ROUND ROBINS

ROUND ROBIN 1 OCT 5-20
ROUND ROBIN 2 NOV 2-19
ROUND ROBIN 3 DEC 2-19
Each yacht will meet the others once.

LOUIS VUITTON CUP SEMI-FINALS

DEC 28-JAN 7, 87
The four top-scoring yachts will enter the semifinals.
The first yacht to win four races.

12
LV
Louis Vuitton Cup

LOUYIS VUITTON CUP FINALS

JAN 13-23, 87
The winner of the Louis Vuitton Cup is the one who first wins four races. He is selected to fight against the best defender in the final match.

4 DEFENDERS – AUSTRALIA

DEFENDER'S CUP

SERIES

SERIES A OCT 18-29
SERIES B NOV 10-23
SERIES C DEC 06-21
Each yacht will meet the others twice.

SERIES D
JAN 10-16, 87

DEFENDER'S CUP FINALS

JAN 18-25, 87
The two top-scoring yachts enter the finals. The winner defends t4he America's Cup against the Louis Vuitton Cup's winner.

AMERICA'S CUP

CHALLENGER ⟷ DEFENDER
JAN 31-FEB 15, 1987
The first yacht to win four races.

Communications Infrastructure and Commercial Aspects — America's Cup

C. N. HERRING

An event of the magnitude of the 1987 America's Cup Defence places great reliance on a wide range of quality communications services. Their operation and efficiency of connection will be closely appraised by many people and to, an extent, Australia will be judged on the outcome.

But much of the America's Cup story is about money and the returns on investment which other Country participants would anticipate through a successful association with an individual challenger or the event itself. Never before has Western Australia had such an opportunity to show itself to the world. The organisation arrangements for the event, facilities, tourist attractions and other activities all play a part in determining the long term benefits to both the State and Australia.

COUNTRY

The America's Cup is now a major international event. If it were on the world market for competitive bids in the same manner as the Commonwealth or Olympic Games, cities and nations would spend millions of dollars to try to attract it and hundreds of millions to service it. Beginning life as a leisurely yachting regatta 135 years ago, the Defence of the Cup has now become a contest between Nations generating intense interest in sport, travel and technology.

An event of this magnitude demands and places great reliance on a wide range of communications services. In this regard, Telecom, the National carrier and major provider and manager of telecommunications within Australia, has established an infrastructure to meet the resultant communications demand, a demand which will come not only from yachting syndicates but also from the many sponsors and organisers, the hospitality industry, entrepreneurs, visitors to Western Australia and the media.

INFRASTRUCTURE ESTABLISHMENT

In planning for the Cup events, Telecom actions have been guided by adoption of the following principles —

- Any decision to undertake major works was strongly influenced by their potential for post-Cup community use.
- The application of standard charges to the provision of telecommunications services for yachting syndicates, sponsor operations, the media, etc.
- The charges for provision and extension of underground cables to locations beyond those normally serviced by Telecom should be at commercial rates.
- Non-standard work undertaken on a discretionary basis at a customer's request should be charged at commercial rates.
- The opportunity should be taken to promote and advertise Telecom's role in support of this major event.

Towards the end of 1983 (and soon after Australia II's success at Newport) funds were requested by Telecom WA for inclusion in future years capital works programmes, especially for the Challenge and related Cup events. At the same time, a letter to the State Government offered Telecom's support and expertise in assisting with the staging of the 1987 Defence. Late 1984 saw the first major expenditure of funds as work to upgrade telephone exchanges was started and external plant crews commenced laying ducts and cables to service 12 metre syndicate operations in the Fremantle Fishing Boat Harbour, Challenger Harbour and the Fremantle Sailing Club. Attention was also directed to the needs of the media at this time and planning, in conjunction with the Fremantle Port Authority, to upgrade facilities along Victoria Quay (which alone will become home for some 10,000 people living in luxury liners) was undertaken.

At the beginning of 1985, Telecom devoted considerable attention to supporting both the City of Fremantle and business operations in their plans to upgrade facilities, accommodation and other developments in the Fremantle area. The City commenced an extensive programme of footpath replacement and construction, together with roadworks and drainage projects. Business groups became involved with housing redevelopments, hotel upgrading and other activities. In almost every case Telecom underground plant was affected. These early works, and others, were completed at Telecom expense to provide a significant part of the initial establishment of an America's Cup communications infrastructure.

SERVICE PROVISION

As overseas yachting syndicates arrived in Fremantle with their plans for headquarters and dockside facilities, commercial negotiations were quickly completed to ensure almost immediate provision of telephone, telex and data services. In many cases, cable extensions into transportable accommodation were required and special facilities such as locks and private metering equipment fitted to telephones to control usage.

Having upgraded telecommunications including all internal cabling at the Royal Perth Yacht Club (RPYC) in Perth, attention was then directed to the needs of the newly established RPYC annexe located in the midst of activities in Challenger Harbour.

This venue, being the Race Central Headquarters, requested a flexible communications plan to cater for not only the yacht racing, but also for activities in up to 22 hospitality areas and to service 3 associated jetties with 60 telephone points.

In conjunction with the Club management and architects, cabling was extended from the clubhouse annexe to locations within the area of lease to service the 'Wimbledon style' marquee accommodation for corporate bodies, and to the three jetties for provision of a range of immediate communications options to boats on both a temporary and semi-permanent basis. Other locations

serviced included the jury, and measurers and harbour masters transportables, these being positioned some distance from the clubhouse building to ensure a degree of visual separation.

The annexe communications required the inclusion of a small business system, telex, facsimile, data lines, sound circuits for the host radio broadcaster, links to the Media Centre PABX Challenger of Record Operations and the 17 competing yachting syndicates. Seiko timing signals and printouts of progress, and IBM history/results information is also available at the annexe.

Estimates have indicated that, over the five month period October-February, the Cup would be expected to attract to Perth an additional 119,000 WA Country visitors (over and above the normal 512,000 for the period), an additional 304,000 interstate visitors (2.2 times the normal 133,000) and an additional 70,000 international visitors (over and above the normal 76,000 international visitors for the period).

In total, the number of people expected to visit Perth during the America's Cup 5 month period is 1,216,000 of which some 12% will be visitors from overseas **(ref. 1)**.

Plans to cater for this 'visitor market' included:—

- Special arrangements through real estate and travel agents to ensure the provision of a telephone service on the day of arrival, dedicated to visitors renting private accommodation.
- The installation of additional pay phones at locations attractive to tourists, including the provision of more services to cater for an anticipated significant increase in the South Australia to Western Australia Eyre Highway vehicular traffic.
- A field trial of a magnetic strip debit and credit 'Card Phone' timed to coincide with the Cup racing period in WA as part of a National technical/market evaluation of this product.
- An increase in the number of interstate circuits for STD/ISD connections and the retention by OTC of additional international satellite circuits, provisioned for Christmas traffic, until after the final Challenge match in February.

TELEVISION OPERATIONS

Elsewhere in this journal, attention has been directed to the facilities and operation of the Media Centre which largely caters for the press (including photographers) and radio broadcasters **(ref 2).** In this regard, most requests for service accompanied accreditation documents or were negotiated in conjunction with media centre management.

For television operations, commercial negotiations were conducted separately from other media activities and with a number of distinct groups namely —

- A consortium comprising representatives of four Australian networks whose role is to provide a host signal initially of limited duration increasing progressively to full time coverage of the final, best of seven, 1987 Defence races.
- The International Management Group (a division of the McCormack organisation) appointed by the RPYC to market the Cup.
- Australian networks who, as individuals, established their own operations and entered into arrangements with overseas networks.
- Overseas networks during their investigations and negotiations with production companies and Australian networks in their quest for local support for their operations.
- The Overseas Telecommunication Commission in the establishment of the Perth International Terminal at Gnangara.

These negotiations carried with them an element of commercial risk as, due to the need to forward order video equipment and special cable, and complete external plant work at an early stage for telephone services, decisions on television circuit requirements were often anticipated in advance.

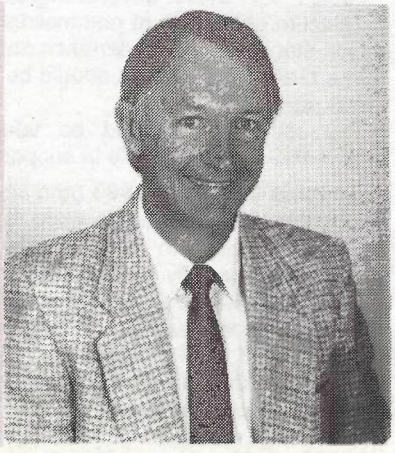
Nevertheless through the utilisation of spare optic fibre cable capacity between Fremantle and Perth and the efficient use of existing underground ducts coupled with the interstate loan and reuse after the Cup of video radio links and terminating equipment, Telecom was able to effectively satisfy the majority of network requests. (Ref 3).

To ensure full availablity of bearers in allowing for conditions of yacht racing which could see events delayed, postponed or require increased coverage through moments of vivid interest, local video links were arranged under a special 19 week full time lease agreement. This arrangement also allowed individual network operation staff to carry out line patching at Fremantle, much of which will be carried out 'after hours,' as required.

OTHER ACTIVITIES

The defence of the Cup will attract to Perth the biggest collection ever of the world's leaders in commerce and industry to assemble in Australia. Most sponsors of yachting syndicates are sending high-powered teams to Western Australia for at least part of the Cup period.

COLIN HERRING is Manager — America's Cup (Commercial) Telecom Western Australia. He joined the then P.M.G.'s Department in 1952 and has previously been involved with Sub Professional Training and the Common User Data Network (C.U.D.N.) project. More recently he has held various positions in the Operations Department organisation. Since commencing on the America's Cup project in December 1984 Colin has been closely involved with the Western Australian State Government, Royal Perth Yacht Club and other organisations providing communications consultancy and support initially for the staging of the World 12 Metre Championships in February 1986 and presently for the first Australian defence of the America's Cup to be sailed off Fremantle early in 1987.



Debit/Credit card telephones which will be trialled in Western Australia during the period of the America's Cup are expected to be populr amongst visitors and tourists.

In addition to requiring personal accommodation, many businesses are seeking locations to display and market their respective products and services and to promote these through media liaison. Since early 1985 there has been a constant demand for Telecom to provide communications advice and service to these groups.

The large numbers of business and professional conventions being held during the Cup period have added to Telecom's workload. Two concurrent events that will highlight Western Australia's economic importance will be the Perth America's Cup International (PACI) Exposition to be held in Fremantle in November 1986 and PacRim '86, an international symposium of finance, trade and investment interests centred on the Pacific Rim region to be held in Perth November 17 to 19. Each of these events demands international communications of world standard.

Additionally, the America's Cup Festival of Sport, September 19 to February 20, which includes a world boxing contest at the new $280M Burswood Island Casino, a $1,000,000 horse race and other entrepreneurial activities have required forward planning to ensure provision of adequate communications facilities.

The mini-America's Cup, usually conducted at Cowes on the Isle of Wight during the Admirals Cup, and sailed in scaled down 5-metre replicas of 12-metre yachts will, in 1987, be sailed off Bathers Beach, Fremantle between January 27 to 29. The Beach will be an ideal amphitheatre for the mini-Cup because it has vantage spots along the South Harbour and Challenger Harbour. It will also be popular for spectators wishing to view the departure and return of the 12-metre boats on both race and lay days.

Anchorages and moorings between Rockingham, 20 nautical miles south of the America's Cup course and Hillarys marina at Ocean Reef, just north of the race area will 'park' an armada of spectator vessels ranging from 10-metre sportsfishing launches to 70 metre floating palaces, all visiting to see the competition. For the larger vessels private charter companies are providing victualling, fuelling, sewage disposal and commuter transport services with computers being used to co-ordinate the many needs.

Overhead a 59 metre helium-filled airship will be employed as a television camera platform and for airborne advertising. Other airspace will cater for up to 40 helicopters hovering over the courses with fixed wing aircraft operating above.

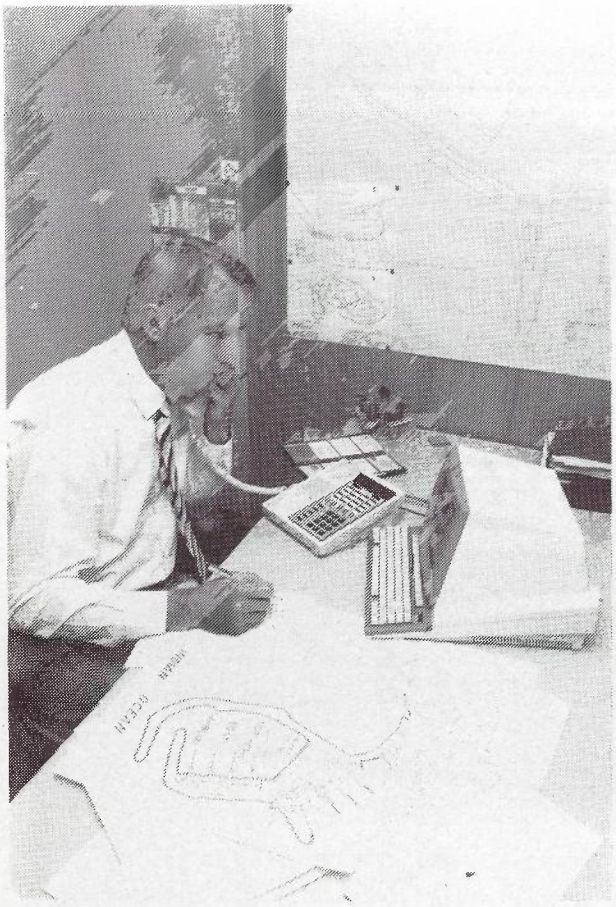
THE BOTTOM LINE

It will cost the Royal Perth Yacht Club (through its trust company ADAC — Australia's Defence America's Cup 1987 Pty Ltd) some $4M to stage the first Australian defence of the Cup.

The majority of this money will be provided by major sponsors and companies who have signed agreements to use sponsors' and licencees' symbols, along with the sale of television and radio broadcast rights and 'Official Supporters Hospitality Packages.'

The Federal Government gave a direct grant of $30M and the capital cost to the WA State Government for preparations is expected to be about $54M.

Much of the Government expenditure, however, can be classified as payment for improvements in the social infrastructure of the region with a useful life well beyond



Colin Herring, Telecom's Manager, America's Cup is shown at work handling the commercial aspects of the event.

the Cup period. Only a little can be identified as America's Cup specific.

Similarly, Telecom Australia with an overall Cup budget of some $8.3M has constructed World class communications services which will provide long term benefits to the community.

By the standards of other 'hallmark events' the level of public sector commitment to stage the Cup Defence is relatively modest. Compared to Olympic and Commonwealth Games and to Expositions, which require very significant commitment of Government resources for an infrastructure which is arguably not well utilized after the event, the cost of $7M to construct the major Cup venue (Challenger Harbour) is minimal.

The previously mentioned 'America's Cup — Economic Impact' study report says the defence could inject at least $600M into the Western Australian economy and up to $1.117 billion. The spending could create some 14,400 jobs over 12 months, half of these resulting from visitor spending.

Finally, even if the America's Cup is not retained, the 1987 Series will have a substantial positive impact on the economy through promotional and trade opportunities flowing from the staging of the event.

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2. Herring, C. 'America's Cup Media Complex,' Telecommunication Journal of Australia, Vol. 36, No. 3, 1986.
3. Norman, M. 'Video and Sound Program Network for the America's Cup,' Telecommunication Journal of Australia, Vol. 36, No. 3, 1986.

Information Transfer News

Navigation Accuracy for the America's Cup

The Royal Perth Yacht Club are taking no risks with the placing of the navigational marks for the America's Cup races. They have appointed a Perth firm, Seatronics Pty. Ltd., as official suppliers of navigational equipment, and all mark laying will be done with the aid of a Syledis navigational system.

The difference between Syledis and other navigation systems is that the others tend to work on a range to range mode, whereas Syledis works on hyperbolic mode as well. To put that into simpler terms, with a range to range navigation system, the unit on the boat sends out a signal to a series of fixed beacons and times how long they take to come back, then by a simple triangulation works out the position. The Syledis has what is called a passive receiver on the vessel that just receives signals from other beacons and that is done by a synchronised set of signals that come from a master beacon. By calculating the time dfference in a hyperbolic fashion, the unit can work out precisely where it is in relation to those beacons either on a grid or geographically. Because Syledis uses a passive receiver, it has unlimited user capability, whereas most others can only handle about four users at once.

Syledis, a French made system, is used all over the world. There are chains of beacons in the Middle East, all around the coast of Britain and in Australia. Since putting up the chain off Fremantle for the America's Cup, it has been found that other people besides the yachtsmen have a use for it. The Marine and Harbours Department have a definite need for very precise positioning, if for example they are called out in the middle of the night to rescue someone, it is very comforting for them to know exactly where they are to within a metre or so.

The navigators on the yachts will not only be able to tell exactly where they are, in latitude and longitude, there will be a graphic display on the screen that will give the yacht's position relative to the next mark, the distances up to thirty marks and the yacht's speed. The system has been tried and tested over the past months, both by the Royal Perth Yacht Club and the yachts that are here training. The system was also used in the World Championships in February, 1986.

Video and Sound Programme Network for the America's Cup

M. J. NORMAN, B.E. (HONS)

Telecom in Western Australia has installed an extensive metropolitan video and sound program transmission network to support the American's Cup events over the five month period October 1986 to February 1987. The backbone of the network uses W.A.'s first optical fibre cables. This article describes the initial plans, the evolution in network design as customer demand grew, and the final network structure.

INTRODUCTION

Within days of Australia II's historic win at Newport in September 1983, Telecom Planners were busy considering the preliminary design of the Telecom facilities that would be required to support the next defence in Western Australia. It was evident from previous major international sporting events held in Australia that one of Telecom's important support roles would be the provision of additional video and sound programme circuits to augment the existing facilities, and that early attention to network planning was essential to enable an appropriate level of special funding, and the forward ordering of critical items of equipment.

Initially, the location of the yachting course for the next defence was uncertain. Possibilities ranged from Yanchep to the North, Rottnest Island to the West and Cockburn Sound to the South. Within a few months of the win, it had been decided that the yachting syndicates would be located at the old port city of Fremantle, 16 km South-West of the capital Perth, and the yachting courses would be set off the coastal suburbs. Some early discussions confirmed that television signals from the yachting courses would be received at Fremantle (the Co-operative Bulk Handling wheat silo or the Fremantle Port Authority building being likely locations for the antennas) and that a Media Complex would be established in Fremantle (Ref 1). Thus the basic backbone of the video and sound network was established; a terrestial network linking Fremantle to the Pier Television and Sound Operating Centre (Pier TOC/SOC) in Perth city, and from there to the broadband radio terminal at Mt Yokine, 9 km north of Perth, to link with national and overseas networks (Ref 2).

INITIAL PLANS

The quantities of video and sound programme circuits on the Fremantle-Pier-Yokine route was intially difficult to gauge, since there was no Host Broadcaster, or similar, to contribute to the planning process. Futhermore, there was no previous yachting event with such a large number of syndicates from which the infrastructure demand could be gauged. In November-December 1984, the Regional Engineer (Metro) visited Newport and some other sporting venues and found that the telecommunications support at Newport had been surprisingly minimal, but adequate up until the last few races (Ref 3). In fact, only one outgoing video link for bookings had been available at Newport in 1983. Clearly, with the increased local and international interest, and the dramatic increase in the number of yachting syndicates involved, the arrangements at Newport could not be reliably used as a model for the facilities required in Perth.

Nevertheless, planning decisions and state construction programme entries had to be made, despite the lack of external inputs. Microwave radio links fom Fremantle to Perth were difficult to establish because of near end obstruction (i.e., Mount Eliza, King's Park) at the Perth end. A high capacity digital route was required between Perth and Fremantle (and Cannington) for the integrated digital network, and it was already planned to make this the first optical fibre cable route in W.A. Planning decided to bring the installation forward by one year and equip four of the ten fibres with multimode video transmission systems. Another optic fibre route between Pier and Yokine, equipped with three video systems, was also planned.

Other initial plans included:

(i) an increase in the number of dedicated bothway TV bearers between Perth and Adelaide. Two additional bothway bearers, one using TV Codecs on the new digital bearer, and the other using analogue video equipment on a converted telephony bearer, were planned.

(ii) expansion and complete refurbishment of the Pier Sound and Television Operating Centre (Pier SOC/TOC), to separate equipment and operational areas, and house the proposed SAVAS (State Automated Video Audio Switcher) system.

(iii) the design of a microprocessor based audio monitor switch system that would allow Pier SOC operators to monitor any sound circuit (and obtain basic circuit construction details) by simply keying in the particular circuits national identification number (Ref 4).

NETWORK DEVELOPMENT

The development of the video and sound network plans tended to be an iterative process as the American's Cup Television Consortium (formed im March 1985 to pool equipment and manpower for the five month coverage) and the individual television stations discussed their requirements with Telecom on an irregular basis. In February, 1985, a senior engineer was seconded to further develop Telecom's engineering plans (in consultation with the Commercial Manager and outside bodies) and to closely co-ordinate material supply and installation activities. Subsequent network development included:

(i) an increase in the Fremantle-Pier TOC video programme circuits to fully use all the spare fibres in the 10 fibre cable.

(ii) a corresponding increase in the Pier TOC-Mt Yokine video links.

(iii) the establishment of 15 kHz sound programme routes (for TV sound and radio broadcast purposes) using digital carrier programme (DCP) equipment on the Fremantle-Wellington-Pier 140 Mbit/s optical fibre system, and 2 Mbit/s digital line systems Pier-Mt Yokine. A loan of DCP equipment, used previously for the World Cup Athletics in Canberra and then the Grand Prix in Adelaide, was arranged to augment local orders, and establish sound circuits for the World 12 m Championships held in Perth in February, 1986.

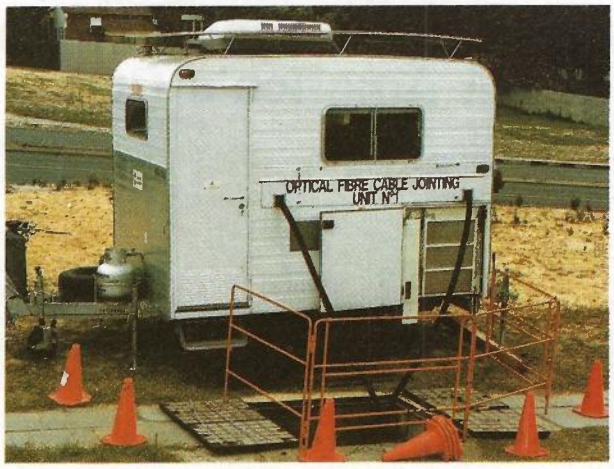
(iv) the establishment of a dedicated 4 kHz sound circuit route between Fremantle and Pier SOC using Special Services Network (SSN) rack arrangements.

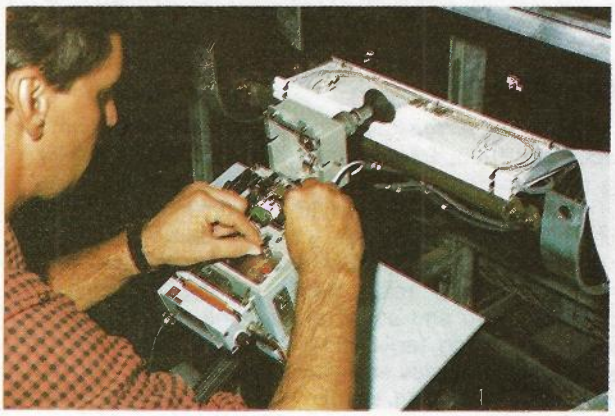
(v) the establishment of direct 15 kHz and 4 kHz sound circuits from Pier SOC to City South SOC in Sydney for connections to the OTC (Australia) patch facility in Sydney.

(vi) the termination of the optical fibre video circuits at the Fremantle Port Authority (FPA) building rather than Fremantle Exchange.

(vii) the establishment of video circuits using single quad carrier (SQC) cables between the FPA building and the America's Cup Media Complex.

(viii) the establishment of radio links at either end of the optical fibre cable route, using 15 GHz outside broadcast (OB) systems on loan from NSW.





Jointing the optical fibre cable hauled on the Fremantle to Pier route.

UNPLANNED DEVELOPMENTS

By December, 1985, Telecom's network plans seemed more than adequate to support the coverage of the America's Cup, and the installation of the subducts and the optical fibre cables was underway. However, there were a number of unexpected developments which required some significant changes to these plans, as follows:

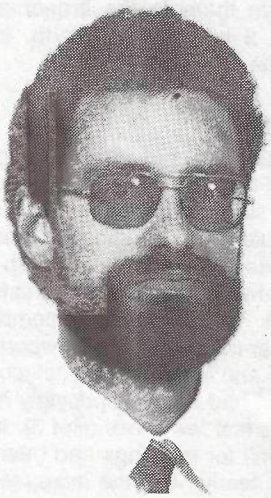
(i) In January, 1986, just prior to the World 12 metre Championships, the TV Consortium informed Telecom that they could not receive fade-free yachting course signals from the top of the FPA building, due to multipath signal fading over the water, and a high inland site was required instead. The water tower at Mt Yokine (and later the higher Mt Yokine Telecom tower) was selected because of its proximity to the local commercial station studios. From this point, the TV Consortium planned to receive up to four video signals off the course simultaneously, and send these signals to temporary studios to be established in Fremantle.

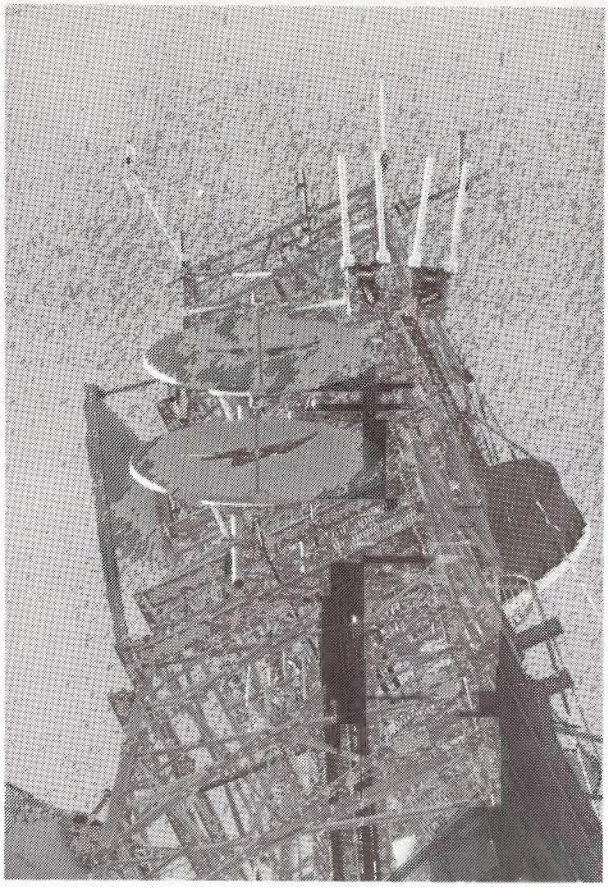
This unplanned requirement for another four video circuits between Mt Yokine and Fremantle presented a problem, since all the video circuits on the spare fibres between Fremantle and Pier TOC had already

MICHAEL NORMAN joined Telecom Australia as a cadet enginner in 1971 and graduated in electrical engineering from the University of Western Australia in 1974. Between 1974 and 1977, he was involved in a range of internal and external plant projects in both metro and country localities. In 1977, he was transferred to Telecom Headquarters to assist with the design and installation of a VDU/TRESS interface system. In 1978, he returned to Perth and worked in Customer Networks and Equipment (CN & E) Section as Engineer Class 2, Special Services. In 1981, he was again transferred to Headquarters to work for Transmission Network Design Branch. In this capacity, he prepared specifications and technical publications for the design and application of a new range of line conditioning devices. Returning to Perth, he again worked for CN & E Section as senior Engineer, Special Services.

In Februrary, 1985, Michael was transferred to Metro Region to co-ordinate the engineering aspects of the America's Cup preparations, as Senior Engineer, Special Projects.

Michael is married with three children. His interests include community tree planting projects, swimming, ballroom dancing and of course, yachting (he claims his catamaran is faster, and a lot cheaper, than a 12 metre yacht).





Two sets of TV consortium duel rod antenna mounted on the Mt. Yokine tower (top right hand corner).

been allocated. The solution using available equipment (some of which were borrowed from NSW and Victoria) was for Telecom to provide two additional circuits and the TV Consortium to provide the remaining two using 7 GHz radio links.

The video circuits between Pier and Fremantle were provided by reallocating from elsewhere two NEC 2 x 34 Mbit/s TV Codecs for use on the Pier-Wellington-Fremantle optical fibre 140 Mbit/s system (thereby using half of the bearer reserved for telephony circuits with bothway video transmission) and by reversing the direction of one of the planned video programme circuits.

The lost telephony capacity was partly regained by using spare capacity on PCM routes and an existing 140 Mbit/s coax system.

