THE QUIET REVOLUTION
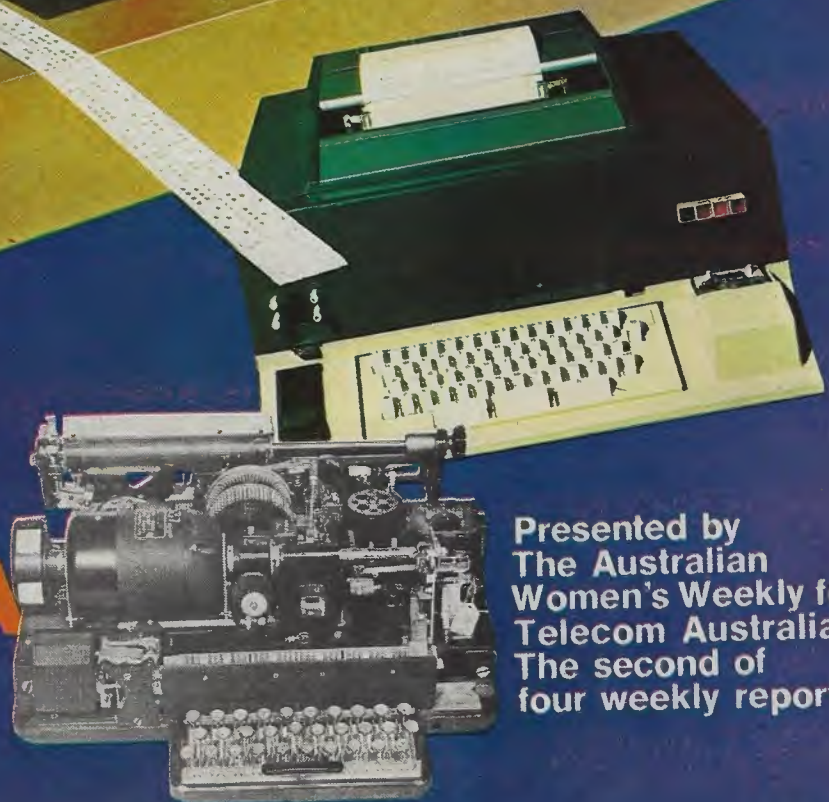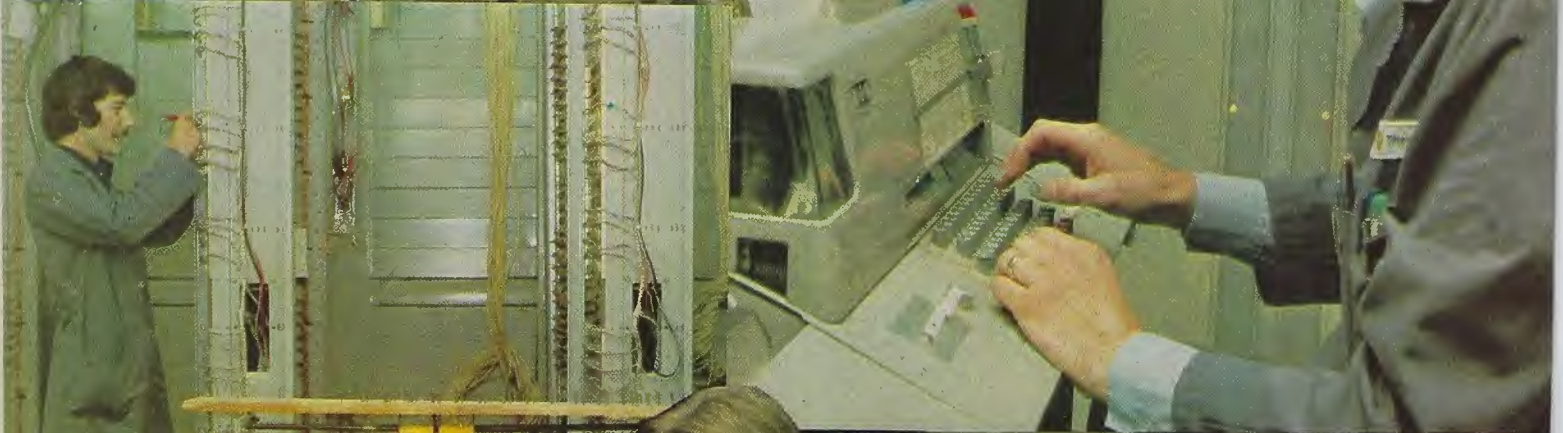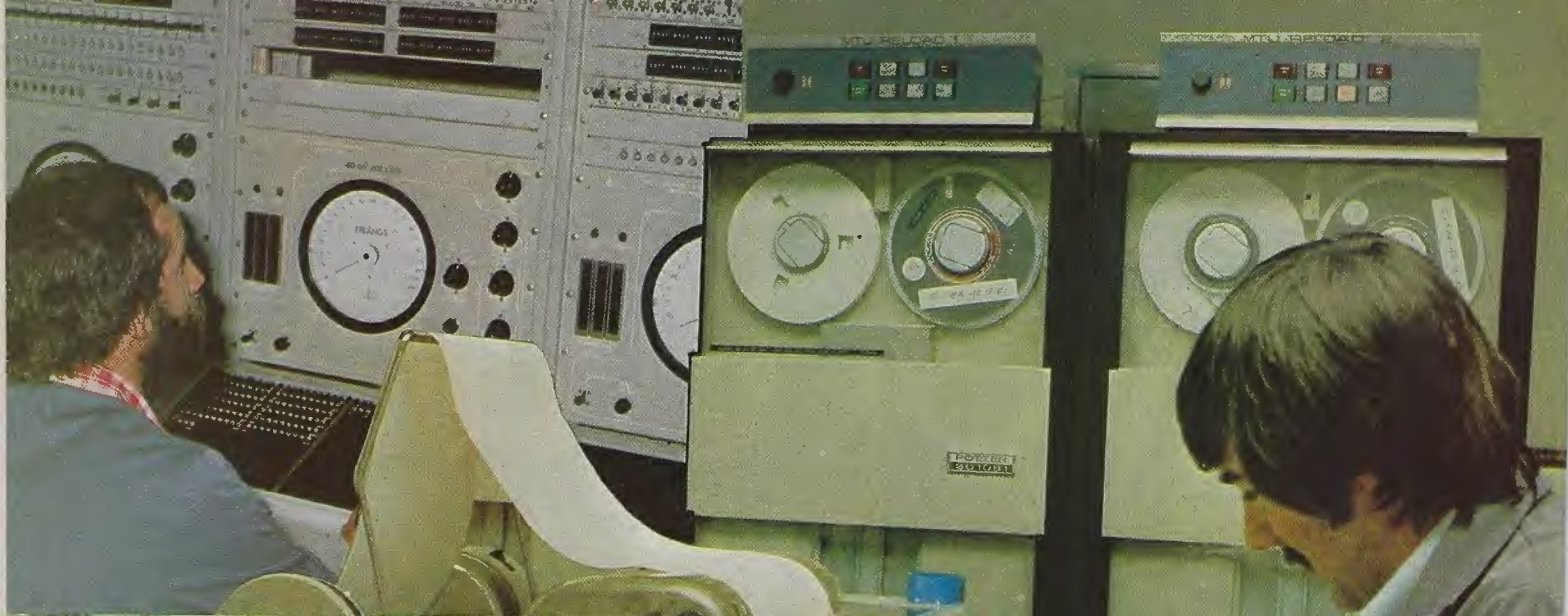
A SPECIAL TELECOM AUSTRALIA REPORT