(ii) In March, 1985, NSW reported they had experienced considerable problems attempting to commission their 15 GHz OB radio systems (to be later loaned to W.A. for the America's Cup) and that they had been returned to the USA for repair. It was then decided to alter the network design to reduce the reliance on these systems. Some video circuits in the Fremantle area were redesigned using SQC cable, the three of the four video circuits to the OTC (A) International Telecommunications Centre at Gnangara were redesigned to use recovered 6.7 GHz radio equipment (from the east-west microwave route) and 8.0 GHz radio equipment (originally used for the Commonwealth Games in Brisbane).

(iii) Telecom expected that all temporary studio facilities at Fremantle would be established near the America's Cup Media Centre (which was designed mainly for photographers and the written press). Instead, a number of temporary studios were established in the Challenger Harbour/Lombardo's area, requiring the hauling of more SQC cable than was orginally intended. Additional stocks of SQC baseband video systems were ordered, direct from the manufacturer, IRT Electronics, in Sydney. The hauling of the optical fibre was delayed pending the final decision on the number of SQC cables required, so that best use could be made of the very limited duct space under the railway line and down Cliff Street, Fremantle.

(iv) By April, 1986, it became clear that Australian and overseas television networks required more video circuits out of Fremantle than could be accommodated on the optical fibre cable which was basically dimensioned and installed for Telecom's long term requirements. The TV Consortium made arrangements with the Fremantle Port Authority to locate scaffolding on top of the FPA building, to provide at least another eight video links using privately supplied OB radio equipment and various intermediate repeater sites between Fremantle and Perth.

FINAL NETWORK STRUCTURE

Figure 1 illustrates the final structure of the network superimposed over a map of the Perth metropolitan area. Additional privately supplied radio links are not illustrated. A brief description of the type and quantity of the video and sound transmission systems used is listed in Figure 1 for each route.

VIDEO PROGRAM CIRCUIT ROUTING

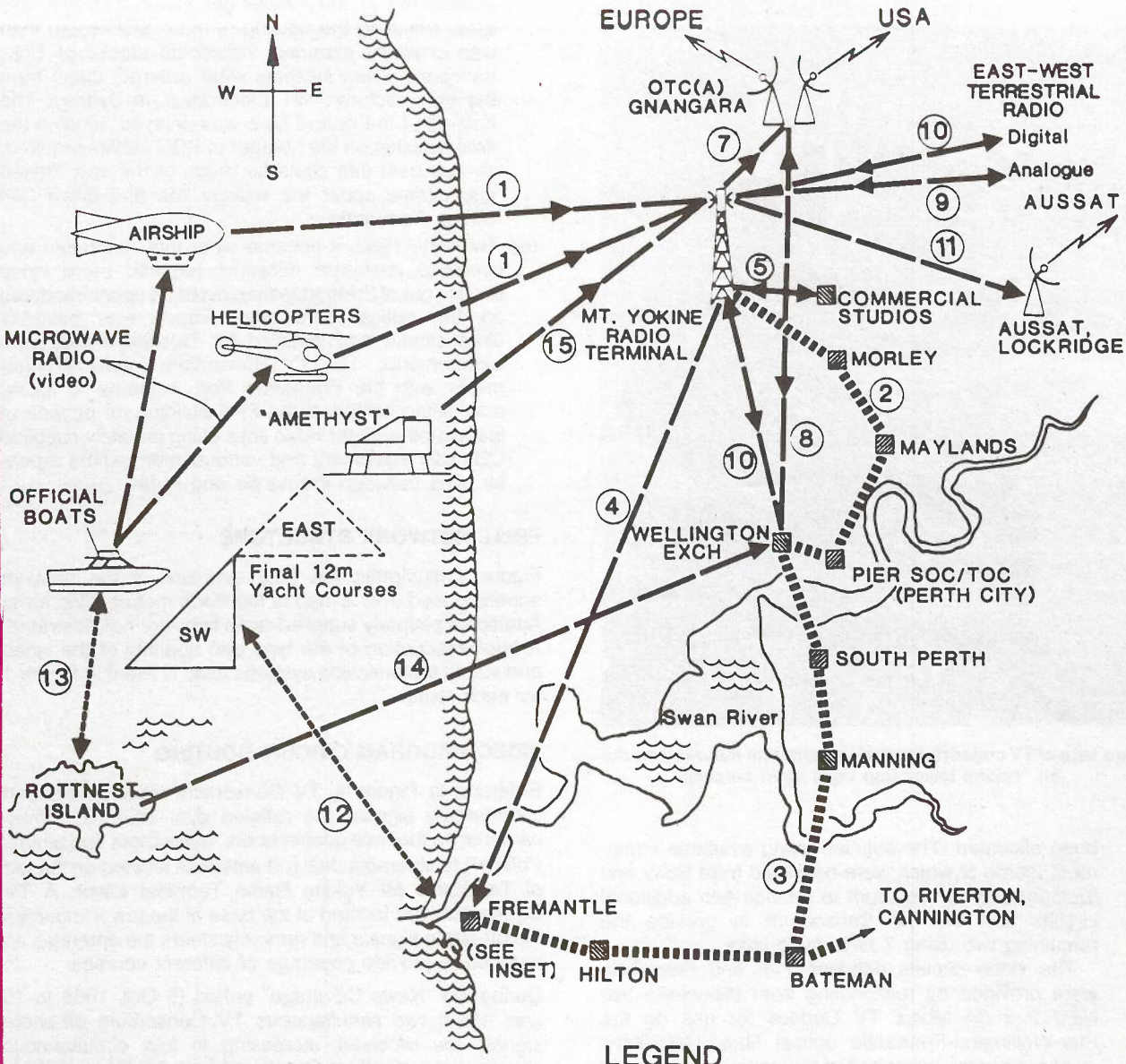
Referring to Figure 1, TV Consortium video and sound commentary signals are relayed over ROUTE 1 from cameras on the race control boats, helicopters and airship ("blimp") to steerable dual rod antennas located on the top of Telecom's Mt Yokine Radio Terminal tower. A TV Consortium van located at the base of the tower monitors the off-shore signals and remotely steers the antennas as required to provide coverage of different courses.

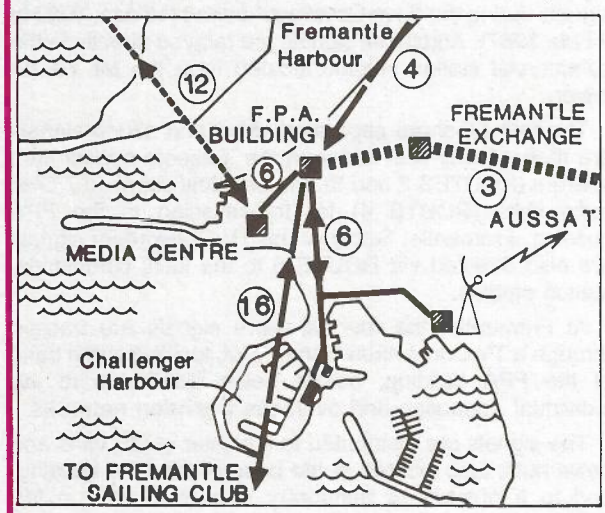
During the "News Coverage" period (5 Oct, 1986 to 10 Jan, 1987) two simultaneous TV Consortium off-shore signals are received, increasing to four simultaneous signals during the "Live Coverage" period (13 Jan, 1987 to 9 Feb, 1987). Additional signals are relayed directly to the commercial station studios located near the Mt Yokine tower.

The four off-shore separated video and sound signals are then equally split between the Telecom optical fibre bearers (ROUTES 2 and 3) and privately supplied 7 GHz radio links (ROUTE 4) for transmission to the FPA building, Fremantle. Some of the TV Consortium signals are also directed via ROUTE 5 to the local commercial station studios.

At Fremantle, the four off-shore signals are passed through a TV Consortium Control Hut, located at the base of the FPA building, before being distributed to the individual Australian and overseas television networks.

The signals are distributed to a cluster of OB vans and news huts, also located at the base of the FPA building, and to a number of temporary studios located in the Challenger Harbour/Lombardo's complex area and the Fremantle Sailing Club at Success Harbour, via ROUTES 6 and 16. Here, the off-shore pictures are enhanced with stories collected in the Fremantle area (e.g., interviews, dockside activity, etc).





LEGEND

- OPTICAL FIBRE CABLE
- MICROWAVE RADIO SYSTEMS
- UHF RADIO SYSTEMS
- SQC CABLES
- (1) ROUTE NUMBER

(ADDITIONAL PRIVATELY INSTALLED LINKS NOT ILLUSTRATED)

FIGURE 1
METROPOLITAN VIDEO AND SOUND PROGRAM CIRCUIT ROUTES FOR THE AMERICA'S CUP

ROUTE 1	4 x Offshore video and sound circuits (on privately supplied 2.5 GHz radio links).
ROUTE 2	7 x Video circuits using Siemens multimode transmission systems. 10 x 15 kHz sound circuits using Siemens digital program equipment.
ROUTE 3	6 x Video circuits using Siemens multimode transmission system. 2 x Video circuits using NEC (2 x 34 MBit/s) TV codecs. 30 x 15 kHz sound circuits using Siemens digital program equipment. 60 x 4 kHz circuits using T5 MUX and SSN interface units.
ROUTE 4	2 x Video and sound circuits (on privately supplied 7.0 GHz radio links). 2 x Video and sound circuits using 15 GHz radio links.
ROUTE 5	NEW: 4x Video circuits using 1RT transmission systems on SQC cable. 6 x 15 kHz sound circuits on equalised cable pairs. EXISTING: 6 x Video and sound circuits.
ROUTE 6	16 x Video circuits using 1RT transmission systems on SQC cable. 30 x 15 kHz sound circuits on equalised cable pairs.
ROUTE 7	2 x Video and sound circuits using 8 GHz and 15 GHz radio links.
ROUTE 8	Bothway video and sound circuit using 6.7 GHz radio links.
ROUTE 9	New: Bothway video and sound circuit. EXISTING OUTGOING LINKS: 2 x Video and sound circuits. 3 x 10 kHz sound circuits. 2 x 15 kHz sound circuits.
ROUTE 10	Bothway video and 15 kHz sound circuits using NEC (2 x 34 Mbit/s) TV codecs 5 x 15 kHz sound circuits using Siemens digital program equipment. 30 x 4 kHz sound circuits using T5 MUX and SSN interface units.
ROUTE 11	2 x Video and sound circuits using 15 GHz radio links.
ROUTES 12 AND 13	10 kHz sound circuits on privately supplied UHF radio links.
ROUTE 14	5 x 15 kHz sound circuits and 30 x 4 kHz sound ciruits using Rottnest 34 Mbit/s digital radio system.
ROUTE 15	2 x Offshore video and sound circuits (using privately supplied 2 GHz radio links) for video conferences.
ROUTE 16	2 x Video and sound circuits using 15 GHz radio links.

From Fremantle, the various television networks distribute their material throughout Australia and overseas. Some signals are directly transmitted from the temporary earthstation facility in Fremantle. However, most signals are transmitted using the optical fibre cable route to Pier TOC (ROUTE 3) or privately supplied OB radio links (not illustrated) mounted to top of the FPA building.

From Pier TOC, a number of different routes are available for onward transmission, as follows:

(i) ROUTES 2 and 5 to the local commercial studios
(ii) ROUTES 2 and 7, or ROUTE 8, to the new OTC (A) Perth International Telecommunications Centre at Gnangara
(iii) ROUTES 2 and 9, or ROUTE 10, to the eastern states
(iv) ROUTES 2 and 11 to the AUSSAT earthstation at Lockridge
(v) ROUTES not illustrated to city based television studios and television editing companies

SOUND PROGRAM ROUTING (FOR RADIO BROADCASTS)

Separated 15 kHz sound signals associated with the video signals are transmitted over the same routes as the video signals, as described above. Some additional transmission routes are involved in carrying the 10 kHz and 4 kHz sound signals for radio station broadcasts.

Again referring to Figure 1, off-shore 10 kHz and 4 kHz signals are relayed via privately installed UHF links to the America's Cup Media Complex and other elevated sites in the Fremantle area (ROUTE 12) and to the Rottnest Island exchange tower (ROUTE 13). The signals received at Rottnest Island are relayed to Wellington Exchange in Perth city over ROUTE 14 and then on the optical fibre cable (ROUTE 3) to Fremantle.

In Fremantle, the signals are distributed to the Media Centre and elsewhere using equalised cable pairs. From there, some signals are distributed nationally and internationally from small privately operated earthstation dishes, but most signals are carried on the optical fibre cable (ROUTE 3) to Pier SOC for onward transmission over established sound programme circuits.

All connections of sound circuits (other than those associated with video) to overseas destinations are patched at the OTC (A) facility in Sydney. Direct 15 kHz and 4 kHz sound programme circuits using digital bearers (ROUTE 10) were established mainly for this purpose.

POST RACE EQUIPMENT RECOVERY PLANS

Most of Telecom's investment to support the America's Cup has been directed into facilities for which there is a long term, if not immediate, need. However, it is inevitable that the temporary increase in facility demand will result in some surplus equipment holdings at the conclusion of the event.

Plans are therefore in hand to recover and redistribute all surplus equipment, as follows:-

(i) All borrowed equipment will be immediately returned to their state of origin.
(ii) Surplus optical fibre multimode video systems will make up the National 86/87 order
(iii) Surplus digital carrier programme equipment will be reinstalled on main metropolitan outside broadcast routes
(iv) The Fremantle-Pier TV Codecs will be transferred for use on the Sydney-Melbourne route.

CONCLUSION

Telecom in Western Australia has installed an extensive metropolitan video and sound program circuit network for the America's Cup. This network makes good use of W.A.'s first optical fibre cables connecting Fremantle with Perth city and the Mt Yokine radio terminal.

The planning of this network was a dynamic process, with continual changes being made to accommodate increasing customer demands. Material availability problems arose which were greatly assisted by equipment loans from the other states.

The television and radio broadcast coverage of the America's Cup involves the provision of video and sound circuits by Telecom as well as the America's Cup TV Consortium, the individual Australian television networks, the official radio broadcast sponsor, OTC (Australia) and AUSSAT. The number of circuits required is an indication of the national and international interest in this major sporting event.

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Information Transfer News

IBM AUSTRALIA OFFICIAL SPONSOR OF AMERICA'S CUP MEDIA CENTRE

IBM Australia has announced that it will be a major sponsor of the America's Cup Media Centre at Fremantle.

The Centre, located within walking distance of the competitors moorings, will accommodate almost 1200 journalists from October this year until the regatta is completed in February 1987.

IBM will provide computer hardware, software, printers, copiers and other information processing equipment. The total value of IBM's sponsorship is worth almost $1 million equipment.

The Media Centre building was once an indoor sports stadium. Now it is being transformed into one of the world's largest yachting 'newsrooms'. There will be desks to cater for more than 200 working journalists at any time, an area where radio reporters can broadcast their stories direct to their stations via land-lines and television monitors positioned in the Centre for everyone to watch the races live. The Centre even has its own Post Office.

Media Operations Manager at the America's Cup Media Centre, Mr Lyall Rowe, is a veteran of every Commonwealth and Olympic Games since 1950 with the exception of Moscow. He said the Fremantle Centre would be the best media centre ever established for a world yachting event.

"With the support of IBM's computers, journalists will have an enormous information resource available which will eliminate hours of research," Mr Rowe said.

"Let me give a typical example of what will happen. During a race information will be entered into the IBM System/36 computer such as wind speeds on various legs, weather conditions and times. On completion of the race, this information will be printed, copied and made available to every journalist. So, when a journalist returns to the Centre after following the race on one of the press boats, he or she can collect this information upon entering the door and get on with writing the story.

"Historical data also will be available on the system. For example, journalists will be able to compare the performance of yachts on various days under different weather conditions. They will even be able to obtain biographical detail on boat crews or refer to the race rules.

Deena Le Page, IBM Perth Branch Manager Mike Gurry (centre) and Media Operations Manager Lyall Rowe discuss aspects of the IBM computer system being installed at the America's Cup Media Centre in Fremantle. IBM Australia has announced that it is a major sponsor of the Media Centre, which will house almost 1200 journalists during the America's Cup campaign.

"Away from the Media Centre computer terminals will be located at the Royal Perth Yacht Club annexe at Fremantle, the RPYC in the city, the Fremantle Port Authority and the ADAC headquarters," Mr Rowe said.

IBM Australia's Perth Branch Manager Mr Mike Gurry said that IBM people had been working with Media Centre staff for almost a year to ensure optimum performance of the system.

"The World Twelve Metre Championships earlier this year provided us with the opportunity to determine the exact requirements for the America's Cup. We are extremely satisfied with the progress that has been made since then and are looking forward to continuing our support throughout the regatta."

Cabling for the Cup — A District Perspective

SANDY McTAGGART

The staff of Telecom WA's Perth South District barely had time to recover from the euphoria surrounding Australia II's win at the 1983 America's Cup series before the first enquiries for service for the 1987 challenge came flooding in. This article discusses the background and methods adopted to provide a local cable network to cope with the greatly increased demand for telecommunications services in the Fremantle area.

BACKGROUND

Fremantle, where the 1987 challenge will be centred, has in the past been largely unaffected by the State's recurrent economic booms and population increases. It was, and would no doubt have remained, an area of slow service growth. This, combined with local difficulties in providing underground plant within the narrow road verges and through hard limestone rock common in this area, did little to encourage generous plant provision in the past.

As the number and variety of service enquiries increased, it was clear they could not be met by simple additions or alterations to the existing network. If costs were to be contained, while providing service promised to be superior to that provided at Newport, then maximum effort in local planning and co-ordination was needed.

DISTRICT PLANNING

Though it was readily agreed by all concerned that the 1987 challenge would generate unprecedented service demand, uncertainty surrounded the detail required to upgrade and extend the network. Key questions such as "Where would challenge syndicates be accommodated" "What demand would be generated by visitors and spectators" "Where would the Media Centre be established" required answers.

Faced by these questions, Telecom in Western Australia did what Telecoms the world over do, we formed a committee. We did however keep it lean (three members) and seconded staff whose duties dictated they retain a vital interest in the outcomes of the many issues raised.

The committee's brief was:

— To gather and record information regarding projects planned in and around Fremantle in the three year timespan. (A number of projects were first heard of only as rumours and could easily have been overlooked).
— To establish a base to provide lines of communication between the District and other authorities and groups involved in "Challenge" planning.
— To liaise with other Telecom groups engaged in related activities.
— From the information gained, predict customer requirements and recommend action to provide local plant, in an economic manner to meet the demand.

As information was gathered and preliminary planning commenced, additional ground rules were required to ensure the provisioning would be both economic and timely. These would cover secondary questions such as, "How many additional lines will be required by, cruise ships, or a floating hotel?" and "How best could we capitalise on our investment, if the Fremantle "Challenge" proved to be a once only affair?"

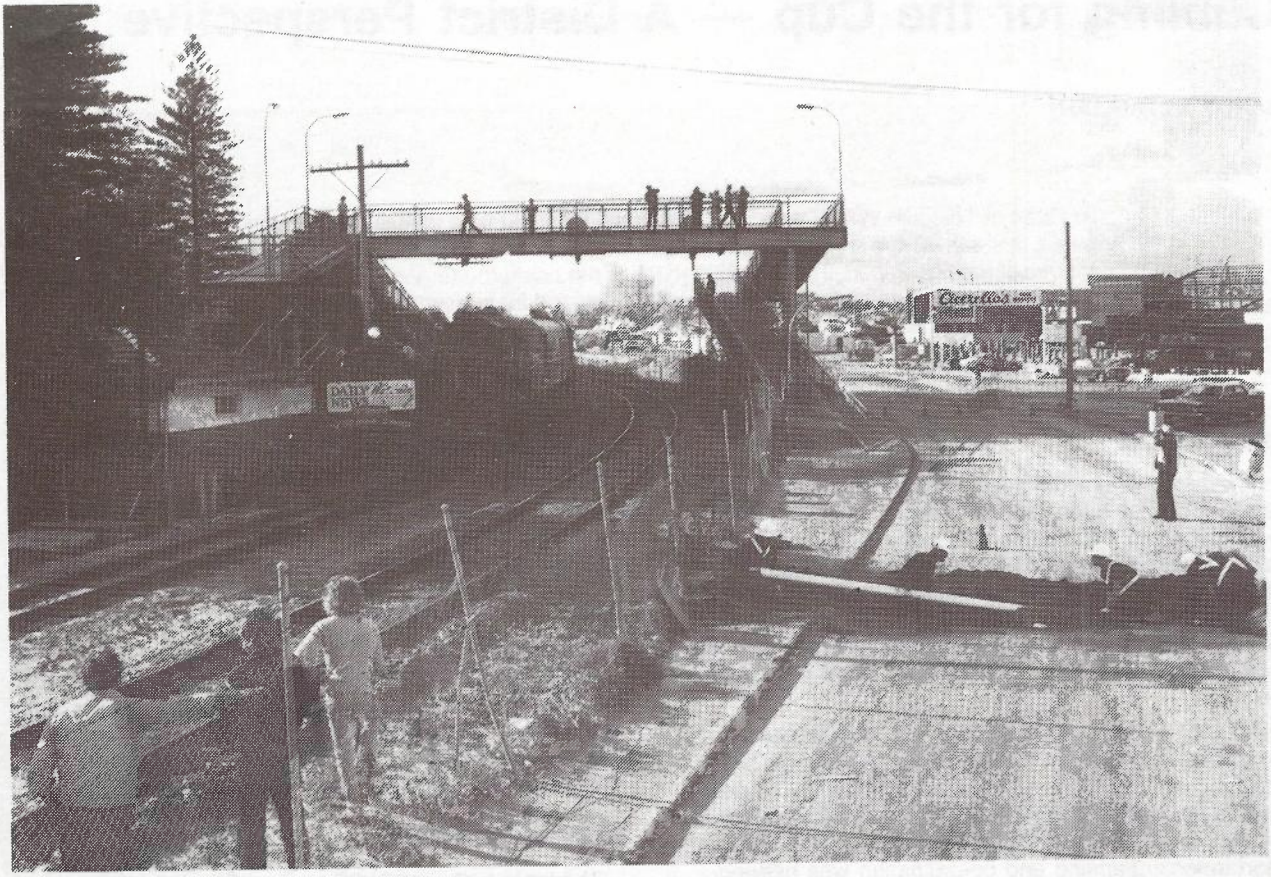
Rules relating to questions on the number of pairs required in specific cases proved relatively easy. By considering similar events, such as previous berthings by cruise ships and the pair requirement for shore based hotels, we obtained sufficient information to provide reliable predictions.

Ensuring that as far as possible we would get the best return on investment, proved a somewhat more difficult task. It required a study of proposed development beyond 1987 and recognition of the information gained, within the design for the new cable plant.

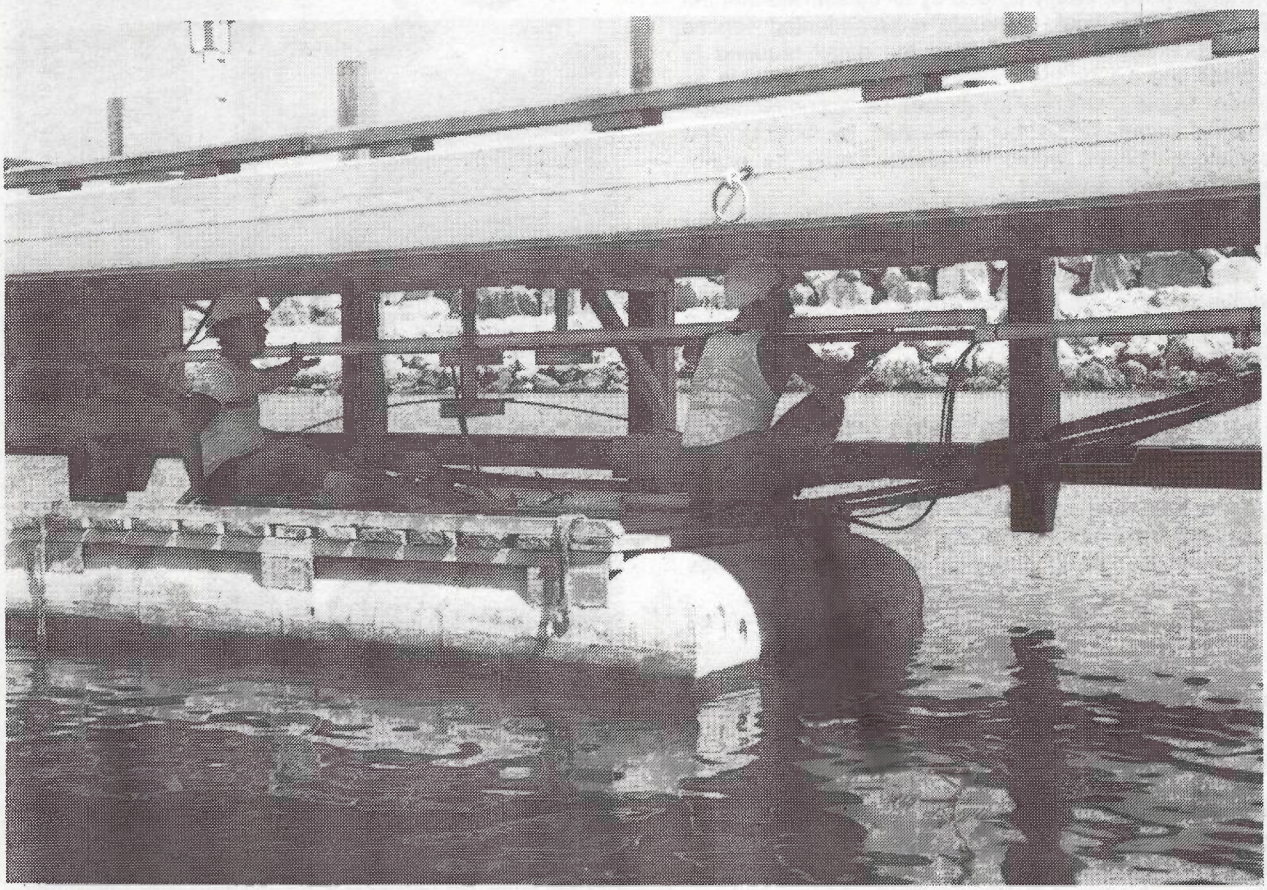
SERVICE PROVISION

The latter half of 1984/85 saw confirmation of Fremantle's bid to host the 12 Metre, World Championships in

Ducting under the railway line in Fremantle, near Challenger Harbour.



Laying ducts to Challenger Harbour.



A home-made pontoon, used to assist with ducting and cabling in Challenger Harbour.

1986. Though it meant a significant reduction in our planning and provisioning time, the event presented such a golden opportunity to rehearse the 1987 Cup Challenge that it could not be missed.

With this in mind, last minute negotiations with Councils and other interested bodies were undertaken and plans finalised. Then, with a deep breath and much touching of wood, we started on the project, which was estimated to require 10,000 manhours and cost in excess of $200,000 to complete.

Though the majority of jobs proceeded uneventfully, there were a number of interesting and often unexpected sidelights. Installation crews for instance, found their image and interest enhanced by the general interest shown by the public. Material shortages, that bane of most large projects, were kept to a minimum by our earlier decision to use known available cable and material items wherever possible.

In looking back on the work, the narrow and congested verges previously mentioned, required many hours of difficult hand digging. Though this brought to light a surprising number of antique bottles, it also demanded cable laying of a style more akin to weaving than to our normal strict observance of service depths and alignments.

To provide wharfs and jetties with service our linemen took to fixing pipe and cable from borrowed boats, barges and on one occasion a home made raft of secondhand innertubes and a plank of wood. There was also a gang who, having just cut beneath a railway track, which had proved too difficult to bore, ran into the 1 metre thick foundation of an old sea wall. This happy accident proved a blessing for local historians and helped plot the course of a long forgotten shoreline.

CONCLUSION

It is now a matter of record that all was ready on time for the 12 Metre Championships. Thanks for this must go to our staff, who overcame many difficulties in their usual laconic and quiet humoured manner. Communication systems, serviced through the local network, performed well and to the best of our knowledge there were no shortages or serious breakdowns. We are not however about to become complacent, for I know that somewhere out there, just before the starting gun sounds, someone will find an urgent need for 100 additional pairs in the tower behind the Town Hall clock. Even at this very moment some excavation contractor may be drawing an X on the very spot where one of his workmen can do the most damage in the least time.

SANDY McTAGGART, joined the PMG Department as a Lineman, sometime after the arrival of the first fleet. His present position as the External Plant Manager, Perth South District, was arrived at by a path which included periods as a Technical Instructor, Technical Officer Engineering and Planning. He vehemently denies that his overseas holiday booking which coincides with the 1987 Cup Challenge, has anything to do with the performance of the local network.

Information Transfer News

IBM ANNOUNCES PLANS TO MANUFACTURE TELECOMMUNICATIONS PRODUCTS

IBM Australia has announced it will produce telecommunications products at its Wangaratta facility, in Victoria.