Presented by
The Australian
Women's Weekly for
Telecom Australia
The second of
four weekly reports

THE QUIET REVOLUTION

In 1959 a Community Telephone Plan was launched to set the course of Australia's telephone development until 2010. The main thrusts of that plan have been achieved, giving Australians a telephone service of world standard.

The term STD was about to become a part of everyday language when the Community Telephone Plan was unveiled in 1959. A new telephone numbering system for Australia saw that all places could be reached by a combination of nine numbers — the area code and the customer's number. This all number system born in Australia was to become the basis for the world numbering plan.

In the next 20 years the giant Australian telephone network underwent a major transformation.

New telephone exchanges which automatically chose the best possible route for a call were introduced and the continent was crossed with new "super highways" — thousands of kilometres of coaxial cable and microwave radio systems. These super highways can carry thousands of telephone calls simultaneously — each call being a discreet message amplified along its path so that "clear across" Australia became a fact.

Radio and television relays, telex messages, streams of data, whole newspapers and individual pictures travel together with the telephone calls at the speed of light.

Today's Telecom network is 95 percent automatic and people dial 87 percent of their calls by STD.

News from around Australia and the world are flashed to newspaper offices and into our homes by radio and television.

During that 20 years billions of dollars were invested in making the 1959 plan a 1979 reality.

Planning such a quiet revolution involved many engineers, scientists and draftsmen, economists and a host of people who studied customers' needs, both commercial and social.

Installing the systems saw people on mountain tops surveying the best path for a microwave radio system. Studies were conducted across deserts and seas to work out the best method of transmitting telephone calls.

The physical construction involved specially designed tractors ploughing cable across all manner of country, crossing rivers and gorges, harsh dry deserts and rolling plains. Helicopters were used to take men and equip-

ment to mountain tops and ships carried supplies to far-flung ports.

Backing up this huge operation involved people in buying, storing and transporting supplies for the field forces. Whole caravan trains were employed to house and feed those far away from towns.

From the tropics to the snows, from coast to coast the revolution quietly rolled on as thousands of linemen and technicians installed, built, dug, blasted and ploughed their way.

The countryside was returned to its natural state and today's signs are the microwave towers and the small repeater stations — which amplify the signals and voices — and the small marker posts warning would-be diggers of the path of a cable.

Simultaneously telephone exchanges were enlarged, re-equipped and built in cities, suburbs and the country. The network was extended from less than 1,491,000 services to over four million. The number of non-automatic services was reduced from 26 percent to 2.5 percent.

Again planning, purchas-

ing, providing and installing involved thousands of people. But another large group who shared a lesser amount of the limelight had to continue with their tasks.

Recruiting, training, and looking after the welfare of people is a major task at Telecom.

Similarly the whole system must be maintained and operated 24 hours of every day.

Accounts must be collected, staff and suppliers paid. A whole series of systems must be employed to inform management of plans, progress, problems and solutions.

Keeping the finger on the pulse of the nation's nervous system is no mean task because this must be matched with the customers' needs for new and improved services.

These days it is not just a matter of "putting on the telephone" it's being put in touch with the world. The 20,000 Telecom vehicles are not just carrying materials to jobs — they are helping men and women build a national network.

Next week: How to use the services that Telecom provides.

COVER: Shows three generations of telex machines — the business tool that has become almost as essential as the telephone in many modern office set-ups.
LEFT: Backing up the quiet efficient day-to-day workings of the giant Telecom system is a constant programme of research, development, experimentation and straight-forward maintenance — all undertaken by experts in their fields.