These products will be manufactured in addition to the range of personal computer equipment already being produced there.

This is the first major announcement for IBM in the telecommunications area since it began marketing ROLM products in Australia last February and is in line with a Telecom agreement requiring telecommunications suppliers to include local content in their products.

Two Communications Controllers, the CBX-II and the VSCBX, will be produced at the plant and the first models are expected to be rolling off the assembly line later this year. These controllers are the computer-based hub of the ROLM business communications system.

The ROLM CBX-II 8000 system supports up to 840 voice and/or data lines and/or associated Telecom trunks. The CBX-II also offers connection to information sources and voice/data networks extending beyond the system itself. The VSCBX is designed for smaller systems with 16 to 140 users.

IBM Australia Director of Technical Operations, Tony Bowra said this was a strategic investment for IBM.

"This expansion at Wangaratta emphasises IBM's commitment to local industry by creating opportunities for Australian suppliers and providing employment prospects for a range of skilled people," Mr Bowra said.

Set up the CBX assembly line began in June. Specialised card manufacturing equipment will be installed during October to supplement Wangaratta's card line. Card test and system test equipment also will arrive at the plant at that time.

Initially, ten different high volume control cards will be manufactured on Wangaratta's card line. These will be phased in gradually during 1986 and 1987.

Frames and other metal fabricated components for the CBX will be sourced and manufactured by local vendors. Meetings are being held with local suppliers to determine the supply of other commodities necessary for the CBX.

Mr Bowra said that staff working on the project would receive specialised training to ensure the highest quality production.

"By the end of 1989, we expect to have about 30 people working on the manufacture of telecommunciations equipment," he said. "That is a significant investment in personnel and IBM is committed to ensuring they have the expertise necessary for the job.

"Training will begin this year for engineering staff who will attend courses at ROLM in the United States. One engineer will be assigned to ROLM in the US to learn sophisticated test programming techniques."

The ROLM Corporation became a wholly owned IBM Corporation subsidiary in 1984. It is a leading supplier of digital business communications systems with more than 18,000 systems installed worldwide. ROLM products include the CBX-II and VSCBX, the ROLMphone family of digital telephones, advanced workstations and voice messaging systems.

America's Cup Impact on Perth Interstate and International Telephony Traffic

J. J. A. WILSON

America's Cup challenge events are expected to add significantly to the usual Christmas peak in interstate and international telephony traffic in Perth in 1986 and to extend the period of heavy demand to about April or May, 1987.

The strategy adopted for coping with trunk circuit requirements is to accelerate, by **one** year, the growth of **interstate** trunk circuits and, by **two** years, the growth of **international** trunk circuits, specified in a Headquarters produced document CP2222. This means installing, by October 1986, the total circuit quantities that would normally be needed for Christmas 1987, between the main trunk exchanges in Perth (Wellington 10C, Pier ARM, Pier OTT, Wellington and Maylands DTTs) and their counterparts in the other state capital cities. It also means installing, by October 1986, the total circuit quantities that would normally be needed for Christmas 1988, between the main trunk exchanges in Perth and the OTC's international "gateway" exchanges at Broadway and Paddington, in Sydney.

As OTC's new digital gateway exchange at Scoresby, near Melbourne, will not be ready for service in time for the America's Cup events, it will be necessary to route all of WA's international traffic through the analogue gateway exchanges at Broadway and Paddington. These exchanges are nearing full capacity but the full requirements for terminations for WA circuits have been assured following negotiations and agreement between OTC and Telecom.

Telecom's policy is to provide Call Charge Record (CCR) facilities to all customers with International Subscriber Dialling (ISD) access and Calling Line Identification (CLI) at their local exchange. This means that all ISD calls originating in the Integrated Digital Network (IDN) will require CCR. However, at the time of the Americas Cup challenge events, the AXE Digital Trunk Tandem (DTT) exchanges in Perth will not be capable of providing CCR facilities. It will therefore be necessary to route all ISD/CCR calls from the IDN through the Wellington 10C (the only Perth exchange equipped to provide CCR) enroute to the OTC's gateway exchanges in Sydney.

STD CCR, when available, is provided only if the customer pays for it. Its penetration is, at present, relatively low. Nevertheless, all STD/CCR calls must also be routed through the Wellington 10C.

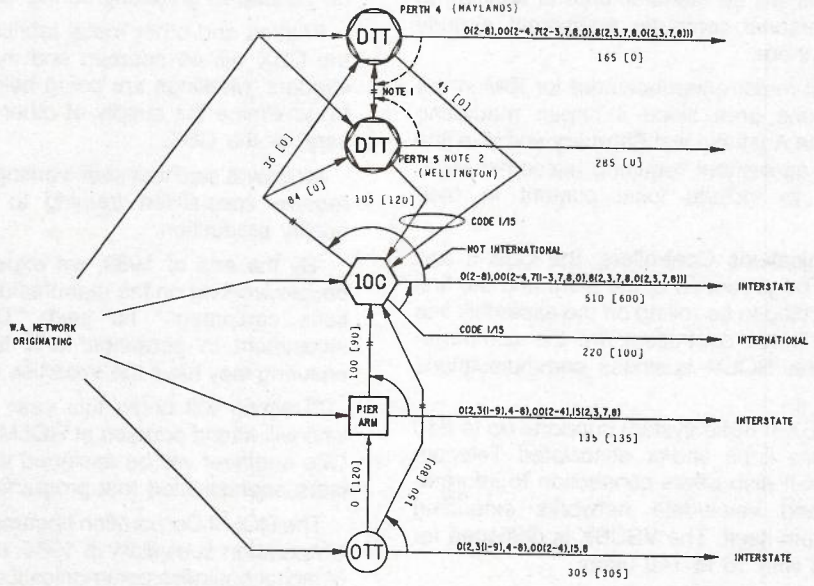
Multimetered STD (STD/MM) calls will be handled, as appropriate, by the OTT, ARM, 10C and DTTs.

Taking all these factors into account, it will be possible to use the newly developed Perth DTTs and East-West digital bearers only for STD/MM traffic from the IDN and overflow STD/MM traffic from the analogue network. It will be necessary to equip the Wellington 10C to its full capacity and to rely heavily on interstate analogue bearers to handle all STD/CCR and ISD traffic during the Americas Cup Challenge events in 1986/87.

Footnote:

JEFF WILSON graduated as an engineer in 1971 from the WA Institute of Technology, having worked as a technician and senior technician in the PMG's Department since 1961.

As an engineer, he worked in a variety of areas, entering the Transmission and Lines Planning Branch (Telecom Aust) in 1978. Since then, all but 18 months have been spent in planning positions and he is, at present, acting Supervising Engineer, Trunk Planning, Country Region, Telecom WA.



W.A.
T.R.S. SWITCHING SCHEME
INTERSTATE/INTERNATIONAL TRAFFIC

12 Metre Yacht Telemetry System

MIKE KENNY B.E., C. Eng., M.I.E. (Aust)
NICK TSIGOULIS B.E.
TED WALKER B. App. Sc.

America's Cup communications needs have resulted in a favourable market for the development of new and novel communications systems.

Telecom Australia has responded to the challenge of providing a mobile telemetry system for America's Cup syndicates.

This article describes the development of the system which transmits a computer's statistical data from a racing yacht to other mobile or fixed locations for subsequent analysis.

INTRODUCTION

One of the more challenging communications facilities provided by Telecom Australia for the America's Cup is the telemetry systems that transmit statistical data from a computer on-board a yacht to data gathering and analysing equipment on a tender (the vessel which tows a yacht out to the racing location) and/or shore-based location.

The names given to the systems are Data Acquisition System 1000 (DAS1000) for the ship to shore system and DAS 2000 for the ship to ship system.

Analysis of the data provides the skipper and crew with information such as timing of different tacking procedures, boat performance, different navigational variants (wind speed, wind angle, compass bearings, rudder angles, rig tensions, deceleration, acceleration, etc.), overall equipment performance (comparison to other sails, masts, etc.) and a host of other indicators.

Many syndicates have used this information to assist in building improved versions of their yachts, for example, Australia III and IV and Kookaburra II and III.

This article is a technical discussion on the development of the telemetry systems now available to America's Cup, Syndicates.

DEVELOPMENT PARAMETERS

At the request of one of the Australian syndicates, Telecom WA conducted a feasibility study into the development of a telemetry system to relay data between two mobile ocean locations (ship to ship) and/or a mobile ocean to shore location (ship to shore). The following parameters were specified for the study.

- The system was required to provide data transmission from ship to ship and ship to shore within the defined America's Cup racecourse area. Refer Fig. 1. A bearer extension to a shore-based computer installation was also required.
- Only one way (simplex) data transmission is permitted, but the option of full duplex or half duplex (both way) was desirable for other than America's Cup use of the equipment.
- Synchronous and asynchronous transmission using RS232 protocol was required.
- The system was required to support a data speed of 4800 bits per second (bps) at error rates better than 10^{-5}.
- Equipment capable of functioning reliably in a harsh environment was required.
- Development time constraints implied the use of available hardware for the prime building blocks of the system, with limited development of ancillary hardware to complement the design.

The project was broken down into two areas — a radio system and a data system. Each system was then investigated separately

RADIO SYSTEM

To assess whether an acceptable data error rate performance could be achieved, worst case radio path losses likely to be encountered on the nominated America's Cup course had to be calculated theoretically. The expected received carrier levels of the radio signal (RSL) has a bearing on error performance.

A further complication to path analysis (theoretically calculated on a fixed transmitting antenna to a fixed receiving antenna) is added by the phenomenon known as multipath fading. Multipath fading occurs when there is simultaneous reception (by the receiving antenna) of electromagnetic waves which have travelled through slightly different path lengths as a result of ducting or reflections from static or moving objects.

Depending on the relative phase and amplitude of electromagnetic waves at the receiving antenna at a particular point in time, it is statistically possible for the received signal to cancel or add. Practically, this phenomenon causes a deviation of the RSL, about the predicted free space RSL for a point to point system without multipath fading.

To determine the system parameters affecting by multipath fading, analysis of the mathematical model for the simple two signal case of one direct path and one reflected or refracted path was undertaken. From this analysis the two parameters modified by multipath fading are the magnitude of the resultant signal at the receiving antenna, and the modulation depth of the FM encoded signal. The modulation index (M) is modified by a product factor of cos ($\varnothing$/2) where $\varnothing$ is the relative phase difference between the two received modulation signals on the RF carriers at the antenna. Both of these effects

result in a degraded Signal to Noise and Distortion (SINAD) ratio for the baseband audio output signal from the radio receiver.

To minimise data errors the selection of a radio system with a high SINAD ratio for the low carrier RSL's expected on the America's Cup course was seen as a pre-requisite in system design.

Evaluation of Available Radio Systems:

- Mobile Telephone Service (MTS):

The MTS system was evaluated for data transmission. An MTS transmitter mounted in the Co-operative Bulk Handling grain silo (CBH) at North Fremantle gives radio path coverage to the America's Cup course. This MTS site is one of four integral sites of the Perth metropolitan area MTS system and is used for coastal pockets where coverage from Perth is marginal.

MTS was rejected because of the frequent multiple data error bursts encountered when using data modems suitable for simplex operation. These error bursts were dependent on the data pattern being transmitted (bit pattern sensitivity) and were attributed to the activation of in-band detectors in the MTS, which caused momentary breaks in the transmission path.

The hand-off function for base station vote and switch used to optimise receive signal level on a mobile call at MTS cell boundaries also created severe data error rates, and although infrequent, was not considered acceptable to the overall design requirements.

- Single Channel Radio Systems:

Data propagation tests were performed over five different single channel radio system types used by Telecom Australia and operating in the VHF band (30-300 MHz).

TED WALKER joined the PMG Department as a Technician in Training in 1964, qualifying as a Technician 1968 and Technical Officer in 1972.

Ted Walker was awarded a Telecom Undergraduate Scholarship at the Western Australia Institutue of Technology (WAIT) receiving the Bachelor of Applied Science Degree in 1979.

In 1982 he was appointed as Engineer Class 2 working for the Radiocommunications Service Group in WA, also undertaking research and design work as the author of a technical publication on the "Design of Telephone Services Using Radio" for HQ Transmission and Network Design Branch.

Ted Walker is currently a Senior Engineer in the Switching Support Section, WA.

NICK TSIGOULIS joined Telecom in 1980 after successfully completing a Bachelor of Electronic Engineering degree course at the University of Western Australia in 1979.

During and after a work experience rotation scheme for graduate engineers the majority of his time was spent providing engineering support for radiocommunication installation projects and customer terminal equipment.

In 1985 he was appointed in his current position of Engineer Class 2 in the Transmission Support Section of Network Management Branch.

MIKE KENNY graduated with a Bachelor of Electronic Engineering degree at the University of Western Australia and commenced working in Telecom's Customer Network Section in 1981. After working on the W.A. Digital Data Network installation he moved to Radio Section where he developed computer programs to analyse microwave bearer performance, and provided support for the Mobile Telephone Service project and the Digital Microwave Upgrade.

In 1985 he was appointed as a Class 2 Engineer in Transmission Support Section where he provided engineering support for customer radio communication systems.

He is presently studying for a Master of Engineering Science Degree and is a partner in a design consultancy firm.

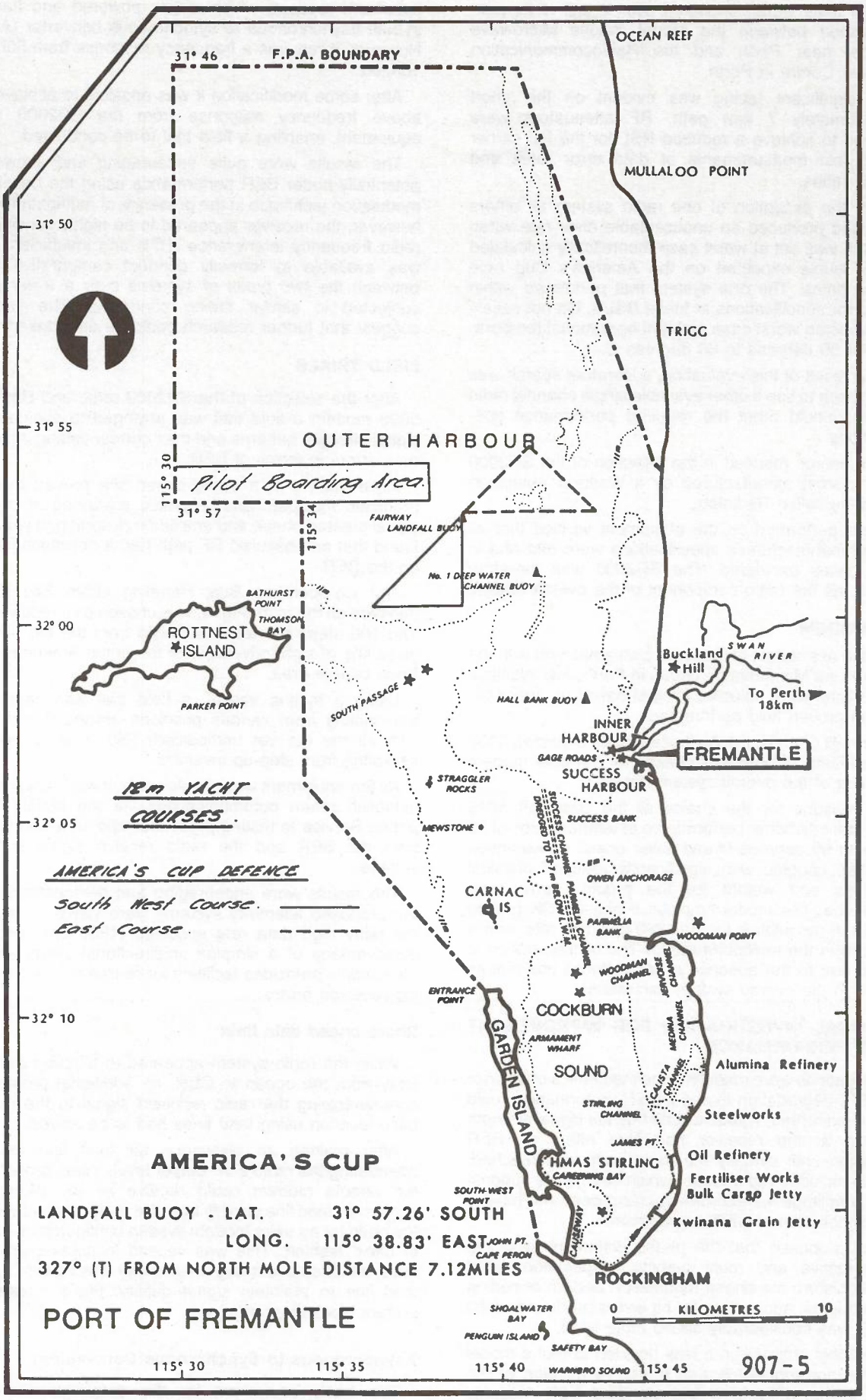


Fig 1. America's Cup Course.

Initial trials were conducted over a test radio path established between the Mount Yokine Microwave terminal near Perth and the Radiocommunication Services Centre in Perth.

No significant fading was evident on this short (approximately 7 km) path. RF attenuators were required to achieve a reduced RSL for the RF carrier during test measurements of data error rates and SINAD ratios.

With the exception of one radio system all others evaluated produced an unacceptable error rate when the RSL was set at worst case theoretically calculated carrier levels expected on the America's Cup race course paths. The one system that performed within data error specifications at these RSL's, did not satisfy the expected worst case ambient operational temperatures of 50 degrees to 60 degrees C.

As a result of this evaluation, a literature search was undertaken to see if other available single channel radio systems could meet the required performance specifications.

This search resulted in the selection of the SR2000 radio system manufactured by a Western Australian Company called Radiolab.

Tests performed on the equipment verified that all quoted manufacturer's specifications were met and in most cases exceeded. The SR2000 was therefore chosen as the radio component of the overall design.

DATA MODEM

With the assistance of Telecom staff employed with the Data and Line Maintenance Group in Perth, two available modem types were selected for trial based on specifications and proven field performance.

As a result of trials, the Australian made Datacraft 5096 Universal Data Modem was chosen for the data modem component of the overall system design.

Main reasons for the choice of the Datacraft 5096 modem were its better performance at temperatures of 50 degrees to 60 degrees C and lower power consumption (11 watts), coupled with significantly reduced physical dimensions and weight for the required error rate performance. The model employs 8 phase PSK (phase shift keying) modulation for the 4800 bps data rate, and is configured in the multipoint mode. The re-train option is disabled due to the absence of a backward channel as specified in the overall system parameters.

ADDITIONAL INVESTIGATION FOR IMPROVEMENT OF BER PERFORMANCE

Investigations were made into the mechanics of bit error rate (BER) degradation to see if BER performance could be improved further. It was noticed that the signal strength appearing at the receiver had little effect on BER degradation until virtually the mute point was reached. This also included rapid fades, which seemed to suggest that an amplitude variation mechanism does not have a major contribution to BER degradation.

It was proposed that the phase distortions resulting from refractive and multi pathing propagation could seriously disturb the phase modulation system of coding in the modems, accounting for bit errors produced whilst the RSL was considerably above mute level.

To test this proposition it was decided to trial a model which did not specifically use phase modulation of the carrier. It was difficult to find standard FSK modems working at 4800 bps. The chosen modem was the EEL baseband modem, which is low powered and has an in-built asynchronous to sytnchronous converter (ASC). However, it requires a frequency response from 50Hz to 10KHxz.

After some modification it was possible to achieve the above frequency response from the SR2000 radio equipment, enabling a field trial to be conducted.

The results were quite encouraging and showed a potentially better BER performance using the baseband modulation technique in the presence of multipath fading, however, the receiver appeared to be highly sensitive to radio frequency interference (RFI) and insufficient time was available to formally conduct comparative tests between the two types of systems over a water path, subjected to similar fading conditions. The findings suggest that further research could be undertaken.

FIELD TRIALS

After the selection of the SR2000 radio and Datacraft 5096 modem a field trial was arranged to evaluate RF signal strength patterns and their corresponding effect on data errors in terms of BER.

Initial trialling at a shore based site proved that the predicted multipath and refractive scattering of the RF signal created phase and amplitude distortion. It was also found that an obscured RF path had a debilitating effect on the BER.

The Co-operative Bulk Handling Grain Silo (CBH) depicted on the map (Fig 1), was chosen as a receive site. The 100 metre elevation achieved from the top of CBH gives line of sight coverage for the entire America's Cup Race course area.

Using a testing vessel, a field trial was conducted transmitting from various positions around the course, with all the (as yet unmodified) 250 V ac equipment operating from step-up inverters.

As the equipment was simplex only, it was necessary to establish return communications via the Mobile Telephone Service to testing personnel who were monitoring both the BER and the radio receive signal strength voltage.

The results were encouraging and demonstrated that the proposed telemetry systems were viable, in spite of the fairly high data rate specified (4800 bps) and the disadvantage of a simplex unidirectional system which necessarily precludes facilities for re-transmission following received errors.

Shore based data link:

While the radio system appeared to function satisfactorily from the ocean to CBH, an additional problem of communicating the radio received signal to the remote base location using land lines had to be solved.

After making an allowance for land line loss by attenuating the radio's VF output level, it was proven that the remote modem could receive its VF information across the land line directly from the radio receiver without the need for an extra modem system configured in a 'back to back' fashion. This was verified in subsequent field trials, although eventually an amplifier was installed in the land line to maintain signal quality. Fig 2 shows the system block diagram.

Asynchronous to Synchronous Conversion:

The basic equipment for the data link was now established with data tests based on standard Telecom

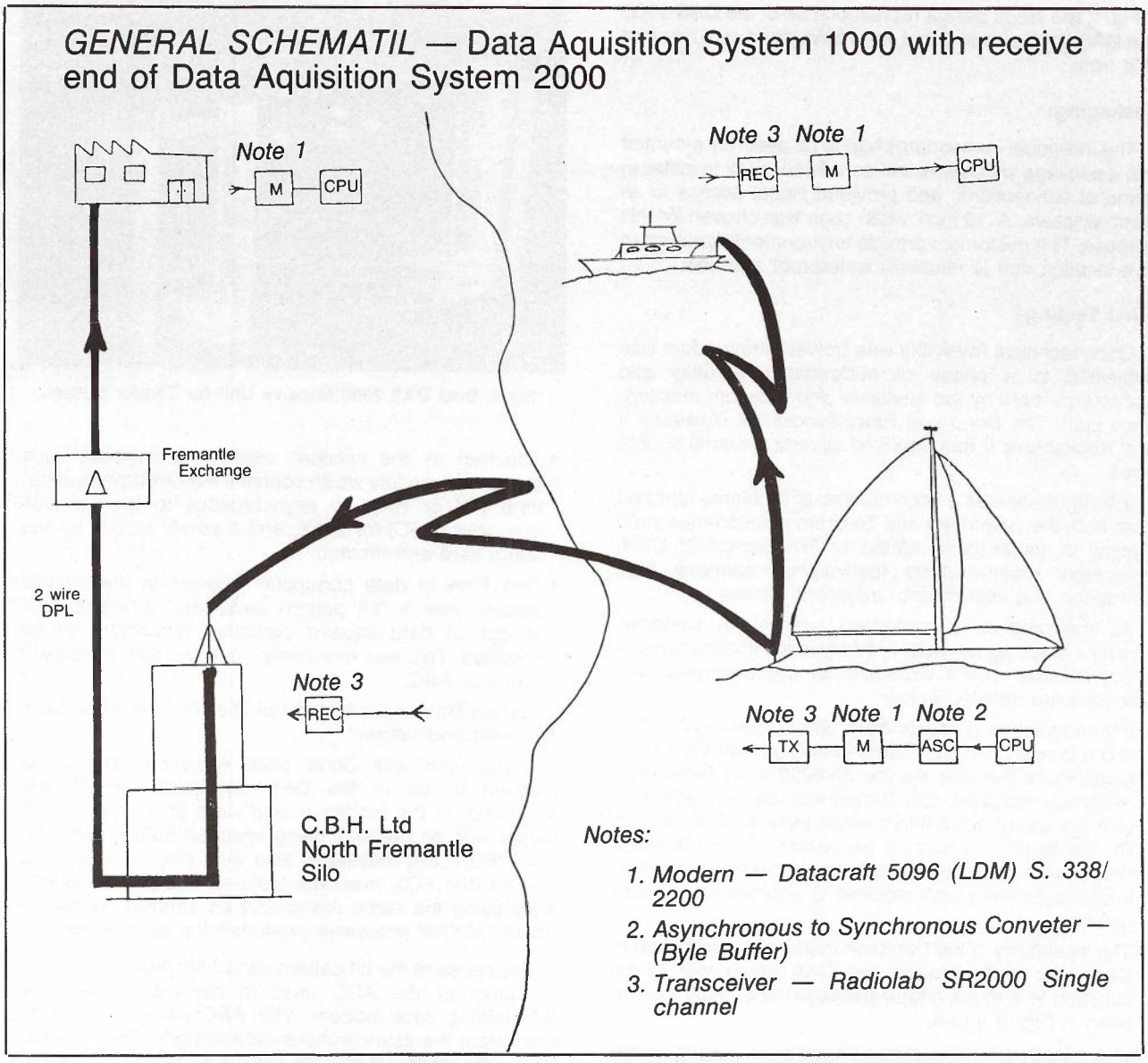


Fig 2. Block Diagram of the DAS 1000 and DAS 2000 Systems.

procedures for 4800 bps data links, which are almost always supplied by Telecom as synchronous in nature.

As the data input to the system is asynchronous in format, commercial asynchronous to synchronous converters (ASC) were sought and evaluated. Some problems were encountered in procuring suitable converters, due mainly to the 'bursty' nature of the data stream from the yacht's computer.

The chosen ASC was powered from the RS232 line and accepted changes in the word format (eg parity, stop bits) without requiring manual configuration. This expedited many tests which involved the use of multiple formats for the words.

After testing it was determined that a receiver ASC was not necessary as most devices would derive their data timing from the incoming clock. This saved costs.

Power Supplies and Alarms:

The next task was to adapt the equipment to a form which was suitable for mounting in a yacht.

A switched mode power supply was required for the modem (which is normally 250 V ac powered) and for the extension of alarm facilities. The yachts use a bank of batteries to supply power.

A small power supply providing $\pm$12V and 5V dc power was designed and fitted in the modem housing. This was replaced in later versions of the equipment with a commercially available unit.

Whilst the modems and ASC's had operation and alarm indications which were still visible after the system had been packaged, the transmitter had no such facilities, although basic logic states were available in internal circuitry.

It was considered necessary to provide simple diagnostic indicators for POWER ON, HIGH VSWR, TRANSMITTING and LOW BATTERY VOLTS. A small printed circuit board (PCB) was designed around a comparator chip, which provided all the above indications. A similar PCB was designed for the receiver which included indications of LOW SIGNAL STRENGTH and RECEIVER MUTING.

As a later refinement, a dual purpose board was designed.

Fig. 2 is a block design representation of the DAS 1000 and DAS 2000 systems that were developed as a result of field trails.

Packaging:

The individual components had to be securely mounted into a package which was self-contained, easy to install in terms of connections, and provided visual access to all alarm displays. A '19 inch' width cage was chosen for this purpose. The customers provide environmental protection in a location that is relatively waterproof and cool.

Final Testing?

Once technical feasibility was proven, the product was subjected to a phase of performance scrutiny and acceptance both by the customer and Telecom maintenance staff. The Bond and Parry syndicates (Australia II and Kookaburra I) had acquired several systems by late 1985.

Initially, there was a large number of problems reported from both the customers and Telecom maintenance staff. Typical of these were related to interference at CBH, equipment maintainability (packaging), spurious data corruption and intermittent equipment failures.

As the product is marketed towards the customer having a lease agreement, it readily lends itself to product improvements. Some examples of improvements and solutions are detailed below:

- Intermodulation products from other equipment at the shore based radio site (CBH) interfered with DAS 1000 receivers at the site. As the SR2000 radio receiver is extremely sensitive, only limited success was achieved with the use of notch filters which allow each receiver's RF bandwidth (25 KHz) to be passed. A new antenna choice with tighter bandwidth and a change of system frequencies were also required to achieve satisfactory results.
- The availability of the Datacraft modem in card format in December 1985 allowed the DAS equipment to be supplied in a much neater package. The result can be seen in **Fig. 3** and **4.**

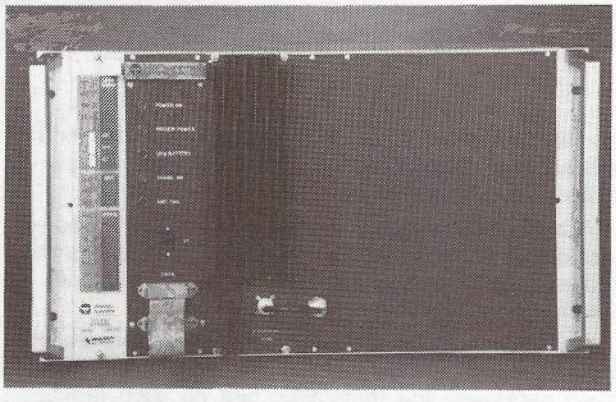


Fig 3. DAS 2000 Transmit Unit for 12m Yacht.

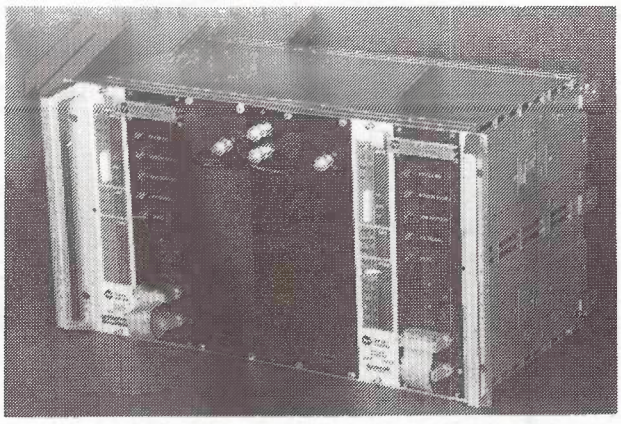


Fig 4. Dual DAS 2000 Receive Unit for Tender Vessel.

- Attached to the modem card is a miscellaneous equipment module which contains a dual purpose alarm card (TX or RX), an asynchronous to synchronous converter (ASC) for a TX, and a power supply for the alarm card and modem.
- One form of data corruption inherent in the original system was a "bit pattern sensitivity" where certain strings of data caused particular characters to be modified. This was eventually remedied with a different brand of ASC.

A Data Maintenance report of this challenging problem is reproduced below:

"Investigations with Serial Data Analysers proved the problem to be in the DAS equipment, which was surprising as the modems used were of a synchronous nature with bit patterns being encoded before transmission. "FOX" test messages also work error free over the system (the FOX message tests all characters). Bench tests using the same timing and bit patterns as the on board OCKAM processor produced the same errors.

The cause of the bit pattern sensitivity proved to be the operation of the ASC used in conjunction with the transmitting data modem. The ASC derives a system clock from the asynchronous data system. The synchronous data modem then uses this clock to input the data at the correct sample rate. Unfortunately, under certain conditions (bit strings), the ASC provided clock variations too great for the modem to track, thus causing bit pattern sensitivity.

To overcome this, an ASC with a different mode of operation was selected. The asynchronous data was now held in a temporary "elastic" memory and then clocked out of the ASC by the normal modem clock. The new ASC was a success and no more problems of this nature have been encountered.

This incident highlights the need to use serial data analysers when fault finding on systems of this nature, as standard "FOX" messages do not, under certain circumstances, fully test the equipment.

Frequency Management for the America's Cup

B. R. FIELD
State Manager
RFM Division, DOC,
Perth

DEPARTMENT OF COMMUNICATIONS

The Radio Frequency Management Division of the Department of Communications is responsible for policy issues affecting the use of the radio frequency spectrum in Australia and its overseas territories. It has statutory responsibility to administer the Radiocommunications Act 1983, is responsible for frequency assignments, the licensing of radio communication stations, the setting of standards in relation to radio transmitters and compliance testing of equipment to ensure adherance to the standards.

An important objective of the RFM Division is to "Enable information to pass through the electromagnetic spectrum between all users in the most efficient and economic manner practicable with minimum interference between services."

With this objective in mind, and because of the international nature of the America's Cup event, special consideration had to be given to the radiocommunication needs of organisations and syndicates involved in the administration of and participation in the event.

Existing users of the radio frequency spectrum in Perth and Fremantle had also to be given special consideration to ensure that their long term development and expansion plans were not inhibited by transient participants in the America's Cup competition.

Assistance to the Syndicates

The staff of the Western Australian office of the RFM Division prepared an "information package" with a wealth of information about the Australian radiocommunications licensing system and as much advice as possible to assist those persons responsible, on behalf of competing syndicates, for liaising with the Division to license radiocommunication systems. The package was distributed within Australia and overseas to syndicates and interested parties in July 1985.

For the sake of completeness the package contained a large number of brochures explaining licensing conditions and equipment approval requirements in depth. The purpose of the brochures was to facilitate long distance telephone and telex discussions, particularly where there were language difficulties, by being able to quote numbered paragraphs in the brochures. It was realised that the mass of information could be daunting for some and for this reason syndicate representatives were invited to telephone or, preferably, visit the Western Australian office of RFM Division to discuss their communication requirements so that any special needs could be considered and licensing made easier for them. It was emphasized that the brochures were intended to be helpful but that a friendly chat with our Department's officers would be much more helpful. Response to the package was very good.

One of the first issues RFM officers had to consider was the use of the Very High Frequency (VHF) International Maritime Mobile (IMM) channels by race organisers and participants. The VHF IMM band provides for a commonly used and available radio communication system for the entire marine industry. If reports are to be believed, the VHF IMM band was used with success at Newport, Rhode Island.

Because Fremantle is a busy international harbour and commercial fishing port there are many existing users of VHF IMM channels and land mobile services using VHF channels adjacent to the IMM band which had to be protected from radio interference. There are 55 standard international channels in the VHF IMM bands but it is not possible to use all of them in any one port, particularly for ship to shore communications where a base station is used on the land. (Complaints of interference were received when just one syndicate attempted to use an unauthorised base station at Fremantle).

There was such intense frequency congestion in the Fremantle/Perth area that it was almost impossible to offer hope that syndicates could satisfactorily operate private VHF IMM Limited Coast Stations (land based stations with VHF IMM frequencies) for ship to shore communications.

Radio interference between the VHF IMM Limited Coast Stations and between those stations and other land mobile services, coupled with the inevitable sharing of channels, made it necessary for syndicates to abandon the idea of using Limited Coast Stations on shore. A need also for a number of VHF IMM channels for race control by the Challenger of Record and Royal Perth Yacht Club, for spectator fleet control by the Marine and Harbours Department, and additional "Seaphone" channels by the Overseas Telecommunications Commission added to the need for some alternative means of ship to shore communication for the syndicates. Intermodulation interference was a particularly critical problem.

Happily, the RFM Division was able to offer syndicates an attractive alternative, viz: licences to operate in the UHF land mobile band between 450-490 MHz with a base and mobile service with talk through repeater facilities.

This alternative provides a number of advantages:

- Each licensee (each syndicate) could be granted exclusive channels, e.g., there would be no other using the same channels.
- Secrecy devices (speech scramblers) could be used as a precaution against interception. Privacy is very important to the syndicates.
- Approved equipment is readily available in Australia and special temporary approvals could be obtained for foreign equipment which met certain minimum compliance with Australian Standards, provided that the equipment also complied with an acceptable foreign standard.

- UHF assignments could be quickly assigned by the Division.
- The system could include a land base station, mobile sets in vehicles and vessels, handheld transceivers and fixed-in-position remote control stations.
- The system could be used for onshore, offshore and ship to ship communications.
- Telemetry (data), as well as voice, could be transmitted between all transceivers, provided that the normal voice bandwidths were not exceeded.
- Separate simplex UHF frequencies could also be assigned to add greater flexibility to the radiocommunication system, e.g., should the yachts and tenders wish to communicate on a separate channel to the talk through system used by others in the syndicate.

Our information package explained that discrete frequencies could also be assigned for the transmission of telemetry (data) from yacht to tender and from tender to shore based syndicate headquarters. These discrete frequency assignments, at approximately 151 MHz have been popularly accepted by the syndicates, and used effectively during the 12 metre championships. (Ref. 1).

Syndicates were also informed about other supplementary means of communication for which they could obtain licences. These included the Citizen Band Radiocommunication Service (CBRS) with 40 channels in two bands at 27 MHz and 477 MHz, and the Inshore Boating Service (IBS) with 10 channels at 27 MHz. The IBS is unique to Australia. No other country in the world has an equivalent service for the boating fraternity.

Experience to date, of those syndicates which have licensed and established their radiocommunication systems for the 12 metre championships, indicate that the RFM Division's objective has been and will continue to be met.

Position Fixing Service

A Sercel Syledis position fixing service has been licensed by the Department of Communications and is operating in coastal waters from Garden Island to Yanchep.

This position fixing service is the recognized system for America's cup established by Royal Perth Yacht Club in co-operation with the Department of Marine and Harbours and supported by the W.A. State Government.

The system operates on a UHF channel and is a "passive" system, i.e., each participating vessel has a receiver only. The vessels do not transmit to, interrogate or "handshake" the beacon stations, or transmit any signal that can be intercepted by other parties.

Anonymity of position is secure. Parties on any vessel cannot determine the position of any other vessel. Only persons on the yacht concerned can ascertain, from the display on the yacht's passive receiver, the boat's grid co-ordinate position.

Navigators on the yachts can tell the yacht's exact position, in latitude and longitude. A graphical display on a screen shows the yacht's position relative to the next mark, the distance to the next mark and the yacht's speed.

Meteorological Services

Syndicates require accurate and current meteorological data concerning wind, wave and temperature variations in the area of the America's Cup race courses.

It was not practicable for syndicates to establish meteorological data buoy systems of their own for two reasons; the Fremantle Port Authority must maintain strict control of the number of buoys in the race course area for obvious safety and navigational reasons, and RFM Division would have some difficulty in assigning each syndicate with groups of suitable frequencies. This being the case, a Meteorological Data Bureau was established in Perth using licensed wave rider buoy transmitters with frequencies assigned by RFM Division.

This service was operated very successfully during the 1985/86 racing season and will continue until the completion of the America's Cup in February 1987. Many of the syndicates undergoing trials off Fremantle assessed the data. The Bureau of Meteorology has also used the data as an aid to forecasting. Response from all users has been very favourable.

Media Communications

The demand caused by America's Cup for increased telecommunications facilities for use by the media commits the Department of Communications significantly because of the need for extra licensed services and frequency assignments.

OTC Australia, Telecom Australia, Aussat, the ABC and commercial television and broadcasting companies have sought additional licensed frequency assignments. News Groups from overseas are expected to apply for video and audio link assignments.

Five thousand circulars have been sent to media organisations in Australia and overseas (by courtesy of the America's Cup Media Centre) to remind media personnel of the need for their intentions to be made

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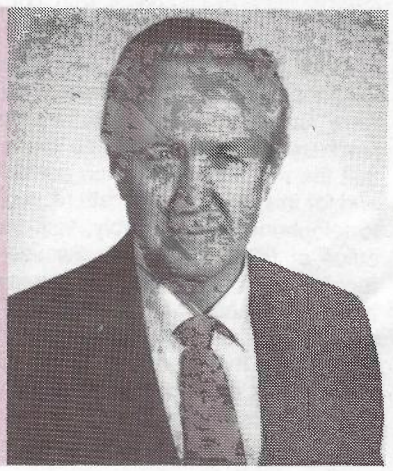
He began his career with the Postmaster General's Department as a Telegraph Messenger in 1944, and subsequently served as a Telegraphist in the Telegraph Branch and Technician in the Engineering Division.

Barrie transferred to the Radio Branch in 1956 as an Assistant Radio Inspector and later obtained the formal qualifications necessary for advancement in that branch.

He remained in the Radio Branch during its various transitions and changes of name before and after the PMG's Department was dissolved, until it became the RFM Division of DOC as it is known today.



known to the RFM Division if they intend to use electronic news gathering equipment, two way radio transceivers or any kind of radio transmitting apparatus.

The unauthorised use of radio transmitters, even handheld transceivers, could have effects ranging from undesirable to catastrophic. Co-ordination of frequency usage is essential.

Licences for radio services in Australia are not normally granted unless the equipment is certified approved to Australian Standards.

An Act of Parliament, the Radiocommunications Act, was proclaimed in August 1985. The Act provides penalties for use, possession or supply of substandard equipment and certain classes of transceivers are prohibited imports. Band plans and frequency assignment tables of other countries differ significantly from those in Australia and equipment which works satisfactorily in another country could cause, or receive, radio interference if used in Australia. This adds to the importance of media personnel to liaise with the RFM Division of the Department of Communications, early before attempting to import and use transmitting equipment in the Fremantle/Perth area.

At the time of writing this in excess of 140 frequencies related to America's Cup activities have been assigned. These are in addition to approximately 400 assignments in use within 3 kilometres of the Fremantle Fisherman's Harbour before America's Cup assignments began, and over 10,000 throughout the metropolitan area of Perth and Fremantle, growing at a rate of approximately 10% per annum. Electronic media equipment, licensed elsewhere in Australia, cannot simply be set up to operate in Perth or Fremantle without liaison with the RFM Division.

Licences have been issued and assignments made as a direct result of the Cup for such diverse services as video links, UHF control stations, a non-directional medium frequency beacon for holding on course a helicopter carrying a camera, a UHF ground-to-air telemetry link to remotely control the camera, electronic news-gathering channels, VHF telemetry links, point-to-point microwave links, UHF base and mobile networks, a maritime position fixing system and meteorological wave rider buoys and a precision time measuring system.

References

1. Kenny, M., Tsigoulas, N., Walker, T. "12 Metre Yacht Telemetry System," Telecommunication Journal of Australia, Vol. 36, No. 2, 1986.

Australian Table of Frequency Allocations – America's Cup

The Australian Table of Frequency Allocations is a listing of the bands into which radio frequency spectrum is divided for the purposes of managing and regulating the operation of radiocommunication services within Australia.

Below are some of the bands in which frequencies have been assigned, at the time of going to press, for communications related to America's Cup.

1705-1800 kHz
FIXED
MOBILE
RADIOLOCATION
RADIONAVIGATION

27.5-28 MHz
METEORLOGICAL AIDS
FIXED
MOBILE

150.05-153 MHz
FIXED
MOBILE
RADIO ASTRONOMY

153-156.7625 MHz
FIXED
MOBILE

156.7625-156.8375 MHz
MARITIME MODULE
(distress and calling)

156.8375-174 MHz
FIXED
MOBILE

420-450 MHz
RADIOLOCATION
Amateur

450-460 MHz
FIXED
MOBILE

460-470 MHz
FIXED
MOBILE
Meteorological-Satellite
(space-to-Earth)

470-520 MHz
FIXED
MOBILE
CITIZEN BAND RADIO
SERVICE

820-850 MHz
FIXED
MOBILE

850-890 MHz
FIXED
MOBILE
Radiolocation

890-902 MHz
FIXED
MOBILE
Radiolocation

902-928 MHz
RADIOLOCATION
Fixed
Mobile

928-942 MHz
FIXED
MOBILE
Radiolocation

942-960 MHz
FIXED
MOBILE

1429-1525 MHz
FIXED
MOBILE

1710-2290 MHz
FIXED
MOBILE

2300-2450 MHz
FIXED
MOBILE
RADIOLOCATION
Amateur

2450-2500 MHz
FIXED
MOBILE
RADIOLOCATION

2500-2535 MHz
FIXED
FIXED-SATELLITE
(space-to-Earth)
MOBILE except
aeronautical mobile
BROADCASTING-
SATELLITE

2535-2655 MHz
FIXED
MOBILE except
aeronautical mobile
BROADCASTING-
SATELLITE

2655-2690 MHz
FIXED
FIXED-SATELLITE
(Earth-to-space)
MOBILE except
aeronautical mobile
BROADCASTING-
SATELLITE
Earth Exploration-
Satellite (passive)
Radio Astronomy
Space Research (passive)

7075-7250 MHz
FIXED
MOBILE

7250-7375 MHz
FIXED SATELLITE
(space-to-Earth)
MOBILE SATELLITE
(space-to-Earth)

12.75-13.25 GHz
FIXED
FIXED-SATELLITE
(Earth-to-space
MOBILE
Space Research
(deep space)
(space-to-Earth)

14.5-14.7145 GHz
FIXED
MOBILE
Space Research

15.1365-15.35 GHz
FIXED
MOBILE
Space Research

America's Cup Media Complex

C.N. HERRING

The countdown to the staging of the first America's Cup in Australia has reached the final phase. For Western Australia the first step was the successful staging of the 1986 World 12 Metre Championships over the period 7 - 20 February.

Around the World, interest in America's Cup racing is high. The competition has become a symbol of sporting excellence. It is one of the great spectator events.

For those not able to be on the course at Fremantle much of the information they receive will be as a result of dissemination through the America's Cup Media Centre.

INTRODUCTION

The 1986 World 12 Metre Fleet Racing Championships conducted off Fremantle during February attracted a record number of media representatives.

The 1987 America's Cup match racing series (October 1986 — February 1987) will attract more media attention than any yachting event in history.

Facilities for up to 2000 Australian and overseas reporters expected to cover the America's Cup events are being jointly funded and sponsored by the Government of Western Australia and the Royal Perth Yacht Club (RPYC).

Development of the Media Centre complex is centred around the use of a former post — World War II navy storage building of some 1300 square metres floor area and other existing buildings on Fremantle Port Authority (FPA) land. The Western Australian Building Management Authority has designed and supervised the project using F.P.A. staff labour for construction.

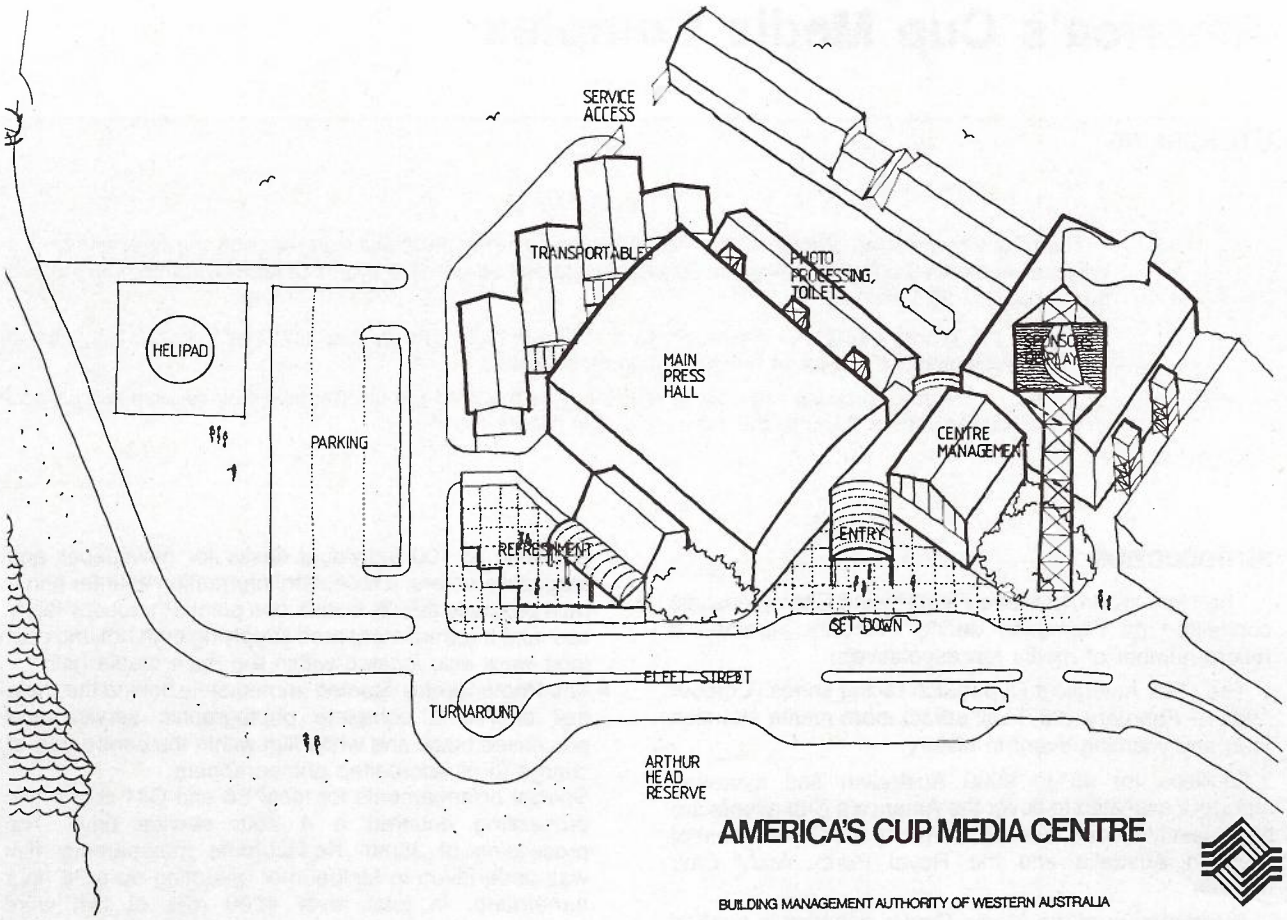
The deployment of reusable transportable classroom buildings provides additional accommodation for a photo centre (four classrooms) and as additional space (three classrooms) to cater for overflow from the main Media Hall and as dedicated space for late demand.

World 12 Metre Championships

With the extensive media interest in the America's Cup events commencing October 1986, the World 12 Metre Championships provided an ideal curtain raiser leading to the full development of the Media Centre Complex.

The first phase of the complex development was completed for use during the World 12 Metre events. Facilities provided include:

- A fully airconditioned main media hall where a range of telephone, telex, facsimile and postal services were provided for use on a "shared" basis.
  The hall also contained five sound booths for radio broadcasters and other areas dedicated to news agencies who had ordered private facilities.
  Television receivers placed around the media hall perimeter provided live viewing of each day's racing, coverage being arranged through the efforts of a local network.
  NOTE — For the America's Cup events, a "host" television signal will be provided under a consortium arrangemment involving four Australian networks.
  Administration and amenities services included the provision of 100 individual desks for newspaper and magazine writers, a reception/information counter and a race progress/results distribution point. Photocopy facilities, and a refreshment area supplying both hot and cold food were also located within the main media hall.
- The Photo Centre situated immediately behind the main hall offered a complete photographic service and processed black and white film within the centre free of charge to all accredited photopraphers.
  Special arrangements for local E6 and C41 colour film processing ensured a 4 hour service time. The processing of 35mm Kodachrome transparency film was undertaken in Melbourne, operating on a 36 hour turnaround. In total, over 4200 rolls of film were processed through the Photo Centre over the race period.
  Facilities for picturegram (wire) transmissions were supported by means of six, 4 wire circuits connecting the Photo Centre with patching facilities at the Perth Carrier Centre.
  A loan and repair camera service operated within the centre stocking a wide range of lenses and camera bodies. Space was also made available to photographers who brought their own enlargers and the Centre provided four machines for general use.
- A centre management and accreditation building, to which media reported on arrival, housed administrative staff, photographic identification equipment and a Telephone Information Management System (TIMS) through which billing for communications service use was processed.
  This building also provided a headquarters for first-aid and security staff.
- The Fremantle Port Authority auditorium located some 300 metres from the main media hall was the venue in which post race interviews were conducted. This venue was equipped with patching facilities to allow direct recording of the interview proceeding and telephones were installed for media working to deadlines.
  Closed circuit television and sound transmissions to the main hall offered an alternative viewing point for those unable to attend the interviews.
  The distribution of results to locations both within Fremantle and Perth was achieved through Telecom's digital data network. IBM terminals were linked to processing equipment installed in the RPYC Fremantle Annex (race control centre) where progressive information during racing was received, validated and input to the database.
  Through the use of helicopters many excellent photos



were obtained as each of the 14 yachts which competed in the World Championships manoeuvred for an advantage.

A helipad located near the Photo Centre allowed members of the media to quickly reach the racing course. On return black and white film was being processed in the Centre and made ready for facsimile transmssion within 25 minutes of landing.

America's Cup Races

From 5 October 1986 to 25 January 1987 the Yacht Club Costa Smeralda (YCCS), appointed by RPYC as Challenger of Record, will conduct the Challenger Elimination event off Fremantle.

Over this four month period, almost 400 races will take place in order to select the best challenger out of the present 13 entries from six countries.

After racing in three Round Robins, the semi-finals and a final, the winner will be awarded the Louis Vuitton Cup (which Australia II won in 1983 in Newport) and will then face the nominated Australian defender.

Commencing 18 October 1986 the RPYC will conduct separate Defenders selection trials for the Australian syndicates, inviting the winner of these trials to defend the America's Cup on Royal Perth's behalf.

In the further development of the Media Centre Complex (Stage 2) special attention has been given to:—

- The need during the period of the Challenger Elimination races and Defenders' selection trials to operate a media complex which will be visually divided into two parts namely the IBM (RPYC) Media Centre and the Louis Vuitton Cup Media Centre.
- An ability to cater for an increase in individual media (above attendance at the World 12s) who will cover the initial Cup events; and also serve the needs (largely dependent on the Nationality of the Challenger) of media representatives who will cover the "best of 7 races" during the 1987 America's Cup Defences.
- Using lessons learnt from the World Championships to improve media operations in an overall sense.

With the above points in mind, existing Centre operations have been expanded in the America's Cup Media Centre and include the following:-

- The number of standard services and facilities for media use on a "shared" basis at no cost to the user excepting for payment of call/service charges has been increased. This arrangement removes the need for a great number of dedicated (personal) services.

Shared facilities available to all accredited media include:-

220 Automatic telephones with direct access to Australian and International networks on individual desks.
4 Coin operated telephones (self service or operator assisted).
8 Charge-a-call telephones (collect or third party billing).
4 Telex machines with International access, and off-line tape preparation machines.
4 Facsimile (telecopier) machines for document transmission.
4 Debit/Credit card telephones (which will be trialled in Western Australia over the Cup period).
6 Country direct services provided by OTC which allow overseas media to make reverse charge calls to their country, bypassing the Australian operator.

Mobile telephones will be available on official press boats

Inside the main media hall some of the 220 desks for shared media use. Raised partitions in the background are radio studio booths. The canteen/refreshment area is behind grills on left.

and photographic services have been increased by over 50% and provided under arrangements similar to those which operated over the period of the World Championships. Film will be recovered by a photo shuttle boat several times during each days racing for processing as the racing progresses.

- Special newsrooms for Australian Associated Press, Reuters, the Associated Press, John Fairfax Group, News Ltd and others have been constructed adjacent to the main Media Hall.
  In the Hanimex/Fuji Photo Centre both private and shared space has been substantially increased beyond that provided for the World 12s to meet the needs of the many leading news and marine photographers who will be present.
  Freelance photographers are also catered for in the complex and the installation of 15 black and white, and 3 colour enlargers and special viewing desks coupled with a total of 14 facsimile leased private circuits will ensure timely worldwide distribution of pictures.
- Television needs will be supported through both local links within Fremantle and other video circuits interfacing with Australian and Overseas network operations. Viewing at the Media Complex is by way of a large central screen and individual monitors throughout all buildings.
  The Fremantle Port Authority building will become the main point for receipt and distribution of the "pool" pictures and also provide a termination point for circuits which will carry video signals out of Fremantle for world-wide viewing (Ref 1).
- In addition to the existing Media Centre Helipad, a refuelling and parking helipad has been constructed within 90 seconds flying time of the Media Centre to service up to 40 aircraft.
  A special directive (NOTAM) issued by the Department of Aviation will assist with air safety during the 4 1/2 months of racing and a special chatter frequency has been assigned for pilot use.
- The Telecom PABX (2400 IOSS) used with success for the first phase of the complex has been increased to operate with 60 outgoing and 25 incoming (indial) exchange lines, and 300 extensions.
  In addition to catering for media and administration needs within the Centre, through outdoor extensions, links have been established to all yachting syndicate dock facilities, the RPYC and YCCS headquarters, Government and Tourism information centres, the FPA and host radio broadcaster and television consortium operations.
  This PABX network provides ready access for arranging post race conference/interviews and disseminating information and results over a wide area.
- The host radio broadcaster (Macquarie Network) has had two studios and an associated equipment area constructed in the main Media Hall. Other radio networks will also operate from private booths which have been constructed at their individual expense.
  In general, signals will be received from the water via VHF radio links and Telecom landlines where distribution then proceeds through both physical circuits and by direct links to Australia's Domestic Satellite (AUSSAT).
- The IBM results network has been enhanced to provide historical data and results services for the RPYC Defender series and Cup match. Olivetti will service the Challenger of Record data and results needs. Both networking terminals and personal computers will be in use.
  Much of the results input comes from the official timekeeper, Seiko, who will receive regular reports and timings from nine reporting centres (on the water) during the series.

Accounting Procedures

The "shared communications" facilities are accessed using an individual Personal Identification Number ('PIN') allocated to media representatives on arrival.

Through the use of a modern PABX equipped with a Telephone Information Management System (TIMS) users can make service connections through the telephone network by the process of insertion of their 'PIN' followed by direct dialling of the wanted number. Push button telephones and a last number redial facility simplify dialling which can involve up to 22 digits for an International connection.

With a high percentage of the written media now using portable word processors with acoustic connection through the telephone network to their agencies central processor, the 'PIN' system provides journalists with a convenient means of communication. An itemised account produced by TIMS gives regular call charge totals, and billing can be quickly finalised through credit card or company billing arrangements. The 'PIN' also provides identification for billing for telex and facsimile transmissions.