MEET THE PEOPLE WHO

Enjoying the outdoor life

Yvonne Steward, lineman, grade 1: Yvonne, aged 23 and married, has worked with Telecom Australia as a lineman for two years.

She first became interested in the work by watching her husband, John, who is a lineman at the Stanmore Depot. John encouraged Yvonne's interest and so she applied for a position as lineman-in-training.

The course lasted 12 months after which she was appointed as lineman grade 1 attached to the Newtown Lines Depot.

Her work is varied and can involve anything from digging a manhole to the complex tasks involved in cable jointing. Yvonne often finds herself working in manholes or in the street upgrading and replacing telephone cables. She enjoys the outdoor life, but prefers the work in summer rather than winter.

The work is constantly changing and she finds the challenges stimulating and interesting.

At present Yvonne and John are building a yacht in the backyard of their home at Hurstville. Their dream is to sail to the Barrier Reef and then possibly travel further.

John sees bright future

John David Meldrum, technician: John, 25, lives with his wife Gloria and two children, Leonie, 6, and David, 14 months, at Seven Hills, Sydney. John has been employed by Telecom Australia for the past eight years. After completing his School Certificate in 1969 he joined the APO as a clerical assistant in 1970.

However, it became apparent to John that his interests lay more in the technical field. This led to his

successfully contesting what was then known as the apprentice telecommunications tradesman examination in 1974.

The four-year course entailed on-the-job training as well as formal instruction at Telecom's Training School. Since completing the course John has been working at the Parramatta Subscriber Installation Depot where his main duties involve the installation of private and business telephones and related equipment. John says that he really enjoys his work as he meets all types of people from all walks of life.

Cycling and photography take up most of John's spare time. He is a member of the Blacktown Amateur Cycling Club and participates in many of the club's racing events.

Rewarded with scholarship

Graeme Harding, finance officer, accounting development section — finance and accounting department: Graeme is 25, married and enjoys playing mah jong, cricket, tennis and golf.

He left Granville Boys' High with a School Certificate in 1969 and then spent two years with the Rural Bank before joining the APO as a trainee computer operator.

Working at the North Sydney ADP Centre, which is a key link in Telecom's national telephone accounting system, Graeme soon tired of the night shifts and realized that his career prospects were inhibited by lack of higher education. With assistance from his supervisors, Graeme avoided the night work and enrolled at Auburn Evening College from which he matriculated to the University of NSW in 1973.

After two years at university, Graeme was rewarded with a Telecom Scholarship

Yvonne Steward

to complete his final year in a Bachelor of Commerce degree.

The scholarship entitles the recipient to one year of special leave on full pay permitting course completion as a full-time student. Upon graduating, Graeme was promoted to the finance and accounting department.

Currently Graeme is a finance officer and is engaged in the review and development of management and financial accounting systems.

Graeme hopes to progress to a higher managerial position.

Managing the facilities

Vance George, manager, major facilities, Sydney City District: Vance was born in Liverpool, NSW, in 1925. After leaving school he attended technical college to study radio theory. He worked in the radio industry until World War II when he joined the RAAF.

After being discharged from the Air Force he joined the management staff of


John Meldrum

Email Pty Ltd in the radio and appliances division.

Then, to pursue a public service career, Vance joined the APO in 1954 as a lineman.

After sitting for a series of examinations he was appointed as the supervisor of installation depots in the inner city area of Sydney. This was during 1955-1965 when major building activity radically altered the skyline of Sydney and brought about a communications need which strained the resources of the APO.

When the Telecommuni-

MAKE THE SYSTEM WORK
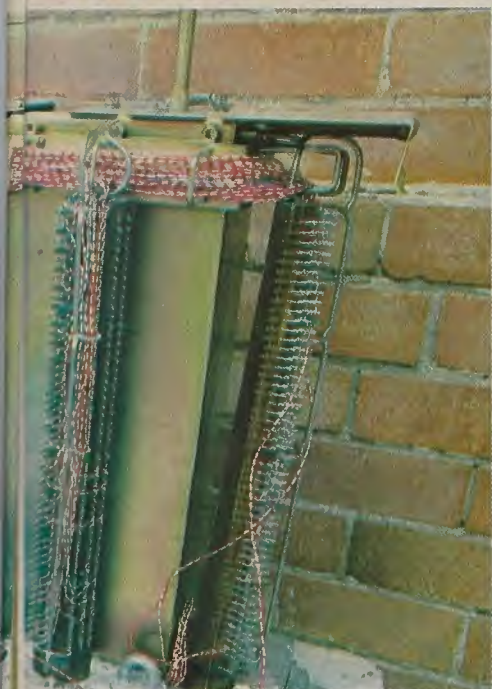
ABOVE: Vance George. BELOW: Paul Deuble: ABOVE RIGHT: Anne Gellel.
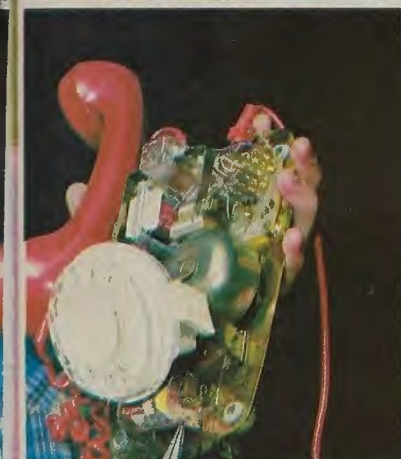
LEFT: Graeme Harding

cations Commission was formed, Vance was appointed as the major facilities manager in Sydney and was responsible for the maintenance and installation of selected large internal exchange (PABX) projects in such places as the Stock Exchange, David Jones, and the Electricity Commission.