The accounting for media services is being processed some 16kms from the Media Centre at Telecom's Perth South District Business Office where the TIMS equipment is located.

A 9600 bits/s data link (with standby facilities) interfaces the Fremantle based PABX with the remotely located accounting equipment.

Conclusion

The staging of the 1987 America's Cup Defence in Fremantle is comparable in magnitude to other past sporting events held in Australia, especially when account is taken of the duration of racing and the many other associated activities and events being staged concurrently throughout the series.

During each day of contest several hundred media, as individuals, will spend up to six hours on the water and commentators, photographers and camera crews will spend many hours in the air.

As yachts are in rivalry on the water so too will their 12 Metre sponsors be vying for media attention on the land to project their corporate image and association with what each hopes will be a winning boat.

Of necessity, such rivalry brings the need for careful allocation of priorities in maintaining media centre equipment coupled with adequate security measures over an extended period.

Safeguards that ensure only authorised maintenance staff gain access to communications facilities were fundamental in planning service restoration arrangements.

The Media Centre Complex will be a headquarters where the media can obtain information, assemble their reports and tell their stories to the world. It also provides a haven where people of common interest can gather together and relax in familiar surroundings. The appreciation of these needs by those responsible for the Media Complex development has greatly assisted in ensuring the successful staging of the 26th Defence.

References

1. Norman, M. "Video and Sound Program Network for the America's Cup" Telecommunication Journal of Australia Vol. 36, No. 2, 1986.

The Official America's Cup Directory

K. P. BIGGINS

Millions of dollars have been spent upgrading Perth and Fremantle to cater for the expected 1.2 million visitors arriving during the America's Cup Defence Series commencing October 1986. The Commonwealth Government alone has made available $30 million to support the conduct of the Defence Series.

Telecom Australia will produce The Official America's Cup Directory, providing visitors with the most comprehensive information source and buying guide available.

The Directory will be a modern and exciting reference breaking new ground in the visitor guide publication field.

Tourism is one of the world's largest industries and continues to grow rapidly. In almost every country the potential of tourism is being recognised and the benefits it brings realised.

In Western Australia the tourism industry is about to come of age. The State has tremendous potential to attract and excite visitors, to provide them with the variety of experiences they seek and can now offer the standards of hospitality and facilities they require.

The America's Cup win in September 1983 catapulted Western Australia and Perth into the world's consciousness and gave the State an unparalleled opportunity to secure high prominence in the world tourism marketplace.

The America's Cup Defence has captured the imagination of people from all walks of life. The influx of Australian and international visitors will be significant. From October 1986 to March 1987 over a million people are expected to visit Perth and Western Australia and spend well in excess of $300 million.

The visitors will not only be coming to see yacht racing but they will also be eager to explore more of Perth, Fremantle and Western Australia in general. The Western Australian tourism industry is poised on the threshold of the most important phase in its history.

This huge influx of tourists will require an information source to serve their needs while visiting the State.

Businesses will also be seeking an effective medium to promote their goods and services to gain maximum benefit during this period. The special nature of the event will ensure that the advertiser market will be artificially inflated as additional funds will be spent to advertise visitor related services.

TOURIST INFORMATION REQUIREMENTS

The opportunity of entering this specialised market to cater for the information requirements of visitors and businesses was realised by the Western Australian Directories Branch of Telecom Australia in November 1984. The idea of producing a visitor's directory for the America's Cup containing editorial and advertising information was presented to the Western Australian Tourism Commission in early 1985. The Commission commended Telecom's initiative and involvement in the tourist market and gave their complete commitment and backing. The Tourism Commission views the Directory as being a most prestigious and comprehensive visitor information publication and has made available the Commission's distribution and promotional network throughout the State.

The Royal Perth Yacht Club is responsible for the overall conduct of the Defence Series, and has given its approval to the Directory.

The Directory, to be called THE OFFICIAL AMERICA'S CUP DIRECTORY is a new marketing venture for Telecom Australia, and will combine the normal attributes of a Yellow Pages directory with an extensive tourist information section.

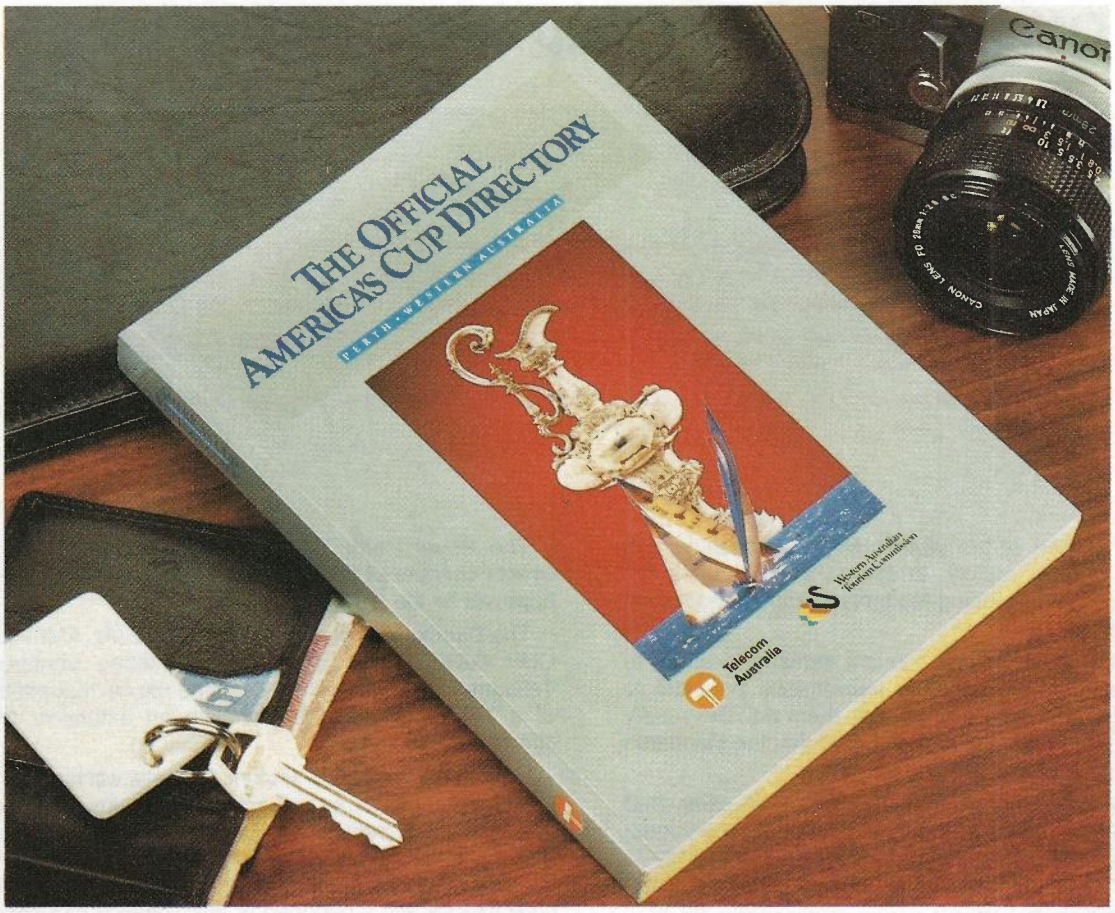
Visitors to Perth and Western Australia will have a need for information about attractions, facilities and public services. The Directory has been designed as a comprehensive information source and buying guide. With physical dimensions of 215 mm x 160 mm, it will fit conveniently into a handbag or the glovebox of a car. The size has been chosen to encourage users to carry the Directory as they travel.

500,000 copies of the Directory will be published. The Directory has a life of 6 months covering the Cup Defence period from October 1986 to March 1987. It will be given away free of charge to visitors. Its quality appearance and full colour information format will increase its value as a souvenir, and it is expected that many visitors will retain the guide as a memento of their visit.

PRODUCTION DETAILS

The Directory will consist of four main sections, three in the White Pages followed by one in Yellow:—

- General Information Section —
  Opening with an introduction and message from the Premier of Western Australia, it will also contain a calendar of events and useful non-commercial information about services available to visitors such as banking, currency, consulates, transport facilities, and emergency information.
- America's Cup Great Race Section —
  This section will cover the history of the America's Cup, and will include a calendar of races and an overview of each syndicate competing to win the Cup in this Series.
- Visitor's Information —
  This section will feature articles highlighting Western Australian attractions, interspersed with high quality four colour advertisements. Headings in this section will include such aspects as Accommodation, Arts, Attractions, Cruise and Charter Services, Eating Out, Entertainment and Night Life, and Tours and Sight Seeing. A geographical overview of Perth and Fremantle with current and historical information will add local colour, while information on the Southwest, Goldfields and



The Official America's Cup Directory

Northwest areas of Western Australia will interest those wishing to venture further afield.

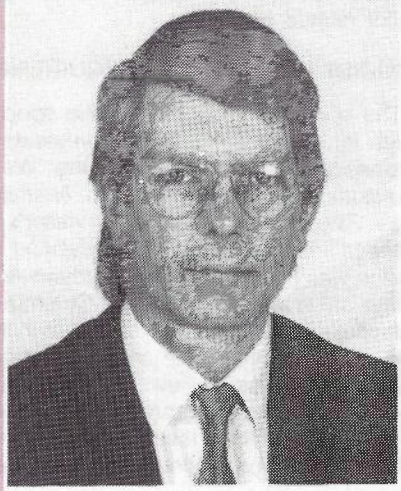
- Yellow Pages — Classified Section—
  This section will become an invaluable buying guide for visitors looking for a particular product or service. Following the format of the normal Yellow Pages, the Classified Section is specifically designed to provide information which will be of most interest to tourists.

The Directory will have approximately 200 pages, made up of 108 pages in the magazine style, full colour, white pages section and 92 in the Yellow Pages classified section. All advertisements in both sections will be sold by Telecom's Advertising Contractor, Australian Directory Services.

To ensure the widest possible distribution of the America's Cup Directory, a variety of outlets has been selected. These include all major accommodation locations, all entry points to Western Australia, Holiday WA Centres, Telecom Business Offices, and car rental firms. Other outlets are being evaluated.

Advertising support will be provided by Telecom to remind visitors to use the guide and also to demonstrate to advertisers that the product is being actively promoted to our visitors.

KEITH P. BIGGINS is Manager Special Directories, Directories Branch, Telecom Australia, Perth, Western Australia. He is responsible for the co-ordination and development of Directories associated with any new product or marketing initiative.



Audio Line Monitoring System

N. GIBBS
P. ALLISON

The America's Cup Defence to be held off Fremantle in 1987 has created an increased demand on audio links for both local, interstate and international use. This increased demand of audio circuits would have overloaded the already inadequate and unrealiable monitoring system previously in use at the Pier street Television and Sound Operating centres. As a result, the Audio Line Monitoring System has been developed to allow faster and more reliable monitoring of programme quality lines in the relocated and modernised Television and Sound operating centres.

INTRODUCTION

The Audio Line Monitoring System (ALMS) has been designed to provide a convienient method for the monitoring of up to 2040 programme quality audio circuits by any one of 8 monitoring stations.

Each monitoring station is equipped with a small visual display terminal which is used to enter the National line number of the circuit to be monitored and to receive the circuit details from the Data Base. The Data Base is maintained from a separate standard VDU.

The ALMS is controlled by a Creative Micro Systems Level 2 processor system and the Microware OS9 real time multitasking operating system. The main controlling software is written in Basic09 and specially written machine code modules. All programs and data are stored on the inbuilt 20 Mega byte hard disk.

The switching component of the ALMS consists of four solid state switch subracks mounted in a standard 19 inch rack cabinet along with the microprocessor system.

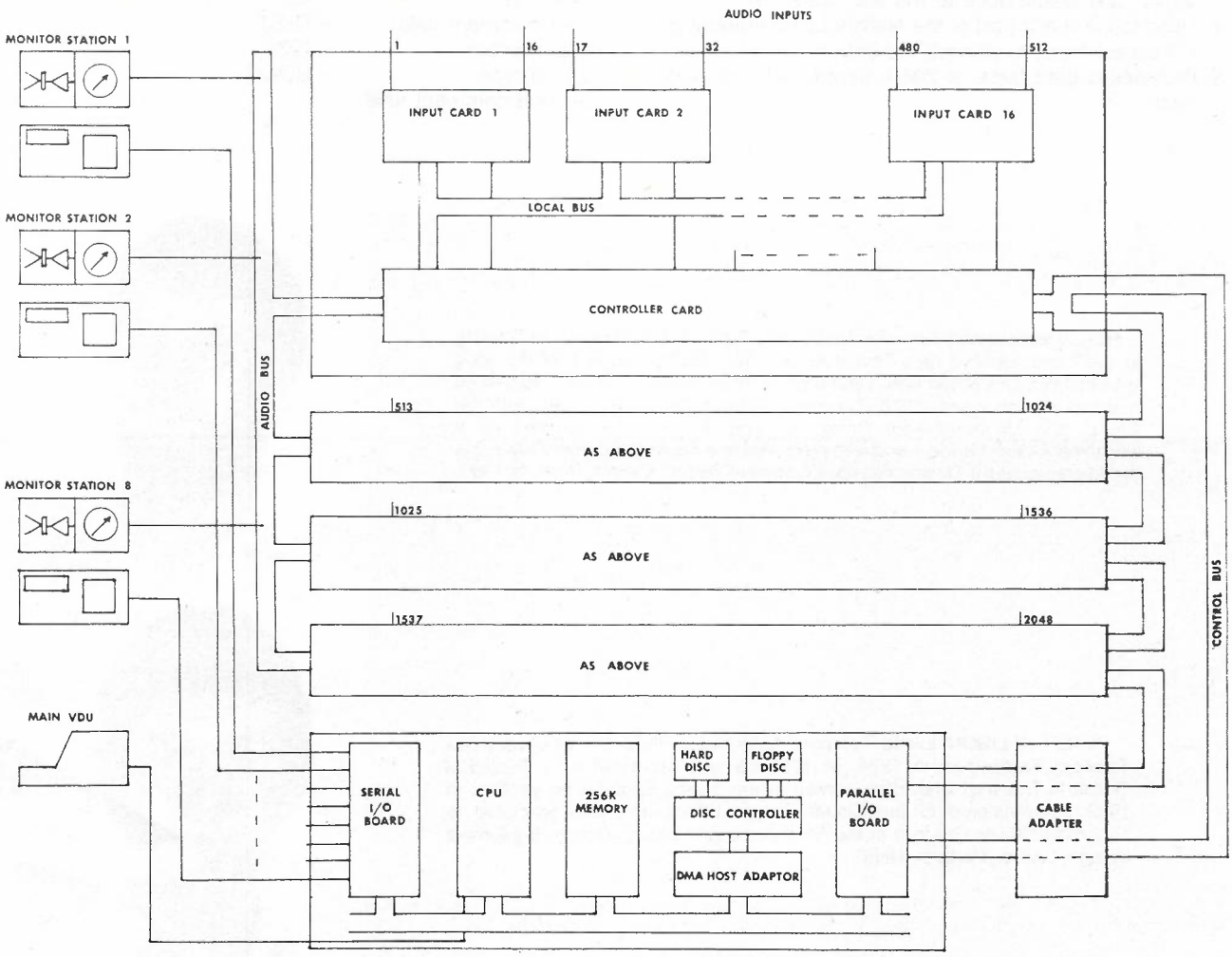
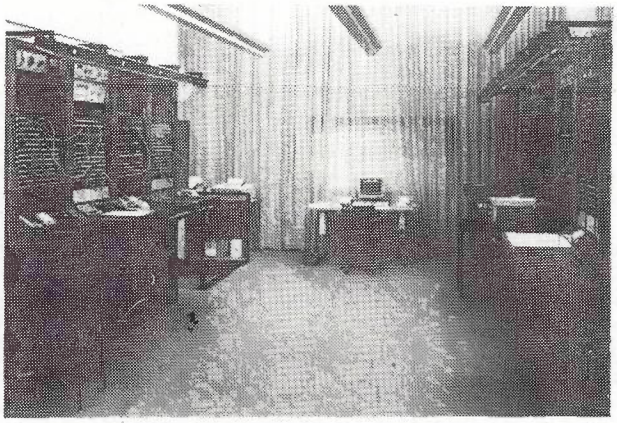


Fig 1 Block diagram of the Audio Line Monitoring System



The Pier Street Sound Operating Centre showing the main VDU at the end of the room and the monitoring stations beneath the Jack Field on the racks.

FACILITIES AND SPECIFICATION

Facilities

- ★ Independent monitoring access to 2040 audio lines.
- ★ 8 Monitoring stations each consisting of one microterminal.
- ★ Utilises low distortion ($\ll$ 1.0%, typically 0.2%) solid state switches.
- ★ Having been switched the audio line monitor system is transparent to the monitoring equipment, and pre vents any disturbance to the line under test.
- ★ Uses the numeric part of the National Line number for Broadcast lines, to access the data base.
- ★ Provides a data base of 2040 records with 10 fields each.
- ★ Separate main VDU for data base management
- ★ Provides comprehensive internal error message facilities.
- ★ All inputs are over voltage protected and therefore suitable for use on ringdown circuits.
- ★ Expandable in modules of 512 input lines, but in 32 line increments with automatic sizing.

Specifications

- ★ Input impedance greater that 30 kHZ Ohms.
- ★ Output impedance 600 Ohms in Bridging mode.
- ★ Bandwidth 35 Hz to 15 kHZ + or − 0.2 dBmO.
- ★ Distortion Less than 1%.
- ★ Noise better than −70 dBmO relative to +8dBm.
- ★ Maximum input level +16 dBmO.
- ★ Operating voltages: −50VD.C. and 25OVA.C. no break.
- ★ Loss — nil.
- ★ Uses one standard 19 inch rack to house all equipment (excluding visual display terminals).

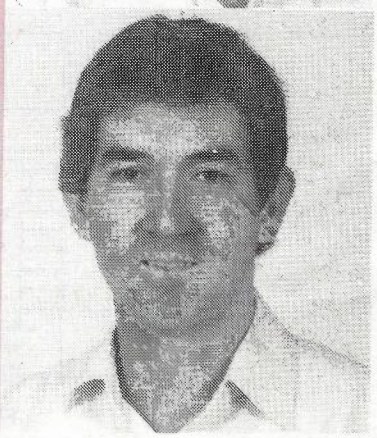
DATA BASE DESCRIPTION

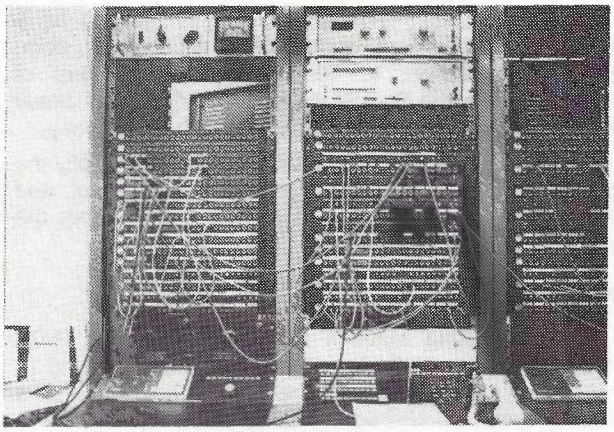
Each record appears on the screen of the main VDU as in the following example:

National Line number	:- 91234
Jack number	:- T123
Far end code	:- FAR
Customer code	:- TCOM
Bandwidth	:- 3 kHz
Direction	:- AB
First comment field	:- TEST
Inlet number	:- 1234
Circuit type	:- MONO
Second comment field	:-

NEIL GIBBS joined Telecom Australia in Perth as a Technician-in-Training in 1967 and qualified as a Technician in 1972. He has worked for the Long Line Installation Section from 1969 until 1974 and then in a country exchange maintenance area until 1976. The past ten years have been spent with the Circuit and Microprocessor Design Groups. In 1985 he qualified as a Technical Officer Grade 1 and was promoted to a Technical Officer Grade 2 in the Microprocessor Design Group, Equipment Design Centre, Perth in 1986.

PETER ALLISON joined Telecom Australia in Perth as an Apprentice Telecom Tradesman in 1974. In 1975 he was promoted to a Technical Officer-in-Training, where he worked in the Traffic Engineering section. In 1982 he transfered to the Circuit Design Group and was promoted to Technical Officer Grade 2 in the Microprocessor Design Group, Equipment Design Centre, Perth in 1985.





Part of the Pier Street Sound Operating Centre showing the Jack Fields with the monitoring terminal beneath and Testing Equipment above.

The ten fields can be divided up into three different sections these are:-

1 The unique fields:

★ National line number — A numeric value ranging from 20000 through to 99999. This number defines the origin, type and the number of the broadcast circuit.
★ Jack number — This is a string of one alpha and three numeric characters. The alpha character defines the rack where the jack is located and the three digits define the actual jack on which the National line numbered circuit appears.
★ Inlet number — This is a numeric value ranging from 9 to 2048. These are the physical inlets of the switching system to which the circuit defined by the National line number is jumpered. Inlets 1 to 8 are used to terminate the audio lines of the eight monitor stations while they are in the MONITOR IDLE condition.

2 The non unique fields:

★ Far end code — This four character alpha-numeric string is used to indicate the destination of the circuit.
★ Customer code — This four character alpha-numeric string is used to indicate the owner of the circuit.
★ Bandwidth — This two digit code is the circuit bandwidth in kHz.
★ Direction — This two character code indicates the circuit's direction. ie AB, BA, BW.

3 The comment fields:

★ Comment 1 — This twelve character alpha-numeric string is free form and is the circuit description sent to the monitoring terminal upon sucessful connection to a line.
★ Comment 2 — This eighty character alpha-numeric string can only be displayed from the VDU. It can be used for more detailed notes, comments etc.
★ Circuit Type — This eight character alpha-numeric string describes the type of circuit eg. MONO, STEREO etc.

DATA BASE

The information contained in the system data base is in 2040 records of 10 fields each. The unique fields are used as keys for defining one particular record and the non unique fields are used for describing certain circuit characteristics. The comment fields are for free form comments.

Maintainance of the system's data base is performed using a dedicated menu driven VDU to provide the following functions:

★ Edit — Allows alteration of any or all field(s) of a record which is found using one of the unique fields as the search key.
★ Search — Enables the listing of any record that matches one search key. Most fields can be used as the search key.
★ New — Using a previously unused National line number, New will allow the entering of the data required for a complete record.
★ Delete — Will delete a whole record from the data base using only the National line number as the key.
★ Backup/Restore — These functions allow the whole data base to be saved onto, or recovered from, a floppy disc.

MONITORING STATION

After power up, each of the eight monitoring stations will be set to the idle condition. They will be displaying the message:- MONITOR IDLE

This means the monitor output is not switched to an active channel.

Before any line can be monitored it must first be jumpered to the input of the ALMS and entered into the Data base using the 'New' command.

The Line can now be switched, ready for monitoring, from one of the eight monitoring stations by entering the five-digit code corresponding to the line required, and terminated by the 'enter' key.

If the line number is valid and a match is found the computer will automatically switch the requested line to the audio outlet associated with this monitor station. At almost the same time the microterminal will display further information about the line which has been stored in the Data Base.

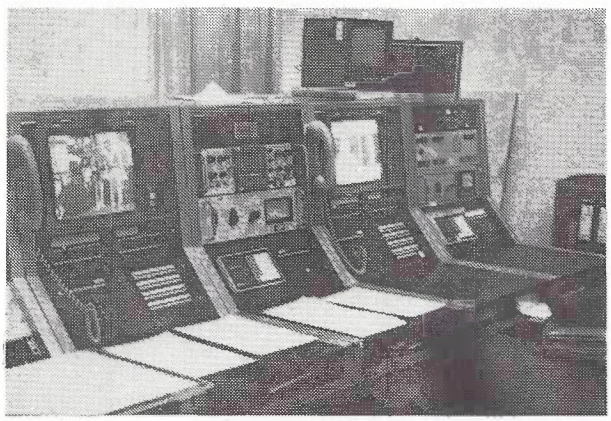
This information consists of the following fields: National line number, Jack number. Far end code, Bandwidth, Direction, Lessee code and Comment field number 1 displayed in that order.

On completion of the monitoring requirement the monitor can be either switched to another line using the same technique as described previously or placed in the idle state by using either the "F1" or the "Enter" key.

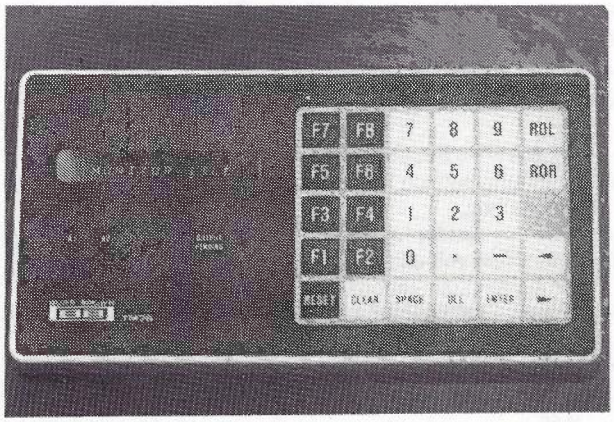
TECHNICAL

Software

All of the software for this project was developed and tested by Equipment Design Centre Staff on either an



Part of the Television Operating Centre showing two monitoring stations with the Burr-Brown terminals.



One of the Burr-Brown monitoring terminals in the idle condition, as used in Pier Street Sound and Television Operating Centres.

OS9 Level 1 or Level 2 system, using either Basic 09 for the basic language programmes or Stylo V3 word processor for the machine code parts, which were then assembled by the OS9 assembler.

There are three major programmes to control operation of the entire system outside of the OS9 operating system. These are, in order of use:

The Switcher startup, the Switcher run and the SOCX programmes. All of these programmes are written in Basic but use calls to machine code programmes.

Switcher Startup — This programme is used to test and initialise the Switching System prior to use and is run as a foreground programme after system startup or reset and after password checking (inbuilt function of OS9).

Switcher Run — This programme is invoked as a background procedure, once switcher Startup has completed its function, to control the establishment of connections in the Switching section and to pass circuit information back to the terminals from the data base.

SOCX — Once Switcher Run is operating correctly the SOCX programme, which controls the operation of, and access into, the data base, is activated and places the main menu onto the VDU.

Hardware

The monitoring stations are BURR-BROWN TM76 microterminals, which have 10 numeric, 8 function and 11 control keys along with a 12 character alphanumeric LED display and a 32 character display buffer.

A Hewlett Packard 2392A Visual Display Unit is used as the data base VDU.

The microprocessor and the four switching system subracks are housed in a 19 inch rack cabinet with the microprocessor located at the centre of the rack to allow easy access to the disc drive.

All subracks are interconnected via a sixteen bit wide control bus interface. This bus originates at the output connector and terminates at input connector of the microprocessor interface card WD10724 described below.

Each switching system subrack is six units high and contains sixteen double hight input cards, a double hight controller card, a single hight power supply card and a single hight front panel unit incorporating a circuit breaker.