Computing a busy life

Paul Deuble, computer systems officer Grade 2 with Telecom's Information Systems Branch: Paul's job is to write computer programmes to solve problems in the engineering, personnel and financial areas of Telecom's activities.

He is also involved with the control and design of computer systems, and finds this type of work particularly rewarding.

Aged 26 and single, Paul matriculated in Queensland in 1969 and then did a science degree at Queensland University.

Paul was selected for the Public Service computer programmer – in – training course with Telecom in Mel-

bourne and at the same time completed the post-graduate Diploma of EDP at Caulfield Institute of Technology. At first, Paul worked in Telecom's research laboratory, programming and testing computer controlled exchanges. Six months later he transferred to Sydney.

Paul is also currently completing an economics degree at Macquarie University and even occasionally finds time for squash, running and sailing.

Interpreting a demand

Anne Gellel, telephonist supervisor grade 2: Anne was born in Alexandria, Egypt, and migrated to Australia with her family in 1951.

She started work with the APO as a telephonist at the Metropolitan Trunk Exchange in Sydney. Four years later Anne transferred to the International Exchange.

Anne speaks English, French, Italian, Arabic and Maltese fluently, and has some knowledge of Spanish
CONTINUED OVERLEAF

MEET THE PEOPLE....

and Greek. For many years she was one of the few telephonists in the International Exchange who could speak a language other than English so her services were in great demand. Even when off duty, the exchange often calls on Anne to act as interpreter.

The main languages Anne uses are French and Italian. French is mainly used to talk to Noumea. As a result of this extensive contact, Anne has become friends with many of the overseas operators and entertains them when they visit Australia for holidays.

Her main use of Italian is in acting as interpreter for radio telephone communications with foreign ships.

In addition to her duties as a telephonist with the International Exchange Anne has been invited to be an interpreter at a number of Telecom conferences.

Anne was promoted to the position of supervisor grade 2 just over a year ago.

She enjoys her work as she loves meeting people.

Handling the telex customers

Lorraine Cristiano, telex service operator: Lorraine, 23, joined the old APO eight years ago when it was still the Postmaster General's Department.

For the first 3½ years she worked as a phonogram operator and then transferred to her present position.

The work area of the telex service operators is pleasant with air-conditioning, carpet and a few pot plants to add colour. There are about 25 operators in this area.

Lorraine's job includes handling customer problems, giving directory assistance for telex numbers, reporting faults to technicians and connecting conference calls for customers who wish to contact several

TOP: Lorraine Cristiano ... keeping the telexes moving.
ABOVE: Jeanne O'Connell. ABOVE RIGHT: Keith Welford.

telex numbers at the same time.

Although telex service operators are required to work shift hours, they are permitted to swap their shifts around. Lorraine makes use of this to enable her to work the 8.30 to 4.30pm shift on most occasions.

Keeping pace with technology

Jeanne O'Connell, keyboard instructor, grade 1: "I started my career with the APO in 1967. I was trained as an accounting machinist which included typing and comptometry. This took 10 weeks.

"Soon after starting work I had the opportunity to train as a data processing operator. The salary was good and promotion came with my

increased efficiency and work capabilities. This meant increased responsibilities as well as more challenging work.

"As Telecom is at present using computers for most of its accounting records and processes it has meant I have kept pace with modern technology.

"I also attend extra training classes provided by Telecom so that I can take advantage of new technology or techniques that can be adapted to the business of providing telecommunications to all of Australia.

"For the past five years I have been training new employees in data processing and in the last year I have been training on the latest key-to-disk equipment.

"The work is enjoyable and I like introducing new

employees to Telecom, and, in many cases, young employees to their first full-time job."

Negotiating with the unions

Keith Welford, assistant manager, industrial relations department: Keith spent his childhood in Armidale, NSW.

He started work in 1945 with the APO as a technician-in-training. After a five-year course Keith was selected to return to the Training School as an instructor on the basis of his leadership qualities.

He was in this position for two years and he then decided to become a clerk.

For the next eight years he worked in various staff administration areas, including two years at Wollongong, taking care of leave, pay and welfare problems of lines and technical staff.

In 1960 Keith obtained a position as industrial officer in the staff and industrial section of the engineering division. This position involved extensive contact with union members of that division and was the start of a long and successful association with the unions.

In 1977 Keith was promoted to his current position of assistant manager, industrial relations branch.

KEEPING YOU IN TOUCH

Telephone exchanges first opened for business in Melbourne, Sydney and Brisbane in 1880, only four years after Alexander Graham Bell first spoke on a telephone.

The exchanges catered only for small numbers of people. The Melbourne telephone directory of 1881 was a single sheet of paper listing 128 subscribers.

Gradually the number of exchanges expanded until both city and country areas were being linked into a telephone network and in 1907 the Sydney-Melbourne trunk line was opened for business.

All operations were manual and "number please" became a well-known expression.

In July, 1912, modern technology arrived in Australia at Geelong, Victoria. Australia's first public automatic telephone exchange and the second in the British Empire opened for business. An automatic exchange for internal Post Office use was installed in Sydney in 1911.

The editor of the Geelong "Advertiser" noted that the new exchange was "so ingenious as almost to beggar complete description."

Eight hundred people and businesses in Geelong were introduced to telephone dials — with numbers only — and began to make their own calls without any assistance from an operator.