All input cards are identical and have 32 high impedance, balanced and over voltage protected inputs

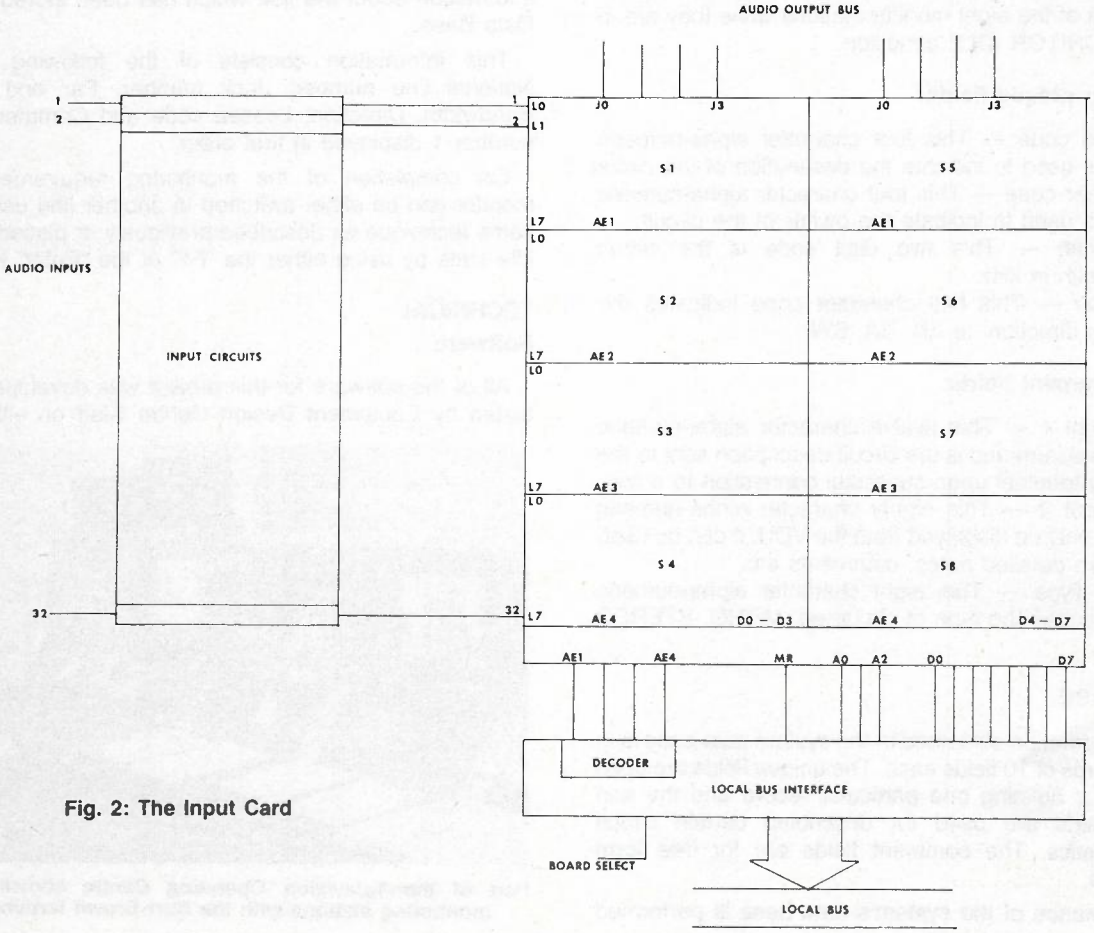
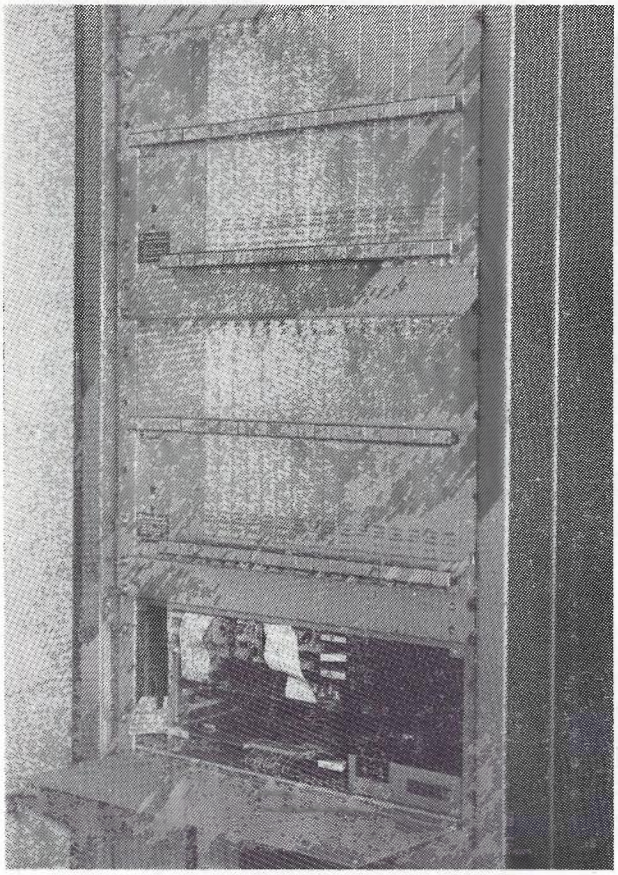


Fig. 2: The Input Card



Audio Line Monitor Switch Rack, provisioned for 1016 lines. The two switching subracks are above the microcomputer situated at the bottom of the picture

and a solid state switching matrix to give 8 unbalanced bus outputs.

The input circuit ensures that any input voltage that exceeds the supply rails is clamped to them by diodes with current limiting. Balanced to unbalanced conversation with approximately 10dB of attenuation is provided.

The heart of the switching matrix is the MITEL 8804A CMOS Analogue Switch Array. This device has an inbuilt control memory, decoder, logic level converters and an eight by four analogue switch matrix.

The controller board can be logically divided into three sections:

★ The Control Bus Interface — provides voltage translation between the sixteen bit wide control bus and the internal logic levels. It also contains logic to check for multiple module selection and, if true, lights a front panel indicator and sets an error condition into the control bus.

★ Local Bus Logic — The main function of this section is to decode and buffer the signal's output from the Control Bus Interface and place them onto the Local Bus. Also within this section is the Module selection logic, the reset logic and the timing generator used to determine whether the addressed input card is present.

★ The Audio Section — The eight unbalanced audio bus lines from the input cards are amplified (by 10 dB) and converted to balanced outputs suitable for use with 600 Ohm high impedence monitoring equipment. Relays connect any output of this card to the Monitor Bus only while that monitor circuit is connected to an input within the addressing range of this module.

The microprocessor system is housed in a four unit high subrack and has provision for eight EXORbus-type cards.

This subrack also contains the microprocessor system's power supply, a five and a quarter inch floppy disc drive and a twenty megabyte hard disc drive.

The processor boards required for system operation are:

★ CMS 9639 Memory Management Processor with onboard Direct Memory Access controller and task switching logic. CPU clock speed is 2MHz.

★ CMS 9633 256K byte static random access memory board.

★ CMS 9650A 8 port duplex asyncronous serial I/O module.

★ CMS 9672 Direct Memory Access Host adapter and associated Disc controller card.

★ WD10724 I/O with Priority Interrupt board. This board has 16 optically isolated current sinking outputs, 16 optically isolated current sourcing inputs and an 8 level priority interrupt generator. The priority interrupt generator facility is not used in this system.

Associated with the WD10724 board is an interface module, WD 3071, housed in a single hight subrack unit which supplies power to the optically isolated inputs and ground for the optically isolated outputs.

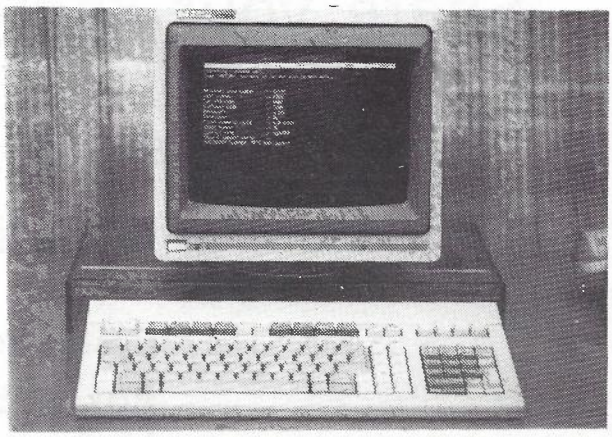
CONCLUSION

The majority of this project has been designed, prototyped, manufactured and installed in a period of nine months, commencing in March 1985. A vastly less complex version of the system was developed as a training exercise, which provided valuable experience in the basic principles.

Obviously, with any project of this complexity a number of problems will arise. In this case these have been minor and mainly associated with software. At the time of writing this article three switching system subracks are installed with provision for the fourth. The subracks have been equipped with a total of thirty-two inputs cards, to give a capacity of 1016 inputs.

More than 600 lines have been connected onto the system, which has been in operation in both the Sound and Television centres for more than four months. The local staff from these areas have provided a quote which best sums up the benefits of the Audio Line Monitoring System to their area:

"After a short familiarisation period, SOC operations staff have found the facilities provided by the monitoring switch of great assistance in the efficient operating of the centre."



The main VDU at Pier Street Sound and Television Operating Centres in the search mode.

America's Cup impact on the Perth Metro Network

MARTIN DAVIS

Extra demand is expected to be placed on the Perth Metro Local Network due to the:

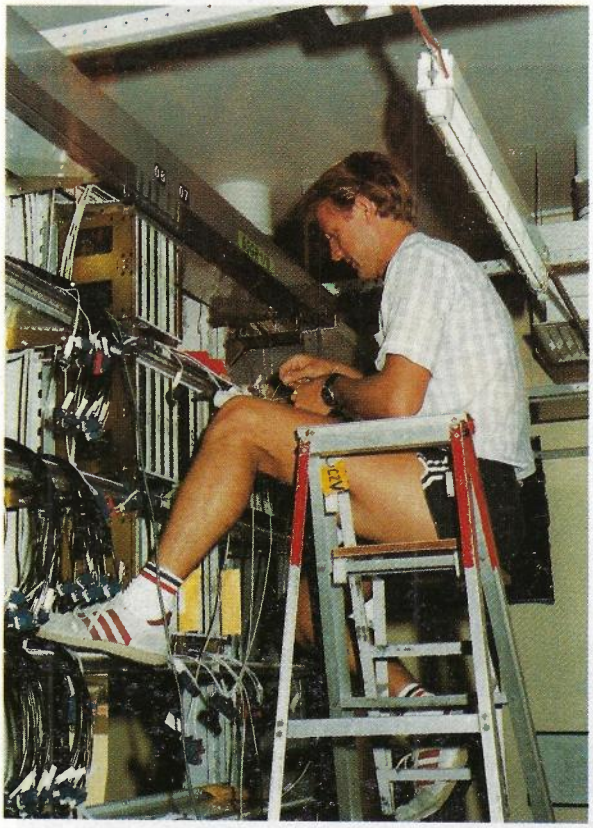
- Number of Visitors — variously estimated in the range of 50,000 to more than 500,000
- Yachting participants — competing syndicates
- Media coverage of races — this will be very peaky traffic

This demand should give rise to increased local traffic, National traffic (STD) and International (ISD) traffic.

Visitors are expected to be housed in the Perth CBD and environs together with the coastal strip from Fremantle to Mullaloo. Some impact will also be felt on Rottnest Island. To cater for their expected demand for telephony services, the provision of 3000 lines of AXE RSS-D exchange equipment has been advanced. These lines will be spread over the 5 coastal exchanges as demand dictates. A Digital Radio System is being provided to Rottnest Island to replace the existing Analogue Radio System which is almost at capacity. This will allow the provision of ISD access to the island and allow the existing Step Exchange to be replaced with RSS-D.

To handle the expected local traffic, the Metro Network junction provision has been boosted around the Fremantle Exchanges as a focus, and in other Metro areas through the boosting of forecast customer demand. Specific allowance has been made for extra National and International traffic as covered in an associated paper in this Journal. The Metro Network has been developed to incorporate two Digital Trunk Tandem exchanges to assist in handling this traffic.

Expansion of the Mobile Telephone System (MTS) has been advanced to allow the sale of up to 500 units to short term high traffic customers located on pleasure yachts or cruise ships used as floating hotels. The network interface exchange for the MTS has also been suitably dimensioned to cater for the expected traffic.



Three "Dial" It recorded services are being set up: two in Perth only for the WA Tourist Commission America's Cup Information Line and Radio station 6PR, plus a National America's Cup IBM News Line service.

These services are expected to generate significant peak traffic, similar to the existing Telecom Sportsfone and Cricket Results services.

Footnote:

Martin Davis is currently Supervising Engineer, Metro Region Planning in Telecom's Western Australian Administration with responsibility for the formulation of plans for developing the Region's telecommunications infrastructure.

Perth International Airport Project Telecom Planning And Installation Aspects

M. J. NORMAN BE (Hons)

The construction of Perth International Airport was brought forward for the America's Cup. This paper describes the plan implemented to establish a digital exchange within the terminal building and connect it to the Telecom network using optical fibre cable.

INTRODUCTION

Perth Airport, Perth's existing airport terminal, was built for the Commonwealth Games in 1962. Since that time the number of passengers using this terminal has increased more than tenfold, to 1,600,000 passengers annually, resulting in periods of unacceptable passenger congestion and delay. It is fitting that Perth's subsequent major terminal development, the Perth International Terminal Complex (Perth ITC) costing nearly 100 million dollars, is scheduled for completion just prior to another international sporting event , the America's Cup. The terminal complex is scheduled for opening mid October, 1986, soon after the commencement of the America's Cup Elimination Series, starting 5 October. Telecom was expected to have its general communications infrastructure in place three weeks prior to the opening, to allow the progressive connection and testing of individual services leading up to opening day.

Fig. 1 shows the location of the Perth ITC in relation to the existing terminal (Perth Airport). The new development is located approximately 1.5 km to the east of Perth Airport, on the opposite side of the main runway. The complex consists initially of the Perth International Terminal Building (Perth ITB) for passenger arrivals and departures, a new Control Tower (to control all aircraft movements, including domestic traffic) and a group of three Qantas Facilities Buildings. A separate Customs Building, and as yet undefined commercial development along the main access road, "Horrie-Miller Drive," are possible additions within the next few years.

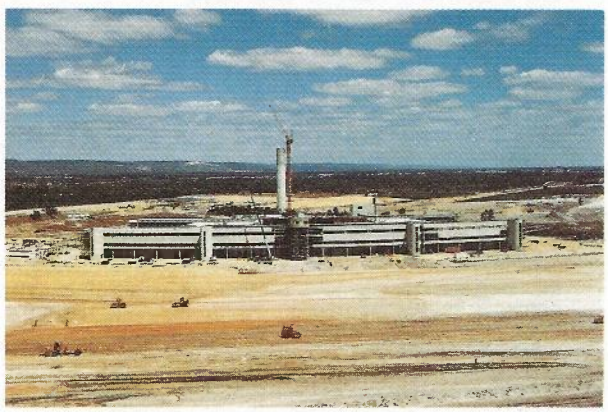
PLANNING CONSIDERATIONS

Early in 1984 the Metropolitan Field Survey Group of Telecom Australia conducted a study to quantify the telephone and miscellaneous demand that could be expected at the new airport. The study concluded an initial demand of approximately 450 services (including 150 services linking the two airports) increasing to 600 services within six years, although the latter figure did not include a prediction for possible development along Horrie-Miller Drive, shown on Department of Aviation (DOA) Building Area Development plans. However, despite the integrity of this study, a fair degree of uncertainty existed simply because many of the Major Business Customers had not finalised their plans at that stage. Uncertainty also existed on the probable break-up of the many different service types inevitably required at a major airport terminal.

The Perth ITC is located within a large area of DOA-owned land acquired for airport development and is relatively remote from all surrounding metropolitan exchanges. However, the Perth ITB itself is located only 1.1 km from the Ascot-Maida Vale junction cable route, which uses an old easement (Grogan Road) actually running across the airport reserve under the main aircraft runway (see Fig. 1). This junction route had spare duct capacity, so it was only a matter of installing ducts alongside Horrie-Miller Drive to obtain a duct route between the Perth ITB and either Ascot or Maida Vale exchanges. Ascot Exchange, already the terminal exchange for Perth Airport, was selected as the most convenient point of connection into the Telecom network and for direct transmission path interconnection between the two airports. The Perth ITB was planned as the through connection point for all other buildings in the complex, including future development down Horrie-Miller Drive.

Planning considered a number of options for connecting the Perth ITB to Ascot Exchange, including the traditional option of installing a large size pair cable. This option was seen to lack flexibility in providing for future growth in the full range of service types. Also, it was expensive to keep PABX exchange lines within transmission limits, and it inevitably placed outdoor extension and tie line services linking the airports well beyond transmission limits (thereby requiring all circuits to be line conditioned).

The option recommended was the more novel approach of using a 6 fibre (graded index multimode) optical fibre cable between Ascot Exchange and the



Perth International Terminal Building under construction,

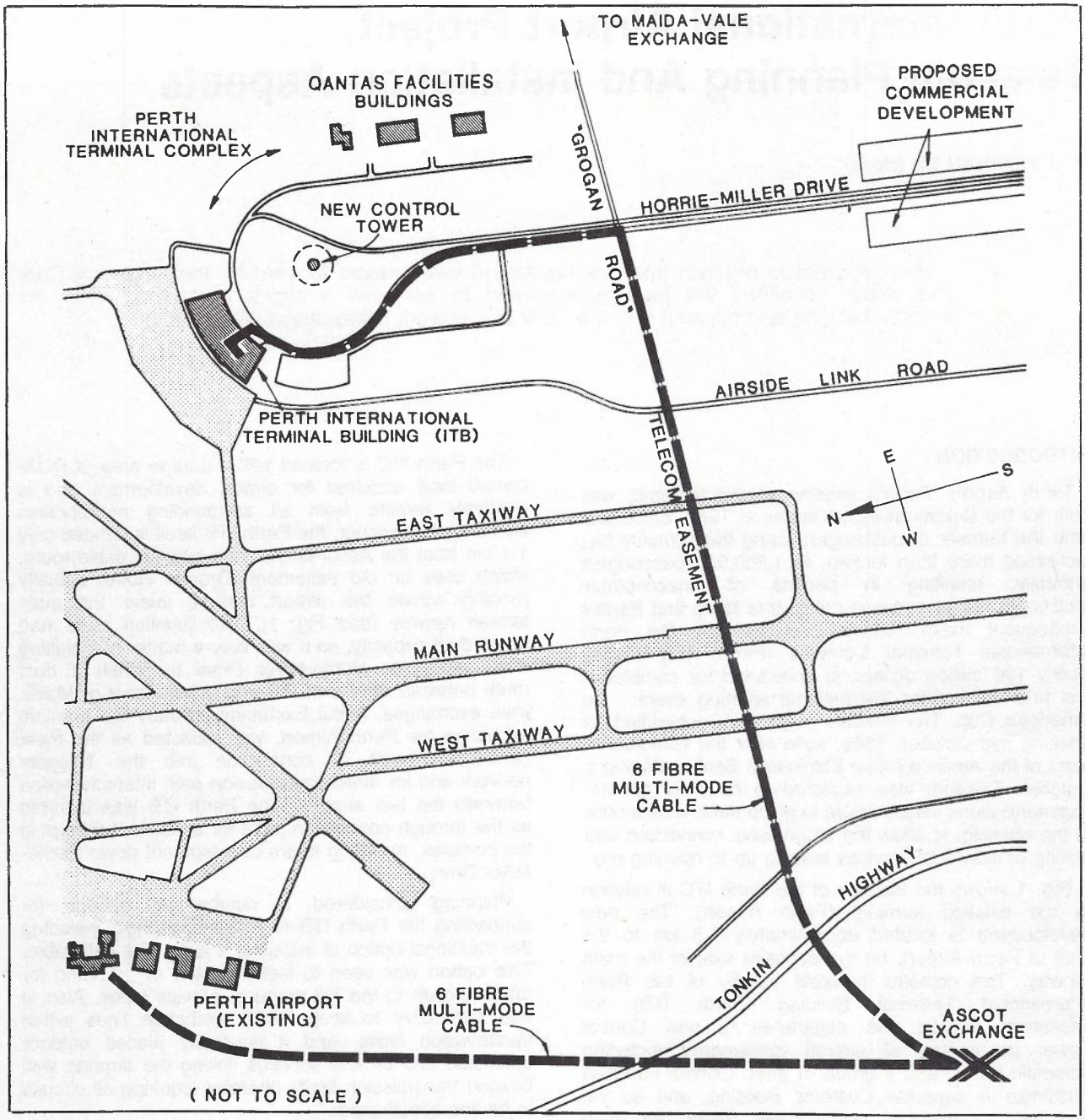
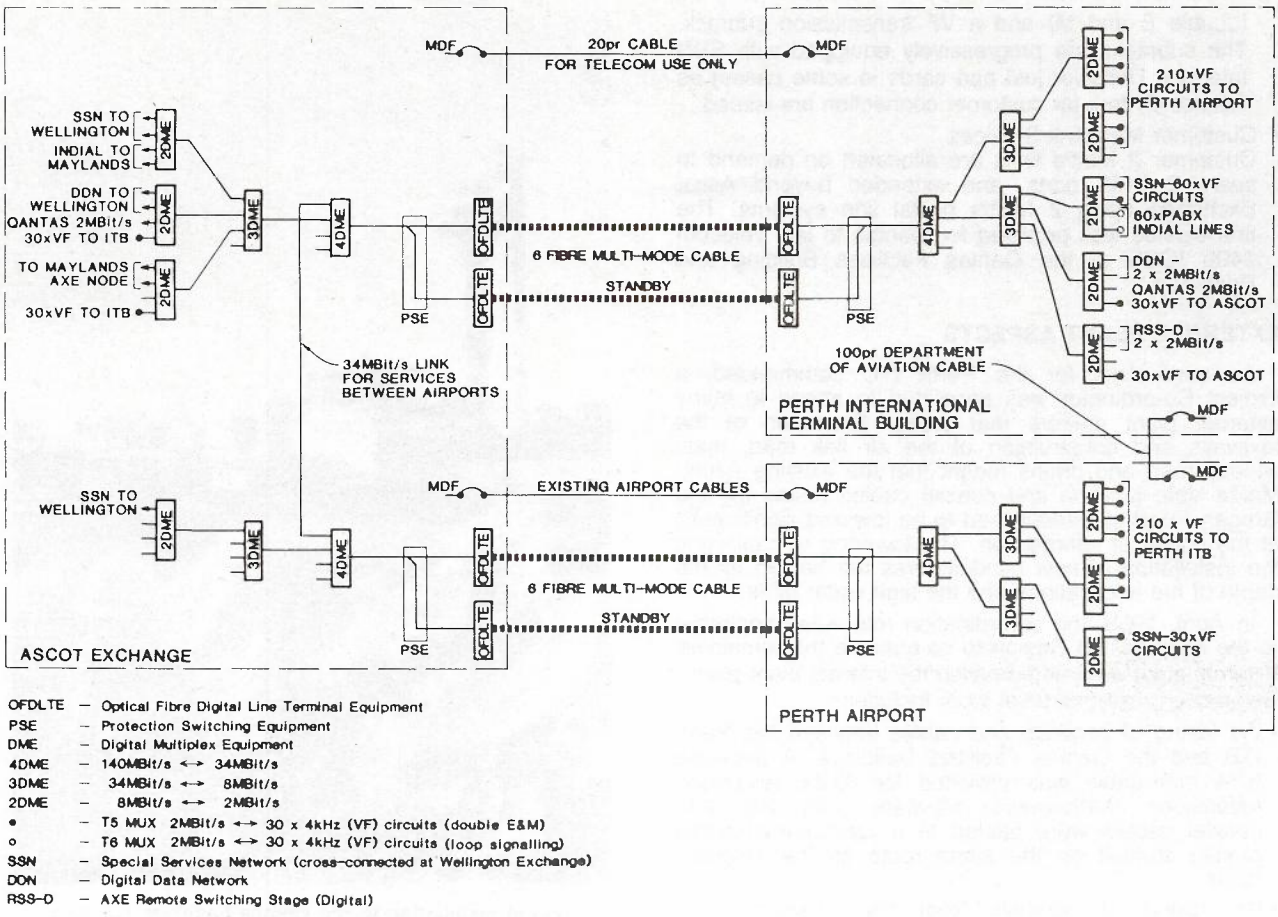


FIG. 1 – Perth Airport and the Perth I.T.C. – Basic layout.

MICHAEL NORMAN joined Telecom Australia as a cadet engineer in 1971 and graduated in electrical engineering from the University of Western Australia in 1974. Between 1974 and 1977 he was involved in a range of internal and external plant projects in both metro and country localities. In 1977 he was transferred to Telecom Headquarters to assist with the design and installation of a VDU/TRESS interface system. In 1978 he returned to Perth and worked in Customer Networks and Equipment(CN & E) Section as Engineer Class 2, Special Services. In 1981 he was again transferred to Headquarters to work for Transmission Network Design Branch. In this capacity he prepared specifications and technical publications for the design and application of a new range of line conditioning devices. Returning to Perth, he again worked for CN & E Section as Senior Engineer, Special Services.

In February, 1985, Michael was transferred to Metro Region to co-ordinate the engineering aspects of the America's Cup preparations, as Senior Engineer, Special Projects.

Michael is married with three children. His interests include community tree planting projects, swimming, ballroom dancing and, of course, yachting (he claims his catamaran is faster, and a lot cheaper, than a 12 metre yacht).



OFDLTE – Optical Fibre Digital Line Terminal Equipment
PSE – Protection Switching Equipment
DME – Digital Multiplex Equipment
4DME – 140MBit/s ↔ 34MBit/s
3DME – 34MBit/s ↔ 8MBit/s
2DME – 8MBit/s ↔ 2MBit/s
• – T5 MUX 2MBit/s ↔ 30 x 4kHz (VF) circuits (double E&M)
o – T6 MUX 2MBit/s ↔ 30 x 4kHz (VF) circuits (loop signalling)
SSN – Special Services Network (cross-connected at Wellington Exchange)
DDN – Digital Data Network
RSS-D – AXE Remote Switching Stage (Digital)

FIG. 2 – Perth ITB, Perth Airport, Ascot Exchange – digital transmission plan.

Perth ITC and another 6-fibre cable between Ascot Exchange and Perth Airport in order to link the two airports. The Perth Airport cable will also be used for future connections to Ascot Exchange, when the existing pair cables become full. The switching function was to be implemented at the Perth ITC by installing a RSS-D and defining a new exchange boundary around the building complex and along the main access road.

TRANSMISSION AND SWITCHING PLAN

Fig. 2 illustrates the resulting transmission plan using the optical fibre cable option. The main elements of this plan are the 140 Mbit/s optical fibre line terminal equipment (with protection switching equipment for automatic changeover between main and standby bearers) and chains of digital multiplex equipment (i.e., 4DME, 3DME, 2DME) to break-up the 140 Mbit/s links to the required number of 2 Mbit/s links. The 2 Mbit/s links are then utilised to obtain the following service types:

- Straight Line Telephone Services
  A 384 line digital remote switching stage (RSS-D) was considered adequate for the initial installation. This RSS-D is connected via three 2 Mbit/s links (extended beyond Ascot using 2 Mbit/s digital line systems on junction pairs) to the Maylands AXE node. Ultimately the RSS-D links will be cutover to the proposed Victoria Park AXE node. Public telephones are connected to the RSS-D via SEPRM equipment.
- PABX Indial Lines
  Indial lines are connected via 30 Channel loop MUX equipment connected at the 2 Mbit/s level into the Maylands AXE node.
- PABX Outgoing Lines
  These are connected via the RSS-D, and SEPRM equipment if customer multimetering is required.
- Digital Data Network (DDN)
  DDN connections are made via a small DDN installation at the Perth ITC, using heterogeneous ZDME connected via two 2 Mbit/s links to Wellington Exchange.
- Telex Services
  Telex services are connected to the AXB telex exchange at Wellington Exchange via Special Services Network (SSN) VF channels (i.e., one telex service per channel). All telex machines are fitted with V21 FSK cards. As telex demand grows a MUX 45 TDM system may be installed, if economic.
- Special Services (other than DDN and Telex)
  Datel, outdoor extension, tie line and permitted attachment private line services are connected using SSN rack arrangements. Both the Perth ITB and Perth Airport are designated as SSN terminals and connected via 2 Mbit/s links to the SSN cross-connect IDF at Wellington Exchange. However, it was not considered efficient to connect all Special Services between the two airports, or between the Perth ITC and Ascot Exchange, via the Wellington SSN IDF. Instead, direct digital links are established between the airports (via a 34 Mbit/s digital cross-connect at Ascot Exchange) and between the Perth ITC and Ascot Exchange.

  Each 2 Mbit/s link used for this purpose is terminated at both ends with 30 channel T5 MUX

(double E and M) and a VF transmission subrack. The subracks are progressively equipped with SSN Interface Units (or just pad cards in some cases) as Service Orders for customer connection are issued.

- Customer Megalink Services
  Customer 2 Mbit/s links are allocated on demand to spare 2 DME ports, and extended beyond Ascot Exchange using 2 Mbit/s digital line systems. The first service was provided for Qantas to link Telecom 2400 IOSS at the Qantas Facilities Building and Perth city.

EXTERNAL PLANT ASPECTS

As earthworks for the Perth ITC commenced, a Project Co-ordinator was appointed to attend to many external plant matters that arose. Extension of the taxiways and construction of the air link road, main access road and drains meant that the existing Ascot-Maida Vale junction and coaxial cables (using the old Grogan Road easement) had to be lowered significantly at the points of intersection. The lowering of cable and the installation of new conduits was not helped by the depth of the excavations and the high water table.

In April, 1985, the co-ordination role was transferred to the Metropolitan Region to co-ordinate the remaining external plant work and develop the internal plant plans. Subsequent external plant work included:—

- the laying of conduits and cables between the Perth ITB and the Qantas Facilities Buildings. A separate 0.64 mm cable was provided for digital telephone extensions. Furthermore, separate pairs and UHF coaxial cables were hauled in a Qantas-maintained private conduit on the same route as the Telecom ducts
- the laying of conduits from the Grogran Road easement to the Perth ITB and
- under the supervision of the Optic Fibre Project Team, the hauling of optical fibre subducts, then optical fibre cable from Ascot Exchange to both airports.

The provision of cable and conduit from the Perth ITB (MDF Room) to any other building in the complex was subject to a WA Telecom Policy decision declaring that since the airport reserve is private property (belonging to DOA), then DOA (or its customers) must pay for such work. The Qantas cables and conduits project was the first job to be affected by this Policy. However, DOA was permitted to use a 100 pair cable laid by them directly between the two airports for their services only.

Conduit installation to the Qantas Facilities Building.