For nearly 50 years, Australia's automatic telephone exchanges used the basic principle embodied in the Geelong exchange.

Step-by-step was the name given to these exchanges. Each time a single digit was dialled electromechanical switches clicked their way up and down a rack to select that digit. When all digits had been selected step-by-step, the telephone rang at the number you had dialled.

In the late '50s the APO was to produce a Community Telephone Plan looking towards Australia's telephone development for the next 50 years. A decision was then made to introduce a new type of telephone exchange into the Australian network.

Called Crossbar, the new exchange had a memory component which would take the number you dialled all in one gulp, instead of step-by-step, and then ingeniously select a way to connect that number.

The Crossbar exchanges were installed in cities, suburbs and small rural settlements. Next they were installed at trunk exchanges because of their memory ability to store numbers until they decided by which route your call could be sent.

Subscriber Trunk Dialling (STD) was then a reality and a trunk call by STD became as easy to make and almost as fast to connect as a local call.

Currently Telecom is planning to introduce a new generation of telephone exchanges in the early '80s.

In the electronic era, the switching abilities of a telephone exchange are being harnessed to the memory powers of computers. The new generation exchanges, the modified crossbar exchanges and major modern trunk exchanges all use computer power for what is called stored programme control.

The major trunk exchanges in Sydney, Melbourne, Adelaide and Bendigo are stored programme controlled. Similar exchanges are to go into service in Brisbane and Perth. They are called 10C (ten see) exchanges.

The programme that is stored by the computers contains every known route by which a call can be connected from A to B. When your STD call arrives at one of these exchanges the computer works out the best path for it in a tiny fraction of a second and then the exchange makes the connection.

If in the course of selecting a route the computer finds any hold-up in any part of the network, it gives a message by teleprinter to the exchange staff who immediately check to see if anything is amiss and needs fixing.

If that 1912 editor could see today's 10C exchanges he would be truly amazed. Apart from the whirring of computer disks and the occasional chatter of a teleprinter, all is still. The only moving parts in the exchange seem to be the tiny lights which indicate equipment is working.

An overall view of the highly sophisticated monitoring panel in a modern 10C exchange.

Suspicion - mother of invention

Everything wasn't up to date in Kansas City, according to one of its undertakers — Almon Strowger.

Rightly or wrongly he believed that telephonists on his local exchange were favouring an opposition undertaker. He sat down with pencil and paper, and, using a cardboard collar box, some pins arranged in rows and some pieces of celluloid, he developed an idea for automatic telephone exchange.

Only 13 years after Bell's invention, Almon Strowger filed the first patent for an automatic exchange in 1889.

Five years later the telephone dial appeared for the first time in America, and the whole world set out to follow a path mapped out by a suspicious undertaker.

COMMUNICATION ☎
AROUND AUSTRALIA...IN

Nine o'clock and it's hot and steamy tonight in Darwin. Time to ring home. That's in Dynnyrne, a suburb in Hobart overlooking Sandy Bay and not far from the Casino. That's a few thousand kilometres.

Funny, I just dial the number and I'm through. I've never thought how my voice gets there.

It must go south from the green north to the red centre, down the track past Katherine and Mataranka, Daly Waters and Newcastle Waters. I follow it and I was right, but then when it gets to Tennant Creek, the gold rush town of the '30s, it does a left hand turn.

Eastwards along the Barkly Highway on to the spinifex country, where the mineral wealth of Mt Isa is won under the fierce sun, past Mary Kathleen, Cloncurry, Julia Creek and Hughenden and then it dashes off north-eastwards, where the copper trains go.

It's southwards now from Townsville, Queensland's second largest city, skipping from hilltop to hilltop past the sugar cane and never far from the ocean. Bowen, Mackay, "Rocky," Bundaberg and a bottle of rum.

Ah, the Gold Coast, and then bananas and lakes and the smoke curling upwards from Newcastle's furnaces — there's good wine out to my right along the Hunter, but I'm on the wing.

From Sydney towards Wollongong and across country to the top of Canberra, skirting the Alps looking down on the city from the Telecom Tower shining atop Black Mountain.

Melbourne's lights greet me as I skim south-eastward to the tip of the mainland, and on across Bass Strait.

Only a short trip now down Tasmania, over Mt Wellington, into Hobart and I'm home.
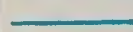
Well at least my voice is — "Hello Mum."

DARWIN

PORT HEDLAND

CARNARVON

PERTH

ALBANY

1. Solar heating panels dominate new houses in reconstructed Darwin. 2. An oyster boat at Broome. 3. Perth. 4. Wrest Point marks Hobart's skyline. 5. Canberra. 6. Centrepoint stands out in this view of Sydney's towering horizon. 7. Brisbane. 8. A Barrier Reef island.

A SPLIT SECOND

LEGEND

- ——— MICROWAVE RADIO
- ←—←— ONE WAY MICROWAVE RADIO FOR TV ONLY
- ——— COAXIAL CABLE
- ——— AERIAL WIRE

CAIRNS

TENNANT CREEK

ROCKHAMPTON

ALICE SPRINGS

CHARLEVILLE

BRISBANE

LISMORE

MOREE

CEDUNA   PORT AUGUSTA   BROKEN HILL

ORANGE NEWCASTLE

ADELAIDE

SYDNEY

WAGGA WAGGA

CANBERRA

BENDIGO

HAMILTON

MELBOURNE

LAUNCESTON

HOBART

THE NETWORK ⊕
ON THE LINE

If you could tune into every recorded telephone service, every radio and television station all at once you would only hear a fraction of what goes over the Telecom network.

Most people think only of telephone calls, telegrams and telex messages passing between cities.

Thanks to modern technology the underground coaxial cables you don't see and the microwave towers you may see on hilltops are alive with sounds far beyond music.

Streams of data from terminals to computers, from computers to terminals, from computers to computers are being sent at speeds of up to 48,000 bits of information per second.

Whole newspapers are transferred from one city to another so that they can be printed simultaneously, hundreds of kilometres apart.

Individual pictures are being flashed to newspapers. Radio and television programmes are being relayed live. Drawings, diagrams and the printed word are being exchanged by facsimile attachments to the telephone.

The water level in a dam is automatically sent from the dam to a monitoring point by phone. Burglar alarms are relayed over the phone lines. The flow of gas and oil along pipelines is constantly monitored, with the results being sent automatically over the Telecom network.

A doctor checking a patient's heart uses a device attached to a telephone to send heartbeats to a cardiograph at a hospital. Before and after Neil Armstrong stepped on the moon, his heartbeats pulsed across the huge Australian telephone network on the way to the doctors at the space headquarters in the USA.

The national and international news services chatter by teleprinter into a hundred newspaper offices, radio and television stations.

Recorded music follows you through offices and lifts — sent to the building over telephone lines.

Banks can exchange confidential information in data streams; airline reservation systems tell someone in Cairns that there's a seat on the 2.30 from Perth to Geraldton tomorrow.

Whether you dial a friend or a prayer your message

ABOVE: A typical Telecom microwave tower ... silent bearer of many messages.

could be rubbing shoulders with a news flash, a Hollywood spectacular, TAB results, the remote calculation of a payroll or the theme from Superman.

But go ahead and ring up. All you'll hear is the voice you want to hear. The rest of what's on the line belongs to other people.

TX20 WILL BE A BOON

LEFT: The TX20 — the new electronic business marvel.

Something from "Star Wars" — well almost. TX20 is the Telecom name for their new electronic teleprinter.

For over 20,000 businesses around Australia that "talk in type" by telex, it will be a boon. But for the telex operator it will be a step into a new world.

The TX20 machine (also pictured on the cover) has these features.

IT is very quiet;

THE electronic keyboard means a lighter touch for the operator;

THE keyboard has a store and forward capacity which allows the operator to operate at higher typing speeds, although the copy is being transmitted at normal Telex speed; a much-appreciated and time-saving device;

TAPE can be prepared and run locally at up to three times the normal transmission speed;

FOR private wire applications, the transmission speed can be substantially increased;

TAPE can be prepared off-line even while the machine is sending or receiving copy;

THE teleprinter itself identifies copy as being prepared locally, received from line or transmitted to line;

USING multiple copy roll paper, up to one original and four copies can be made of inward or outward telex messages.

Over 32 million telex messages are exchanged each year in Australia and another five million go overseas.

That's a lot of talk in type and tape.

Everyone's going beep-beep

"That's fine," he said to the wine waiter. "It was a very good year," "beep-beep-beep." Heads turned in the restaurant and, unspeaking, they all asked is this yet another new wine comment?

A little embarrassed, the diner reached into his pocket, clicked off a little black box and asked, "Where's the phone please?"

In every capital city, on the Gold Coast and in Launceston, people in lifts and cars and buses and places are going beep-beep. And sometimes without even a wink they are getting a nudge.

Telecom's Telefinder Service is the modern way of keeping in touch with people on the move. The person who is required to be kept in touch carries a small box about the size of two matchboxes end to end.

Each black box — a radio paging unit to be precise — has its own telephone number. When that number is rung the unit gives a signal. It can be a beep-beep or with some models the unit either beeps or vibrates — nudge, nudge.

The radio pagers also have a storing device. Our heroic diner could have used the store control and the beep would have remained silent until he switched on after he had left the restaurant.

By 1985 the Telefinder service is expected to have 100,000 customers.

LEFT: Away from the office but still in touch at all times . . .

A GIANT INVESTMENT IN

Telecom staff are installing new phones at the rate of nearly 2000 a working day to meet customers' demands.

As well as the actual telephones in your home or office, there are cables, exchange equipment and new trunk lines which have to be installed, new buildings built, motor vehicles purchased, new directories printed . . . all the things that a modern telephone network requires.

This year $978m will be spent on expanding and modernising the network.

Thanks to productivity, technology and a cost-cutting programme, Telecom is now able to add 60 percent more new services than it did three years ago at an average cost (at constant prices) nearly 40 percent below that of 1974/75. This huge investment in Australia's future provides continuing employment in Telecom and many Australian businesses that supply Telecom's needs.

As a matter of record Telecom spent in 1977/78
- $370m with Australian manufacturers
- $65m on buildings and land
- $60m on renting accommodation and on light, power, water, etc.
- $230m for hire and repair of plant, office equipment, postage, printing, payments to Australia Post and OTC and day-to-day expenditure such as petrol and oil.

How Telecom will spend its money this year can be seen from the following quick glance around Australia.

Queensland: New outback services

Telecom will spend about $147 million in Queensland during 1978/79, mainly to provide new services. This will include 18 major projects costing from $526,000 to $11,943,000 and ranging from the equipping of new telephone exchanges to the provision of new STD and trunk line systems.

Eight major new building projects will be started during the year, ranging in cost from $282,000 through to the $1.825 million workshop building at Bulimba.