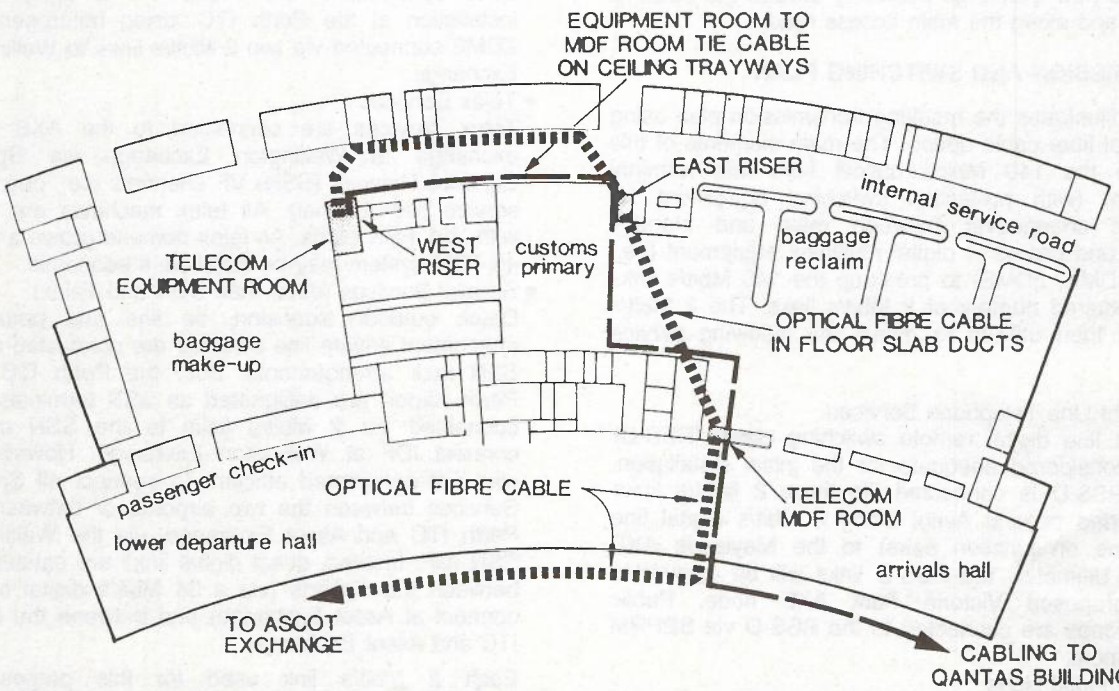


FIG. 3 – Perth ITB, ground floor plan, showing the location of the Telecom Equipment and MDF Rooms.

INTERNAL PLANT ASPECTS

Telecom had advised the need for a MDF Room within the Perth ITB at the design stage in 1983. Later, the penalty of adopting the optical fibre cable option, which required less external plant but more internal plant at the Perth ITB, became apparent. The ground floor MDF Room, measuring 2.9/m x 5.2/m, did not have sufficient floor space to fully implement the plan. The MDF Room floor space could not be expanded because of its location between the arrivals hall and baggage inspection. Nor could its location be moved because the Telecom floor slab ducts radiating from the room had already been installed.

It was decided to seek additional equipment accommodation in the Perth ITB rather than go outside to a small building or portable hut. DOA was approached and eventually floor space was offered on the ground floor adjacent to the west riser, a distance of 85 metres radially from the MDF Room. The nominated area was to be set up for Telecom equipment as a building contract variation at Telecom's expense.

Fig. 3 shows the cable access to the Telecom Equipment and MDF rooms on the Perth ITB. Cable access is by way of a floor slab 100 mm duct for the optical fibre cable and an overhead 300 mm trayway for the tie cables linking the two rooms. Standby power, chilled water (for a fan coil cooling unit) and a fire sprinkler/alarm system is supplied to the Equipment Room by DOA.

Fig. 4 (Perth ITB equipment layout). In the equipment room, recombination cells are used to obviate the need for a partition and sink. The fan coil unit is suspended through the false ceiling from the ceiling slab, and the airconditioning duct is placed directly under the rack ironwork. The room actually tapers due to the curved design of the Perth ITB.

DOA was also approached to provide additional floor space for the digital transmission equipment at Perth Airport (the existing MDF Room was mainly used to accommodate DOA's PABX). An adjacent office area was offered, and building alterations were subsequently arranged.

INTERNAL BUILDING CABLING

Perth South District won the open tender contract to provide telephone cabling within the Perth ITB and the Qantas Facilities Buildings. Subsequently, all backbone and facility cabling, MDFs and IDFs were installed by Telecom under sub-contract to the electrical contractor.

Perth South District staff also installed the 25 x 100 pair tie cables between the MDF and Equipment Rooms. This work was scheduled to occur before the construction of bulkheads and the installation of ceiling tiles.

CONCLUSION

The construction of the Perth International Airport was bought forward to handle the increase in international passengers coming for the America's Cup. Optical fibre and digital transmission equipment were combined to provide the required services, and to give the international airport a flexible communications facility for the future. A digital exchange was installed within the International Terminal Building.

An optical fibre cable was also installed to the existing Perth Airport, initially to provide a direct digital transmission path to the international airport, but ultimately to provide service connection to the Telecom network as well, when existing pair cables become full.

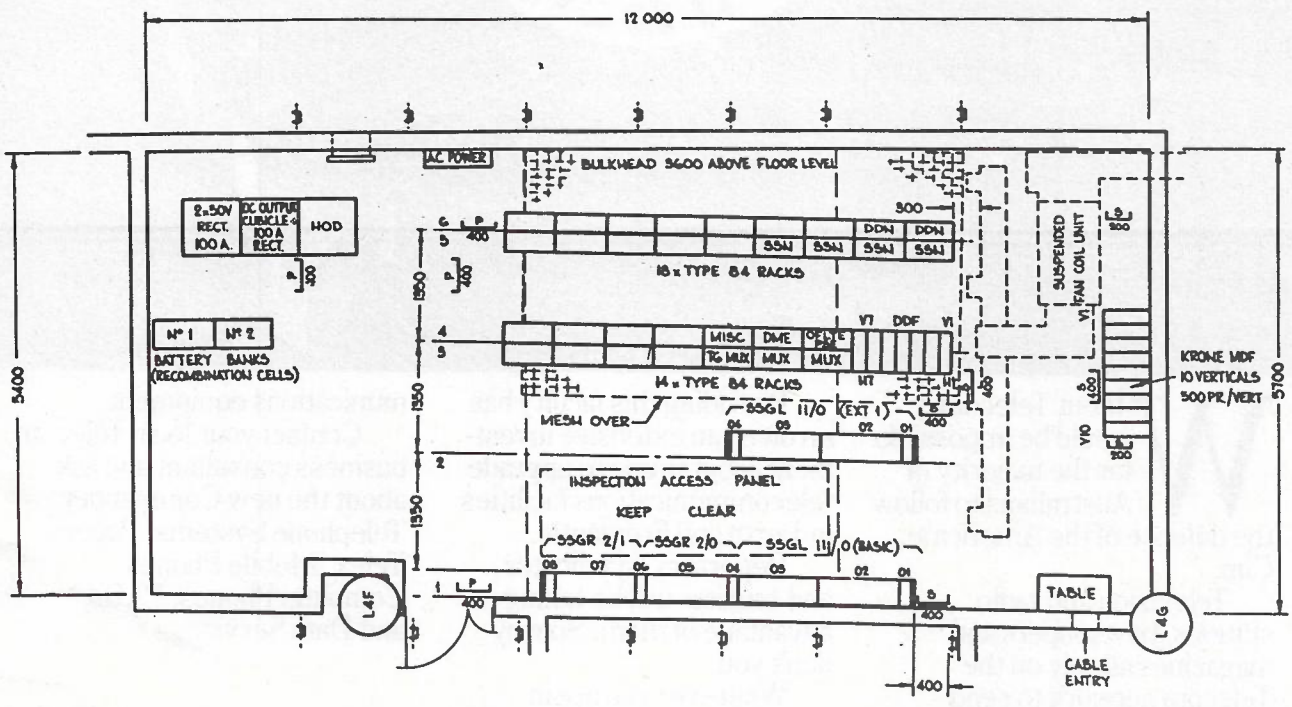
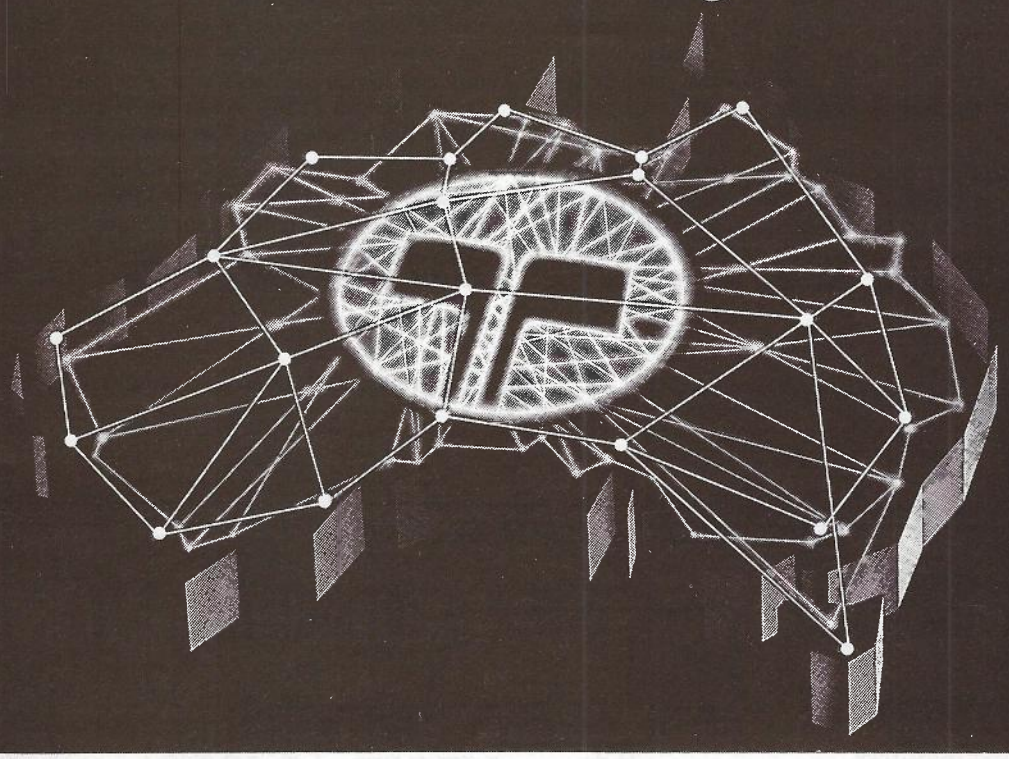


FIG. 4 — Perth ITB Equipment Room Layout.

The America's Cup is making the Telecom Network work even harder for you.



Without Telecom it would be impossible for the majority of Australians to follow the defence of the America's Cup.

Television and radio stations, newspapers and magazines all rely on the Telecom network to send reports direct from the course to all Australians and the rest of the world.

Providing this facility has involved an extensive investment programme to upgrade telecommunications facilities in Perth and Fremantle.

Reporters, syndicates and tourists will be taking advantage of them. So why don't you.

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America's Cup Telecommunications Services — An International Viewpoint

J. O'TOOLE —
OTC Western Australia

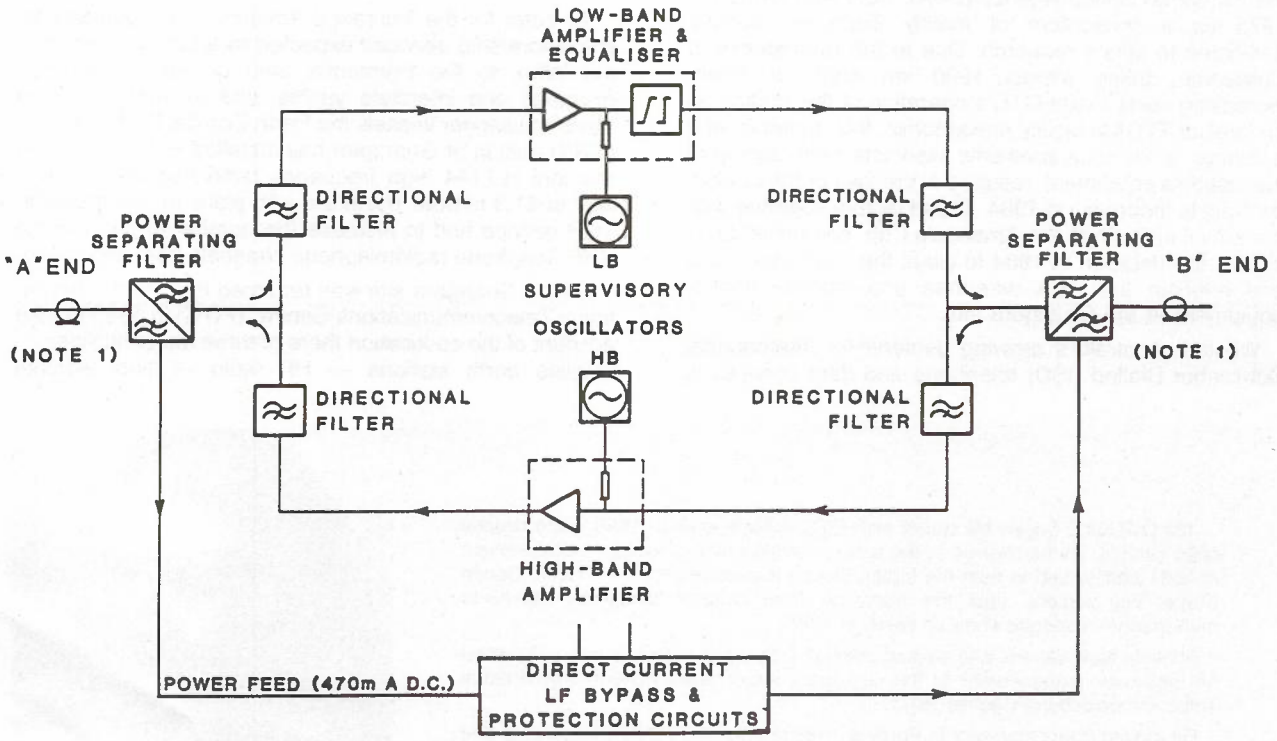
The America's Cup Defence series, to be staged in Indian Ocean waters off the coast near Perth during the latter part of 1986 and early 1987 brings with it a range of challenges — not only to the 12 metre yachting communities — but also to a wide range of public and private sector providers of services and facilities.

Western Australia will be on show as TV crews from around the globe descend upon us to cover this history-making event. Indeed Australia will be 'on trial' as the world's press takes a first-hand look at how well we do things, particularly our ability to cope with the demands of modern telecommunications ranging from television and ISD telephone services to slow and wideband data and maritime ship to shore radio services.

When Alan Bond won the America's Cup for Royal Perth Yacht Club in October 1983, OTC's (Overseas Telecommunications Commission) Western Australian facilities were comprised of a satellite earth station (SES) at Carnarvon and coastal radio stations operating in the medium and high frequency maritime radio bands at Broome, Carnarvon, Esperance and Perth. The Perth station, located at Gnangara (20 km north of Perth), was the largest of these installations operating extensive long, medium and short range ship/shore/ship radiotelephone, radiotelegraph (manual morse code) and radio-telex teleprinter-over-radio (TOR) services to shipping operating mainly in the Persian Gulf, Indian and Pacific oceans, and also a number of point-to-point radio-telex and telephone circuits to Christmas and Cocos-Keeling Islands. The latter islands' services are now provided by thin route Vista satellite service operated through OTC's Ceduna (South Australia) SES communicating through the Intelsat Indian Ocean region (IOR) satellite.

OTC, responsible for all aspects of the planning, provision and operation of the nation's international and maritime telecommunications services, was quick to take the necessary decisions that will result in a number of capital investment programmes being brought forward in Western Australia in order to ensure that sufficient capacity will exist in Perth to meet surge demand for increased international communications services throughout the events leading to and during the America's Cup Defence activities.

By 1982/83 demand for HF radio services was declining while, at the same time, requirements for satellite radio communications using microwave frequencies were increasing. The SES operating at Carnarvon had been established in 1966 to provide communications and launch support for the NASA Mercury and Apollo space flights. These services were later modified to provide



NOTE 1: "A" TERMINAL TRANSMITS LOW-BAND
"B" TERMINAL TRANSMITS HIGH- BAND

Fig 1: Simplified Block Diagram of 14 MHz Submerged Repeater.

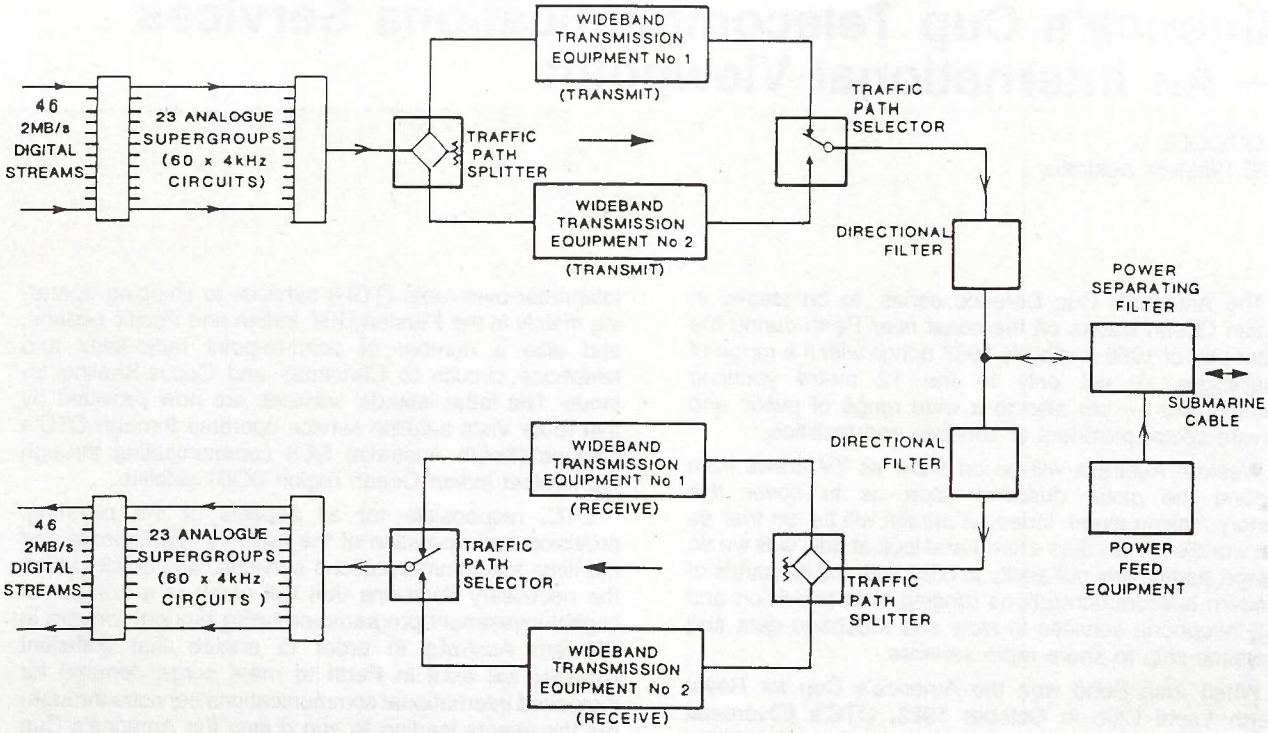


Fig 2: Simplified Block Schematic of Duplicated Terminal Equipment.

tracking, telemetry, command and monitoring (TTC&M) facilities for Intelsat (Intelsat is a consortium of more than 100 nations which develop and operate a global satellite communications system; OTC is Australia's representative and a foundation member, of Intelsat.)

TTC&M services were also provided at Carnarvon for the European Space Agency (ESA). ESA was formed in 1975 as a consortium of mainly European nations dedicated to space research. Due to the remoteness of Carnarvon, being almost 1000 km north of Perth, increasing costs made OTC's operation of this station as an Intelsat TTC&M facility uneconomic; this, together with a number of technical problems associated with ageing of the station's equipment, resulted in the loss of the Intelsat contract to Indonesia in 1984. These factors, together with the arrival in Perth of the America's Cup, compelled OTC to take the decision in 1984 to close the Carnarvon SES and relocate the ESA antennae and satellite control equipment at the Gnangara site.

Western Australia's growing demand for International Subscriber Dialled (ISD) telephone and data services is provided through OTC's Sydney gateway switching terminal facilities located at Broadway and Paddington (and, in mid-1987 also through a terminal under construction at Scoresby in Victoria) all of which are connected with the Telecom terrestrial network. It is therefore unlikely that any international switching facilities will be required in Western Australia until at least the end of this century.

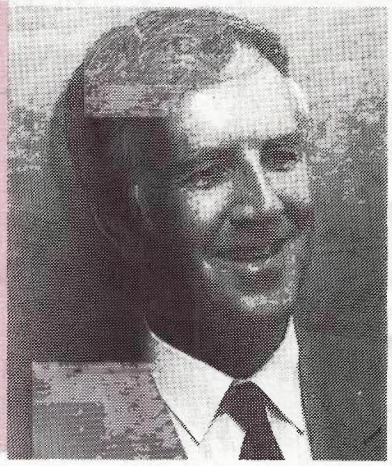
To cater for the increased America's Cup demand for ship/shore/ship services expected to arise as a result of the influx to the Fremantle area of several hundred overseas and interstate yachts, and as many as nine major passenger vessels the Perth Coastal Radio Service (CRS) station at Gnangara has installed nine new 10 kw Marconi H.1144 high frequency radio transmitters at a cost of $1.3 million. There are also plans to automate the TOR service and to increase the number of short-range VHF Seaphone radiotelephone channels from two to five.

OTC's Gnangara site was renamed the "Perth International Telecommunications Centre" (PITC) in 1985 to take account of the co-location there of three major facilities — satellite earth stations — HF radio — and terminal

JIM O'TOOLE began his career with OTC in Melbourne in 1958 in the coastal radio service. He transferred to the submarine telecommunications cable service in 1961 and served in both the Indian Ocean (Cocos Island) and Pacific Ocean (Suva, Fiji) regions until the transition from simplex telegraph cables to multichannel analogue compac cable in 1964.

Stints in New Guinea and several mainland locations followed until 1979 when he took over management of the Gnangara major station (Perth International Telecommunications Centre) PITC.

He moved from Gnangara to Perth in 1985 to open OTC's Perth Business and Marketing office.



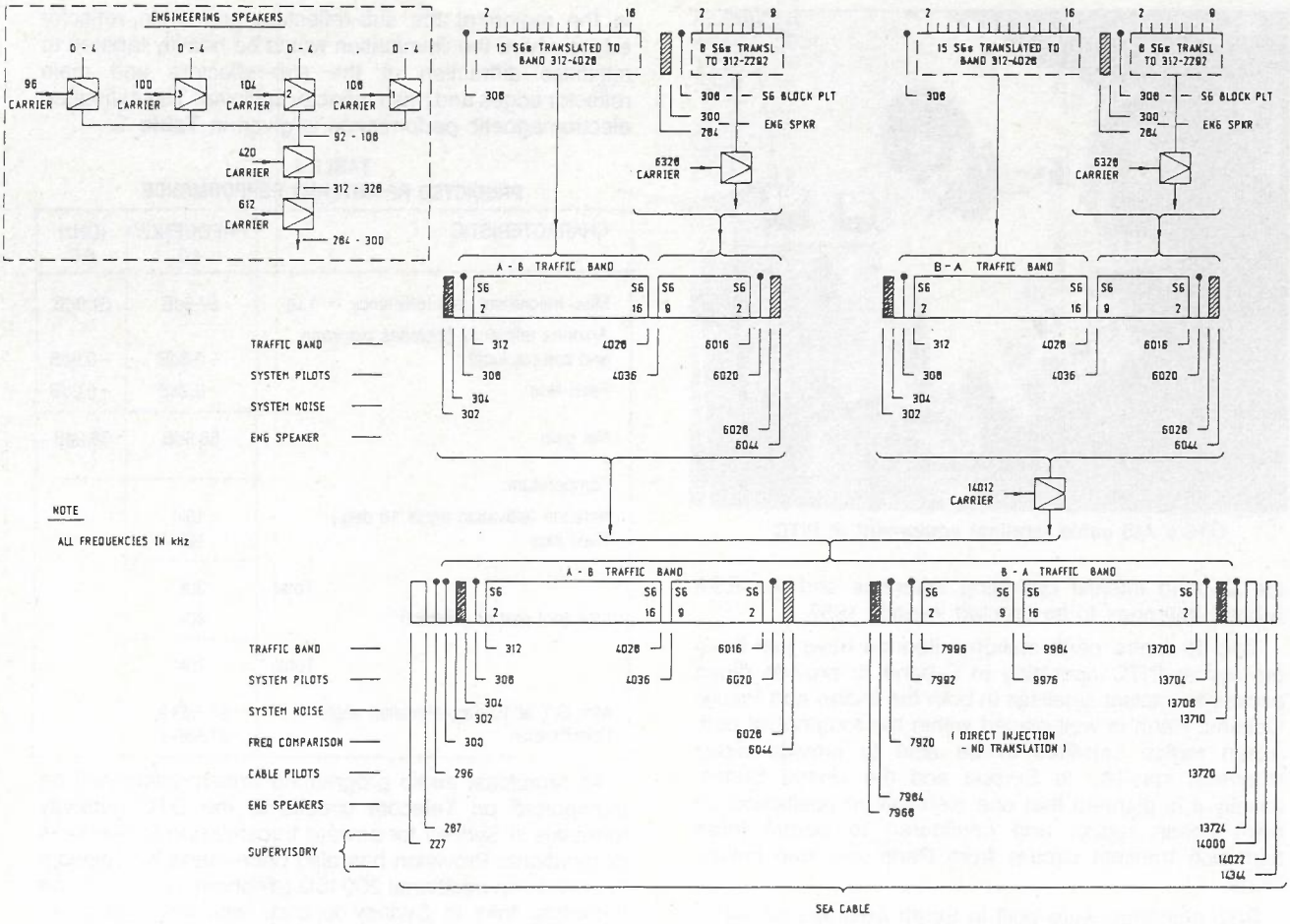


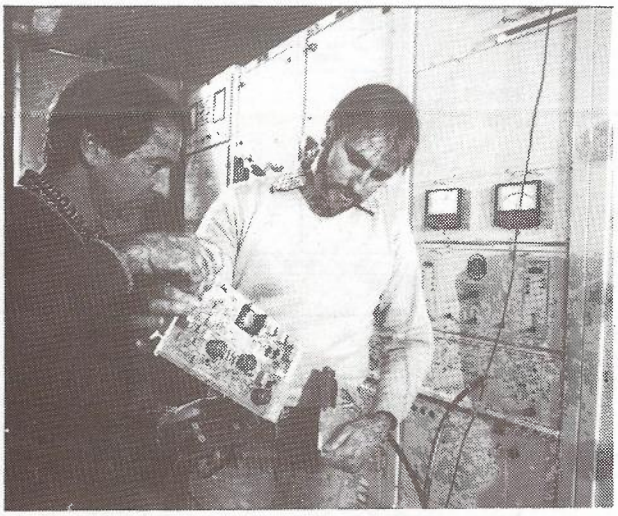
Fig 3: 1380/1840 Channel Duplicated System Frequency Spectrum

18 metre dish under construction at OTC's PITC

equipment associated with the Indian Ocean analogue submarine telecommunications telephone cable linking Australia-Indonesia and Singapore (AIS Cable). The building of AIS is co-incidental to OTC's preparations for the America's Cup activities, but is of interest in that the terminal equipment will be operated in the same building as the HF Coastal Radio Service (CRS) transmitting equipment, and within a few metres of a number of satellite earth stations. **Fig. 1** shows a simplified diagram of a 14 MHz repeater. **Fig. 2** shows a block schematic of terminal equipment.

The mix of the three distinct transmission technologies at a single location presented a number of engineering difficulties in designing the overall system layout. The presence of significant levels of radio frequency (RF) energy required that particular attention be paid to the termination of the AIS cable and to the entry/exit to the site of digital transmission routes. All AIS transmission terminal equipment, including power feed and monitoring equipment, has been enclosed in a screened room to avoid RF interference. The RF field strengths within the enclosed area are reduced to less than 5 mV/m over the cable frequency range. **Fig. 3** shows a 1380/1840 duplicated system frequency spectrum.

A digital microwave link at 6.7 GHz is used from PITC to connect with the Telecom terrestrial digital link at the Wellington Street terminal in Perth. The microwave antenna is mounted on a 53 metre tower at PITC. The location of the microwave tower 700 metres from the main equipment room successfully avoids mutual coupling with



OTC's AIS cable terminal equipment at PITC

the C band Intelsat operating antennas and the ESA S-band antennas to be erected in early 1987.

Two 18 metre earth station antennae have just been erected at PITC operating in C-band to provide direct access to Intelsat satellites in both the Indian and Pacific Oceans. Perth is well placed within the footprint of both ocean region satellites to be able to provide direct television services to Europe and the United States. Initially it is planned that one dish will be positioned on each ocean region and configured to permit three television transmit circuits from Perth and one inward signal.