Another 22 building projects each costing more than $250,000 are currently being completed. Among these is the Mossman-Coen microwave radio system to be powered by solar energy. It will span 400km of some of the State's most rugged and inaccessible country.

Work is also proceeding on improving the telephone services in remote areas.

Telecom spends more than $50 million a year in Queensland on materials, $15 million on buildings and real estate and $7 million on electricity, water and leasing office space.

Steel poles are used where white ants could attack wood.

THE STATES' FUTURES

Sydney's modern, computerized International Exchange.

A new style telephone booth.

New South Wales: Outlay $344m

Providing new services in New South Wales will cost Telecom $334 million during 1978/79. There will be 46 major projects costing from $512,000 to $22,511,000 and ranging from the equipping of new exchanges to the provision of new STD and trunk line systems.

Nineteen new building projects ranging from $275,000 to the $5 million telephone exchange building at Newtown will be started during the year. Another 50 projects each costing more than $250,000 are being completed.

There will be 23 small new country automatic exchanges installed and 50 others replaced or extended. And some 2400 public telephones which give STD as well as local call service will be installed.

South Australia — Northern Territory

The new Alice Springs to Tennant Creek microwave radio system, which will bring STD to Alice Springs, is a world first, being solar powered.

And the coaxial cable link from Ceduna to Port Augusta will give an added dimension to the national trunk network.

Telecom will spend $102 million in South Australia and Northern Territory in 1978/79, with eight major services projects costing from $534,000 to $8,173,000.

A $320,000 operations depot building will be started at Elizabeth and substantial alterations will begin to the Smith Street telephone exchange in Darwin. Another 13 major building projects are being completed.

PLANNING ☎
A GIANT INVESTMENT...

New telephones get a final testing on the production line.

Victoria: Better trunk line service

Among Telecom's 16 major new building projects in Victoria is the $23 million Exhibition telephone exchange building in Melbourne. Another 40 projects each costing more than $250,000 are currently being completed.

New telephone exchange installations include Corio, Bendigo and Camberwell, Dandenong, Endeavour Hills, Hastings, Mt Evelyn, Springvale and Windsor.

Telecom will spend $272 million in the State during 1978/79 with 20 major new services projects costing from $503,000 to $9,450,000.

Improved trunk line service will result from systems such as the microwave radio link to Tasmania.

A helicopter aids survey work in the highlands of Tasmania.

Perth's $21.5 million Wellington Exchange (centre right).

Tasmania: New link to the mainland

Telecom will spend $25 million in Tasmania during 1978/79 on new services and projects such as a new $526,000 operations depot at Burnie.

Queenstown is to have an improved service through a new $800,000 radio telecommunications system, and a new $583,000 radio-system link to the mainland through King Island to Smithton is being built to duplicate the existing service via Flinders Island.

A $3.46 million exchange is being built in Hobart, and a $200,000 works depot at Derwent Park.

Western Australia: $21.5m exchange

Cyclone protection for installations in the North-West and a new high capacity trunk line system between Leonora and Kalgoorlie are among Telecom's projects for 1978/79.

It will spend $8.5 million enlarging country exchanges and a further $17.4 million expanding the rural trunk network.

Total spending in the State will be $98 million, with 12 major services projects costing from $587,000 to $11,363,000.

Projects just completed include the $21.5 million new Perth Exchange.

CYCLONES KEPT AT BAY

When people living in Carnarvon, about 1000km north of Perth, get cyclone warnings, they fasten their windows and anything else that can be tied down.

Radio Australia's high frequency broadcasting station six kilometres from Carnarvon also battens down when these huge, destructive storms are forecast. Their precautions include lowering the costly antennae, which are a local landmark.

These cyclone-proof antennae — erected on the site of the former National Aeronautical and Space Administration (NASA) base — were specified when Telecom called for world-wide tenders to build the Carnarvon station. They replace those at Darwin, which were damaged when Cyclone Tracy tore the Northern Territory port apart on Christmas Day 1974.

A bare three months after Tracy attacked Darwin, the Federal Government approved the building of a temporary Radio Australia station somewhere in Western Australia, at an estimated cost of $2.9 million. The Carnarvon site was announced on April 21, 1976, and a week later an on-site conference of all groups involved in the project (in-cluding overseas representatives of the contractor) was held.

The conference's job was to identify problems connected with the site — and the delegates found them. Carnarvon is still in the cyclone area; it's a long way from the State capital, Perth, causing transport problems; the site was only five kilometres from the sea, meaning corrosion problems were inevitable; and the site was not perfectly level, requiring levelling and alteration to tower heights and catenary (flexible steel rope) design.

A Telecom officer said later: "The station location, on a low, undulating ridge, is not ideal for HF broadcasting and was expected to affect the radiation pattern of the antennae. Consequently, flight tests were made in conjunction with the flying unit of the Department of Transport. The data from these measurements was analysed to determine the actual radiation patterns.

"In considering cyclone protection, the attitude was taken that the station design should give maximum protection to equipment at times when there is a possibility of high winds, even though this could mean closing the station for several days."

Eight major points came out of the conference which examined problems of building the station at Carnarvon:

● The ex-NASA buildings incorporated adequate cyclone protective features;

● Removal of anything that could become flying debris and cause physical damage during a cyclone was of utmost importance (loose branches and other timber; pieces of metal, plastic and cable; remains of buildings and old mechanical and electrical equipment);

● Maintaining a clear site was vital;

● Protection of towers from damage or destruction was particularly important in minimizing any interruption to Radio Australia's service during cyclones;

● Spare insulators would be the most critical items in rebuilding any antennae damaged during cyclones;

● Electric winching would be used to lower antennae to the ground when a cyclone threatened;

● Possible design changes to the antennae were limited because of the time allowed to build the station;

● Self-supporting towers had to be used because of the delays in availability of suitable wire rope for guyed masts.

The Carnarvon station is on a low ridge — 20 to 25m above the surrounding countryside — near the main highway heading north.

The antennae have their main beams directed on a bearing of 347 degrees true to south-east Asia and can be electrically slewed to 325 degrees towards India or to 009 degrees towards China and the Philippines.

All four antennae are supported by counterweighted catenary ropes which are wound on to electric winches. These winches allow the antennae to be lowered to the ground to avoid damage from cyclonic winds and flying debris.

Although lowering the antennae by winch was a major feature of the design, the possibility of not having time to lower some (or all) of the antennae if a cyclone rapidly altered course had to be considered. That was why such massive strength was built into the antennae and their supporting towers.

When the antennae and their screen are on the ground, they are held down by straps attached to firm anchors to prevent movement and damage. Only days after the system was completed, a cyclone passed close to the area and the antennae were lowered. Winds were half the design maximum and, Telecom says, "represented a real test of the system."

'Tropo Scatter' talks to the world

Telecom has gone "tropo" with its service at Nhulunbuy at the top of the Northern Territory. But "tropo" in this sense doesn't mean affected by the hot humid climatic conditions, it's shorthand for "tropospheric scatter radio system."

When people living in this newly-established bauxite town on the Gove Peninsula pick up their phones, their conversation is carried on radio beams through the troposphere (the layer of atmosphere extending about 11km above the earth's surface), where they are scattered and then picked up by a distant receiving station.

This is the first time Australia has used the tropospheric scatter radio system in its commercial telephone network. The system has, however, been used successfully in Japan, Europe and North America to provide large numbers of telephone channels across the sea or inaccessible country. Telecom officials say: "The tropospheric scatter radio system is ideal for the Darwin-Gove link, which crosses inhospitable, rugged terrain.

"To install and maintain the more usual communications systems of open wire lines, coaxial cable or microwave radio relay would not have been feasible.

"Using the new system, there are only two repeater stations needed between Darwin and Nhulunbuy, a distance of about 620km. They are at Munmalary and Milingimbi.

The system between Darwin and Nhulunbuy — which can carry up to 120 telephone channels and will also carry telex and data services — costs about $1,200,000. Nabalco, the mining company operating at Nhulunbuy, picked up the tab for a hefty share of the establishment costs.

A CABINET AFFAIR

The Welsh are renowned as singers and poets, and the exuberant W. M. (Billy) Hughes — farmhand turned peppery politician — proved true to his roots when he unleashed a letter on the deputy director of Posts and Telegraphs, Mr J. W. Kitto, early in 1934.

He opened: ''All Hail! Thane of Cawdor and Worker of Mighty Miracles.''

What had this so-civil civil servant done to merit such a salutation from the man who had been probably Australia's most colourful Prime Minister? He had installed a soundproof telephone box outside the Palm Beach Post Office, about 35 kilometres north of Sydney.

The testy ''little digger'' — who migrated to Australia in 1884, became Prime Minister and later founder of the Australian Party — had been ''rusticating'' at the coastal resort. But it was rather more rustic than he appreciated, particularly when it came to the whole settlement discovering the details of his financial affairs.

In a letter dated February 7, 1934, Mr Hughes (then Minister for Health and Repatriation) complained light-heartedly but still passionately about the ''only public telephone available'' at Palm Beach. Outside the Post Office, it was ''exposed to the fierce glare of the sun and the biting westerlies and heavy rain.''

He added: ''There is no privacy. Every word a sender utters can be heard by the crowd on the Post Office verandah, and the passersby along the road — to say nothing of the neighbours in the adjoining houses.''

Mr Kitto was galvanized into action. A bare two days later, on February 9, he responded: ''It is regrettable that the joy of your holiday at Palm Beach should in any

Billy Hughes ''whispered in the Ear of the Genie'' and a telephone box appeared.

way be dimmed by this department's shortcoming.''

He acknowledged ''the general need for a full-length public telephone cabinet'' and assured Mr Hughes: ''Palm Beach will receive first attention.'' And he made sure it did. On February 12 Mr Hughes fired back his ''All Hail!'' epistle.

The former war leader continued: ''You have restored my fading faith in the efficacy of petitions respectfully worded and ending, as is seemly, in prayer. Wonderful! Wonderful!

''On Friday, going to the Post Office, whilst yet the day was young, musing on things in general and the inanity and ineptitude of governments in particular, contrasting sadly the degeneracy of the present age with the bounding vivacity and virility of other days, I raised my eyes in mute appeal to the heavens, when lo! a wondrous Vision swam before them.

''In the place of that rank and hideous ruin that had disfigured the fair landscape by its rude and wretched mechanism, had provoked even the righteous to profane and lurid words and evoked scornful derision from the ungodly, there stood, passing fair, a lovely CABINET, standing shyly like a young maiden in some Arcadian Grove, awaiting the coming of her lover . . .

''Like Aladdin, I had rubbed the Magic Lamp and whispered in the Ear of the Genie. And he had gone straight away and got the dashed thing. Wonderful and splendid . . .

''When you come down to Palm Beach . . . you will come to the Post Office and look at the Lovely Cabinet and be able to say with Horace, 'Exegi Monumentum perennius aere' — 'I have reared for myself a monument more enduring than brass and loftier than the pyramids'.''