Both antennae were built in South Australia by Johns Perry and the electromagnetic design is based on CSIRO Division of Radiophysics specifications. The main reflectors and subreflectors profiles are shaped to produce uniform illumination across the antenna apertures, except in the region of the sub-reflectors and main reflector edges where the illumination would be heavily tapered to minimise diffraction at the sub-reflectors and main reflector edges and main reflector spillover. The estimated electromagnetic performance is given in **Table 1.**

TABLE 1
PREDICTED RF ANTENNA PERFORMANCE

CHARACTERISTIC	FREQUENCY (GHz) 4.0	6.0
Max. theoretical gain (efficiency = 1.0)	57.5dB	61.0dB
Antenna efficiency (includes blockage and surface loss)	−0.8dB	−0.9dB
Feed loss	−0.2dB	−0.2dB
Net gain	56.5dB	59.9dB
Temperature:		
Antenna (elevation angle 10 deg.)	15k	
Feed loss	15k	
Total:	30k	
LNA (not part of contract)	40k	
Total:	70k	
Min. G/T at 10 deg. elevation angle	37.5dB/K	
Specification	37.5dB/K	

All broadcast audio programme transmissions will be transported on Telecom circuits to the OTC gateway terminals in Sydney for onward transmission to overseas destinations. Provision has also been made by Telecom to provide an additional 200 ISD telephone circuits on the terrestrial links to Sydney to cope with the anticipated upsurge in demand resulting from increased overseas visitors coming to Western Australia during the America's Cup.

New Rates for 1987

TO OUR MEMBERS AND SUBSCRIBERS:

Following examination of the tendered printing costs and the financial plan of the Society, the Council of Control has found it necessary to increase costs of the Telecommunication Journal of Australia and the Australian Telecommunication Research in accordance with the adjoining table.

The Council of Control is concerned about the increased costs of both the TJA and ATR and continues to be mindful of its objective of providing up-to-date information about advances in telecommunications technology to its members at prices they can afford. The Society has been assisted generously by Telecom Australia which in 1985 provided financial assistance in the form of subsidy amounting to $11,000. This subsidy, together with prudent management of costs and increased revenues from higher rates, has consolidated the financial position of the Society to a degree where increased confidence about the future of the Society is shared by all of the Executive.

The Society looks forward to your continuing support and urges you to assist in keeping costs down by encouraging others to become members of the Society or subscriber to the Journals.

S. Lindner
HONORARY TREASURER

TELECOMMUNICATION SOCIETY OF AUSTRALIA

Membership and Subscription Rates for 1986
Membership and Subscription Rates for 1987

Telecommunication Journal of Australia

Member (Australia)	Subscription $13.00 Payroll Deduction (per fortnight) 50c Back Copies or Single Current Copies $8.00 each
Non-Member (Australia)	Subscription $23.00 Back Copies or Single Current Copies $10.00 each
Non-Member	Subscription $32.00 Back Copies or Single Current Copies $13.00 each

Australian Telecommunication Research

Member (Australia)	Subscription $15.00 Payroll Deduction (per fortnight) 58c Back Copies or Single Current Copies $11.00 each
Non-Member Australia)	Subscription $27.00 Back Copies or Single Current Copies $15.00 each
Non-Member (Overseas)	Subscription $35.00 Back Copies and Single Current Copies $18.00 each
Monograph	Member $8.00 Non-Member (Australia) $10.00 Non-Member (Overseas) $16.00

The Telecommunication Society in Western Australia

F. LESLIE

The inaugural meeting of the WA Division of the Society was held on Friday, 11 March 1960 in the West Class Room on the 7th Floor of the GPO. Twenty-two persons attended that meeting and the resultant committee includes the following interesting names:

Chairman	— Mr J H White
Secretary	— Mr J Mead
Treasurer	— Mr J Farrell
3rd Division Reps	— Messrs W L Caudle, L A Jones and J B Minchin
4th Division Reps	— Messrs T J E Neville, R W Wearmouth and L Wilkinson

From that early beginning the WA Division has had periods of vigorous activity and then periods of relative inactivity — the latter being apparent in the early 1980s. The Division was rejuvenated in 1983 when the now Chief State Engineer, Andy Young, was appointed Chairman and an enlarged Committee was elected.

Since that time the Committee has been meeting regularly with active Sub-Committees looking after the Lecture Programme and Publicity & Recruitment.

The 1986 Committee consists of:

Chairman	— Mr F D (Frank) Leslie
Immediate Past Chairman	— Mr S A (Andy) Young
Secretary	— Mr D C (David) Best
Assistant Secretary	— Mr A M (Adrian) Reutens
Treasurer	— Mr B M (Mack) Richards

Secretary — David Best. Chairman — Frank Leslie.

(Left to Right) Brian Davey, Robin Bailey, Adrian Reutens, David Best, Frank Leslie, Colin Herring, Mack Richards, Don Briggs, Geoff White.
ABSENT: Alan Haime, Alan Harris, Dale Henshaw, Gerald Morton, Kingsley Pearce, Andy Young.

Lecture Sub-Committee Convenor	—	Mr R H (Robin) Bailey
Publicity & Recruitment Sub-Committee Convenor	—	Mr D C (Don) Briggs
WA Rep. Editorial Board	—	Mr A L (Alan) Haime
Members	—	Mr B C (Brian) Davey Mr A L (Alan) Harris Mr D C (Dale) Henshaw Mr C N (Colin) Herring Mr G (Gerald) Morton Mr K N (Kingsley) Pearce Mr G (Geoff) White
Council of Control Rep.	—	Mr R A (Ric) Mount

The Lecture Sub-Committee has been particularly successful with monthly lunch-time lectures covering a wide range of topics and, where possible, recent lectures have been videotaped. The tapes are then available for use in country or other areas. Lecture attendances range from approx 40 to 150 or more with the very popular presentations being distributed through the in-house video system to the Conference Rooms in Telecom Centre. Additionally, as an experiment, the July 1986 lecture "Remote Areas Commercial TV" by Dr Jim Lange of Golden West Network Ltd was directly telecast to Bunbury (180 km south of Perth) and the Manning Training Centre (a suburban location 10 km from the city). Initial reports indicate that this was a successful venture and hence it will be expanded to a wider range of centres. This gives our more remote members the opportunity to partake in the Lecture Programme.

Membership has increased from 500 in July 1984 to 600 in January 1986 and although membership is predominantly from the Professonal and Technical groups within Telecom, there is a selection from other staff groups and from outside Telecom. The Publicity & Recruitment Sub-Committee is constantly seeking ways of broadening the membershp base.

Other recent major activities of the Division include:

(a) Publication of the first WA Historical Monograph "50 Years of East-West Telephony, 1930-1980" by J F Moynihan.

(b) Sponsorship of awards to leading trainees graduating from the Manning Training Centre.

(c) Organisation of articles for this special issue of the Journal.

This latter item is principally due to the efforts of Alan Haime — Editorial Board WA Representative and Committeeman, Colin Herring — Manager, America's Cup (Commercial). Their contribution is appreciated by the Committee in particular and the Society as a whole.

The future activities of this Division will be directed towards establishing firm targets against which achievements can be measured and towards providing a better service to members. The targets include membership numbers, lecture attendances, journal sales and increased penetration into other areas to broaden the membership base.

In conclusion, on the occasion of the retirement of Telecom WA State Manager, Mr W L Caudle on 5 September 1986, the present Committee wish him a long, healthy and happy retirement. As mentioned earlier, Mr Caudle was a Founding Committee member of the WA Division and also served as Division Chairman from 1966 to 1968.

Telecommunication Journal of Australia

GUIDE FOR AUTHORS

Readers are encouraged to contribute to the Journal. The following guide outlines the major points most authors would need to know in order to publish a quality article in the Journal. A more comprehensive guide is available from the Editor-in-Chief.

Type of article

Articles should deal with interesting recent developments in matters relating to the management, planning, design, installation, operation and marketing of telecommunications generally. In particular, the Journal should record those special contributions made by individuals to the Australian telecommunications industry. Overseas contributions are also encouraged.

Length of Articles

As a broad guide, articles should consist of about 4000 words. This is about 14 pages of double spaced typing on A4 size sheets. Short articles and brief technical notes are also welcome.

Subdividing the Article

Three major types of headings are used:

- **MAJOR HEADING** — BOLD CAPITALS
- **Secondary Heading** — Bold Capitals and Lower Case
- Tertiary Heading — Small Capitals and Lower Case

Abstract

An abstract of 75 words at the most must be provided when an article is proposed. It should state the scope of the article and its main features.

The Text

The text should be in an impersonal, semi-formal manner. Consistency in spelling, headings, symbols, capitalisation etc. is essential. Some examples of common abbreviations and units are as follows:

kbits/s, Mbits/s, mW, MHz, Fig.

References

References should be numbered consecutively and listed at the end of the paper. The preferred format is:

1. Smith, R. & Jones, A., "Marketing Videotex," Journal of Marketing in Australia, Vol. 20, No. 3, June 1985, pp 36-40.

Illustrations

Members of the Board of Editors can assist you to obtain drafting support. However, the Board will accept good quality artwork.

Photographs

Black and white glossy prints are preferred. Colour prints are acceptable also. Clearly identify photographic prints with figure number written on separate slips of paper attached with adhesive tape to the back of the prints. Captions for the photographs must be provided.

Tables, Diagrams and Graphs

Tables must be typed on separate sheets and presented so that they may be set by the printer. Use diagrams, graphs and illustrations to improve the general presentation of the article. Illustrations, etc., are referred to in the text by figure numbers, consecutively.

Copyright

Authors must complete a "Copyright Declaration" (see below) and attach this with their final typescript.

Clearance to Publish

Authors should get clearance from their employers if the articles contain sensitive information such as costs, un-approved policies, critical statements, etc. There is no objection to authors stating personal views on subjects where at variance with a corporate view, but their viewpoint must be put in perspective so that readers, including those overseas, do not gain a false impression of the status of the subject.

The Final Typescript

Articles should be typed on A4 paper. Good near letter quality (NLQ) dot-matrix print is acceptable. Three copies of the typescript should be sent to the Editor-in-Chief, Box 4050 GPO, Melbourne, Victoria 3001, Australia. The complete package will comprise, on separate sheets:

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- Abstract — less than 75 words
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- Tables, each on a separate sheet
- Illustrations
- Photographs, clearly identified
- List of captions for tables, photographs and illustrations.

Getting Started

The Board of Editors will be pleased to help. For general advice and assistance contact the Editor-in-Chief on telephone number (03) 606 7644.

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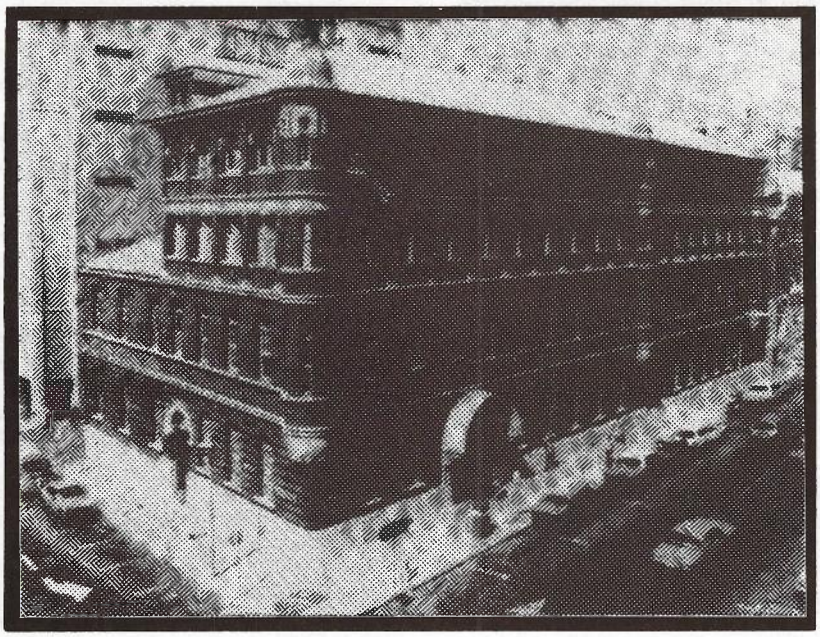

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Western Australians have always been isolated. Desert and distance separates us from the world. But the pioneers were hardy folk. To survive in a harshly unforgiving land, they had to be.

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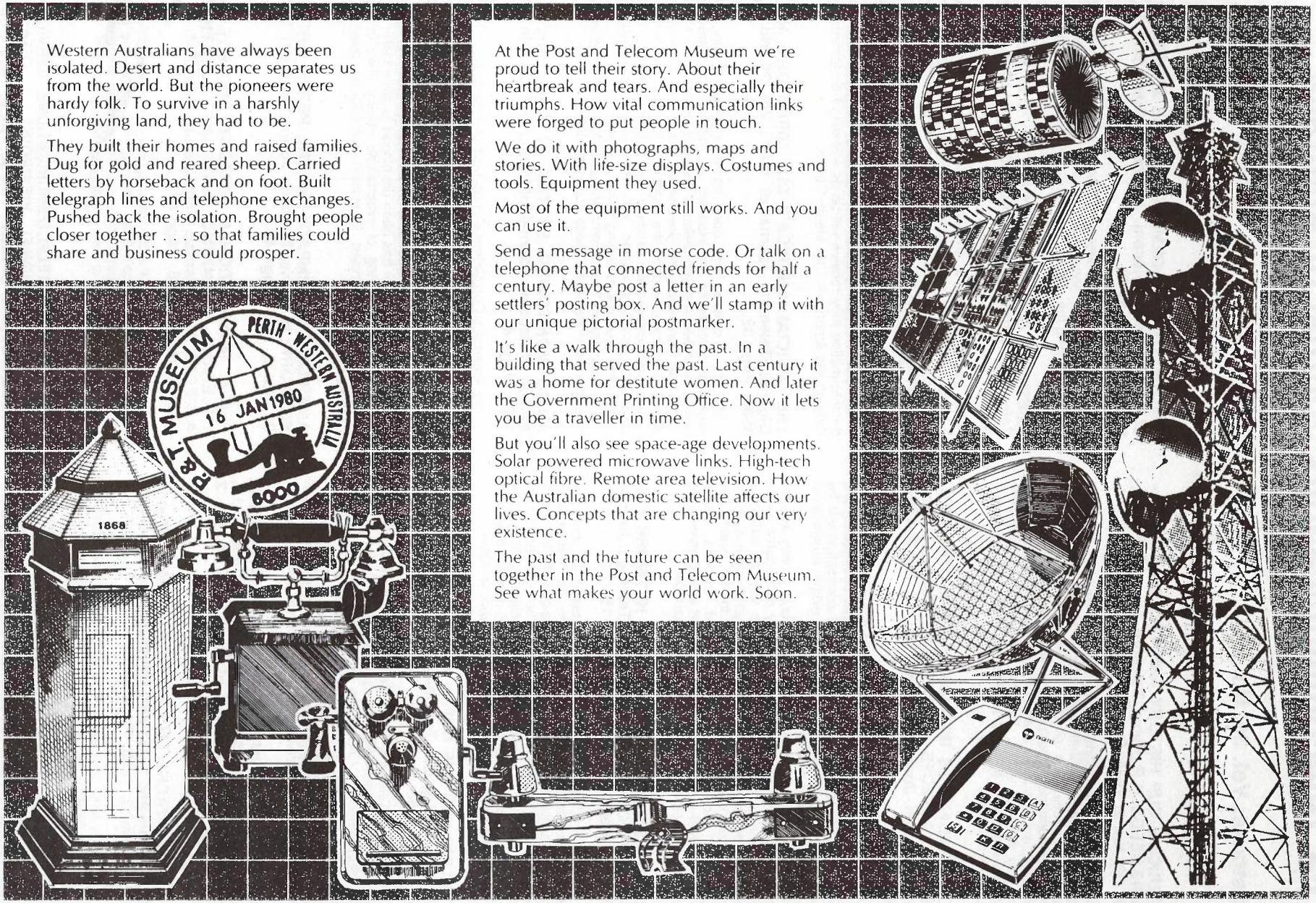
The past and the future can be seen together in the Post and Telecom Museum. See what makes your world work. Soon.



The Telecommunications Journal of Australia

Abstracts: Vol. 36, No. 2

AMERICA'S CUP HISTORY AND TELECOMMUNICATIONS NEEDS: B.R. Hume, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 3.

This paper briefly outlines the saga of the America's Cup and how the Twenty Sixth Challenge came to be held at Fremantle, Western Australia. The situation is considerably different to Newport, Rhode Island, both geographically and telecommunications-wise, and this latest challenge has many more challengers than any previous event. Telecom has had to develop the telecommunications facilities to meet all needs of syndicates, media and visitors.

COMMUNICATIONS INFRASTRUCTURE AND COMMERCIAL ASPECTS — AMERICA'S CUP: C.N. Herring, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 11.

An event of the magnitude of the 1987 America's Cup Defence places great reliance on a wide range of quality communications services. Their operation and efficiency of connection will be closely appraised by many people and to, an extent, Australia will be judged on the outcome.

But much of the America's Cup story is about money and the returns on investment which other Country participants would anticipate through a successful association with an individual challenger or the event itself. Never before has Western Australia had such an opportunity to show itself to the world. The organisation arrangements for the event, facilities, tourist attractions and other activities all play a part in determining the long term benefits to both the State and Australia.

VIDEO AND SOUND PROGRAMME NETWORK FOR THE AMERICA'S CUP: M.J. Norman, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 15.

Telecom in Western Australia has installed an extensive metropolitan video and sound programme the transmission network to support the America's Cup events over the five month period October 1986 to February 1987. The backbone of the network uses W.A.'s first optical fibre cables. This article describes the initial plans, the evolution in network design as customer demand grew, and the final network structure.

CABLING FOR THE CUP — A DISTRICT PERSPECTIVE: S. McTaggart, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 21.

The staff of Telecom W.A.'s Perth South District barely had time to recover from the euphoria surrounding Australia II's win at the 1983 America's Cup series before the first enquiries for service for the 1987 challenge came flooding in. This article discusses the background and methods adopted to provide a local cable network to cope with the greatly increased demand for telecommunications services in the Fremantle area.

AMERICA'S CUP IMPACT ON PERTH INTERSTATE AND INTERNATIONAL TELEPHONY TRAFFIC: J.J.A. Wilson, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 24.

12 METRE YACHT TELEMETRY SYSTEM: M. Kenny, N. Tsigoulis and E. Walker, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 25.

America's Cup communications needs have resulted in a favourable market for the development of new and novel communications systems.

Telecom Australia has responded to the challenge of providing a mobile telemetry system for America's Cup syndicates.

This article describes the development of the system which transmits a computer's statistical data from a racing yacht to other mobile or fixed locations for subsequent analysis.

FREQUENCY MANAGEMENT FOR THE AMERICA'S CUP: B.R. Field, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 31.

This article lists the measures taken by the Department of Communications in handling the use of the radio frequency spectrum during the period the America's Cup will be contested.

AMERICA'S CUP MEDIA COMPLEX: C.N. Herring, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 35.

The countdown to the staging of the first America's Cup in Australia has reached the final phase. For Western Australia the first step was the successful staging of the 1986 World 12 Metre Championships over the period 7-20 February.

Around the World, interest in America's Cup racing is high. The competition has become a symbol of sporting excellence. It is one of the great spectator events.

For those not able to be on the course at Fremantle much of the information they receive will be as a result of dissemination through the America's Cup Media Centre.

THE OFFICIAL AMERICA'S CUP DIRECTORY: K.P. Biggins, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 39.

Millions of dollars have been spent upgrading Perth and Fremantle to cater for the expected 1.2 million visitors arriving during the America's Cup Defence Series commencing October 1986. The Commonwealth Government alone has made available $30 million to support the conduct of the Defence Series.

Telecom Australia will produce The Official America's Cup Directory, providing visitors with the most comprehensive information source and buying guide available.

The Directory will be a modern and exciting reference breaking new ground in the visitor guide publication field.

AUDIO MONITORING SYSTEM: N. Gibbs and P. Allison, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 41.

The America's Cup Defence to be held off Fremantle in 1987 has created an increased demand on audio links for both local, interstate and international use. This increased demand of audio circuits would have overloaded the already inadequate and unreliable monitoring system previously in use at the Pier Street Television and Sound Operating centres. As a result, the Audio Line Monitoring System has been developed to allow faster and more reliable monitoring of programme quality lines in the relocated and modernised Television and Sound operating centres.

AMERICA'S CUP IMPACT ON THE PERTH METRO NETWORK: M. Davis, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 46.

PERTH INTERNATIONAL AIRPORT PROJECT — TELECOM PLANNING AND INSTALLATION ASPECTS: M.J. Norman, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 47.

The construction of Perth's International Airport was brought forward for the America's Cup. This paper describes the plan implemented to establish a digital exchange within the terminal building and connect it to the Telecom network using optical fibre cable.

AMERICA'S CUP TELECOMMUNICATIONS SERVICES — AN INTERNATIONAL VIEWPOINT: J. O'Toole, Telecom. Journal of Aust., Vol. 36, No. 2, 1986, Page 53.

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The Journal reports on the latest developments, both technical and commercial, in telephony, radio and TV and is distributed to professional engineers, executives and technical staff engaged in the planning, marketing, installation and operation of telecommunication services in Australia and overseas, also to manufacturers in this field, government departments, universities and consultants.

The Journal is not an official journal of the Australian Telecommunications Commission. The Commission and the Board of Editors are not responsible for statements made or opinions expressed by authors.

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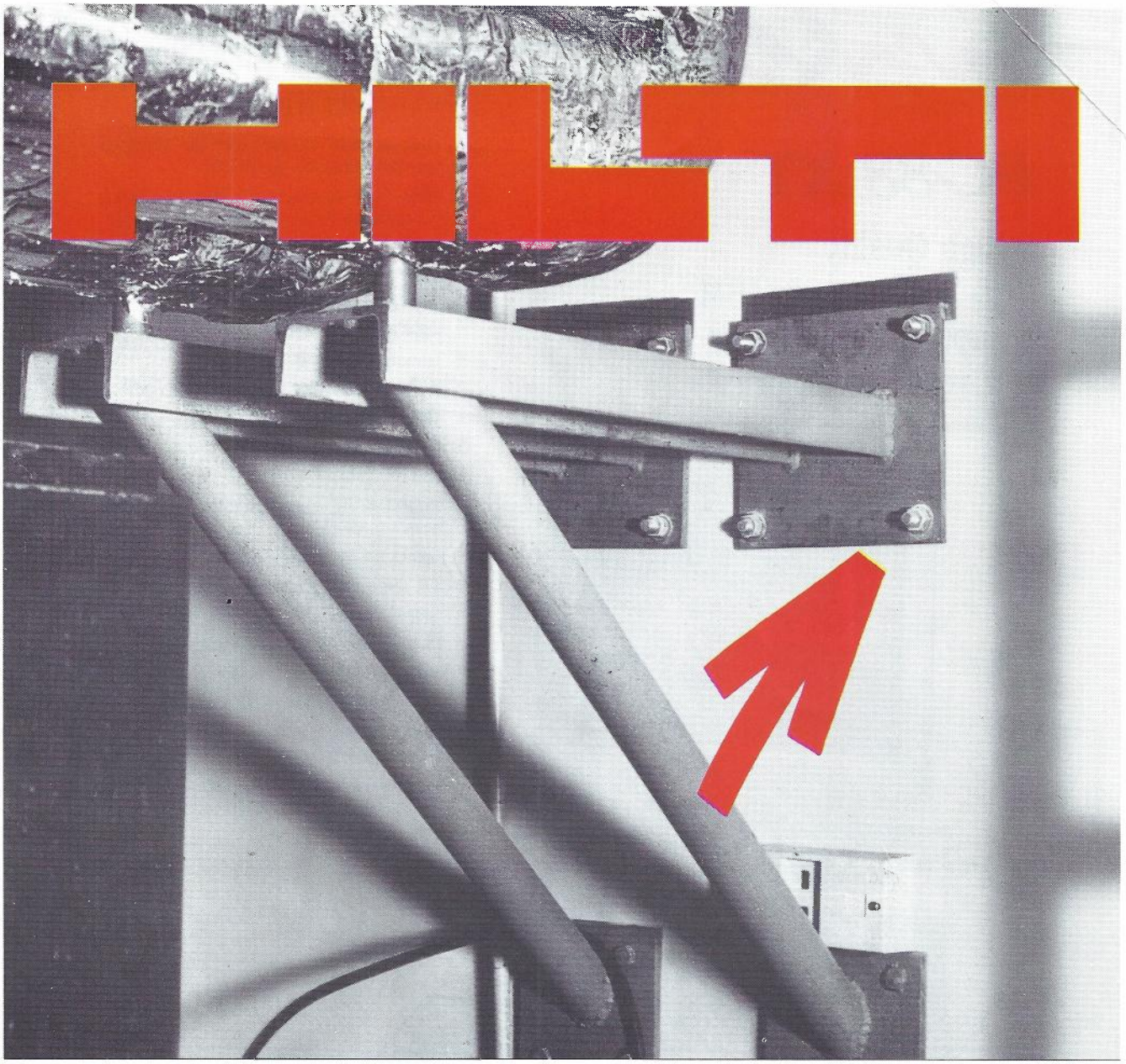

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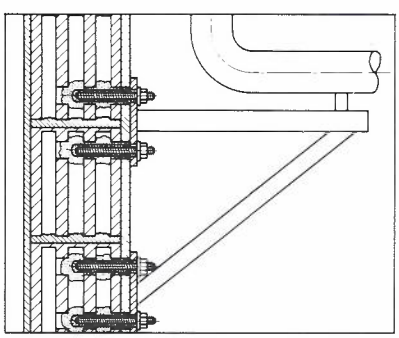

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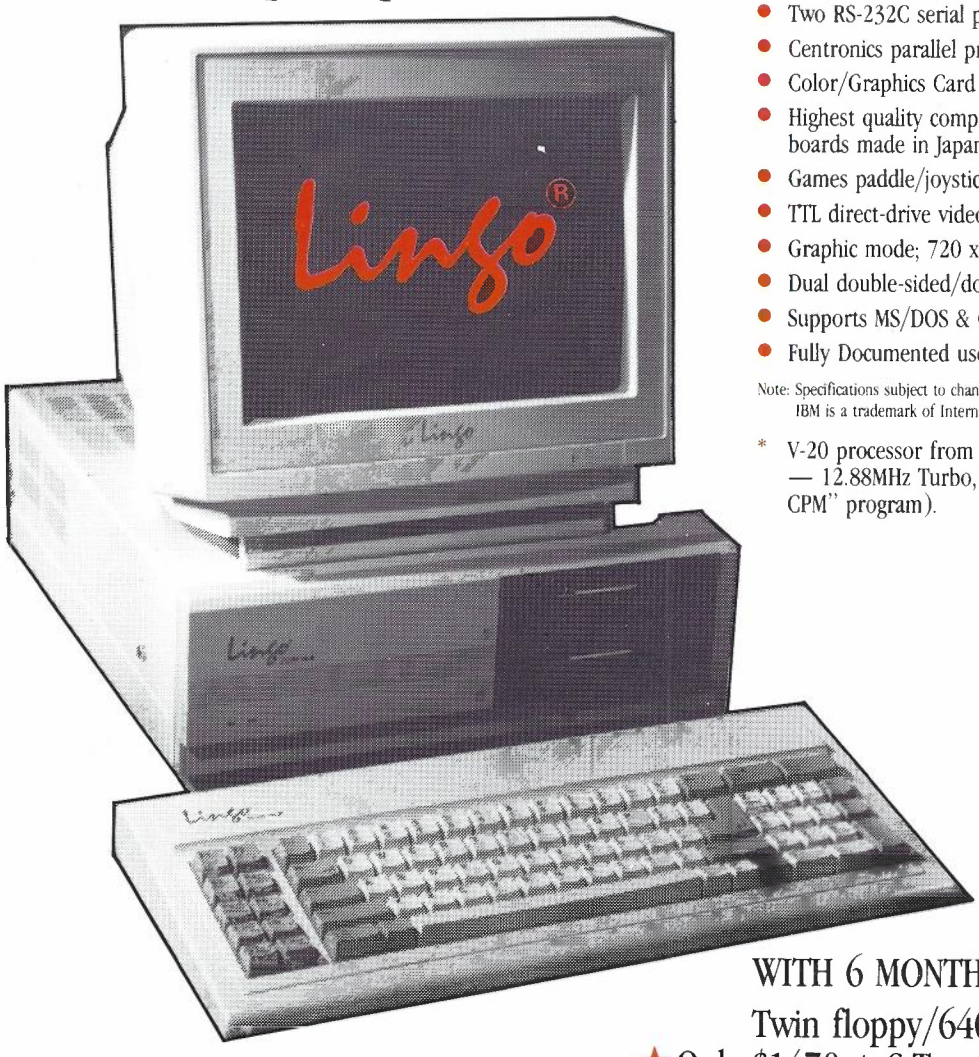

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