Hysteresis

1964

ADELAIDE UNIVERSITY
ENGINEERING SOCIETY

Symposium Issue

HYSTERESIS
1964

Official Journal of the Adelaide University Engineering Society
University of Adelaide
South Australia

Symposium Issue

1964

EDITORIAL . . . . .

"Hysteresis" makes its appearance this year in a somewhat different light from that of preceding years as a product of the A.U.E.S. executive.

This year the magazine features, as its most prominent articles, the papers presented at the Engineering Faculty Bureau Symposium held in Adelaide in the last week of May. The topic of the Symposium, "The Development of Northern Australia", is a problem which faces all Australians, particularly those of us who will be the professional men of the next decades. It is essential that we be well informed on this vital question, both concerning current projects and the plans of the future. To this end we are printing the full texts of the papers delivered at the Symposium.

As a special Symposium issue of "Hysteresis", we feel that this particular edition will receive a wide distribution among persons and organisations not directly associated with the Society but who share our concern in the matter of Northern development. We trust that they will find the material presented both interesting and informative.

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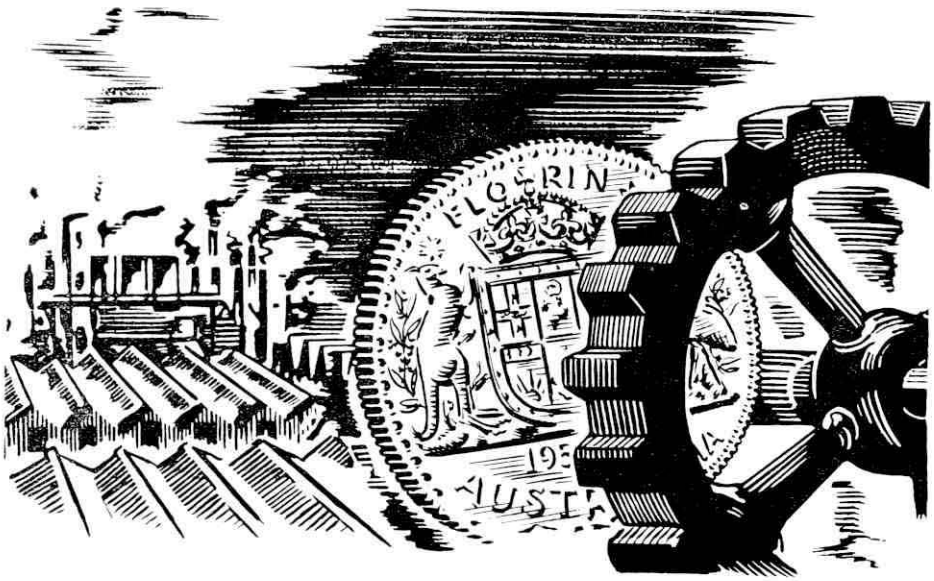

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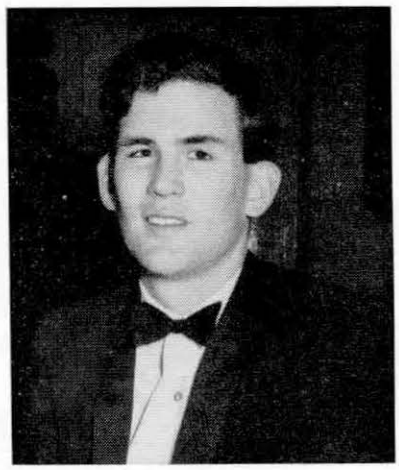
PRESIDENT'S REPORT



THE BEGINNING

The A.U.E.S. committee for 1964 first got together at the beginning of third term last year. We had our initiation at the post exam Smoko which was arranged by Roger Humphreys, Dave Dungey and associates. The Smoko was rather quiet (less than 100 decibels), but no doubt everyone was conserving his effort for this year's Symposium.

FRESHERS' WELCOME

This year the Society enjoyed a very successful freshers' welcome. Freshers were introduced to the society, its committee, and the staff of the Engineering Faculty, and were told of the pleasures of joining (quote) "the premiere faculty of the university". The guest speaker was Mr. K. J. Pascoe who gave a very interesting and somewhat amusing talk on early undergraduate life in England. Our thanks go to Mr. Pascoe for such a bright and entertaining talk. The meeting then adjourned to supper, which was held in the seminar room of the Electrical Engineering department, where the freshers had an opportunity to mix with staff and society members, and also to join the society.

CAR TRIAL

This event was thoroughly enjoyed by all who participated, and was consequently a great success. Starting on Park Terrace the trial headed through the hills to Lobethal, then due south (in a roundabout sort of a way) right down to Kuitpo forest where one or two lucky cars found the lunchtime checkpoint. Nevertheless most cars were headed in the general direction, and after "detouring" to McLaren Vale, everyone headed for Blackwood. Here, at Rhys Robert's place a barbecue tea was enjoyed by all, and prizes presented. Rhys was the organiser along with Rhys Horwood, and they are to be commended on such a successful trial. I hope that more such trials will be held in the future.

THE SYMPOSIUM

This year in the May vacation it was Adelaide's turn to host the annual Engineering Symposium. The theme —"The Development of Northern Australia" could not have been better, the whole Symposium being a tremendous success. It was a tribute to the organisers, and something which the society should be proud of. I shall not attempt to cover any details as this is all done in further pages, but rather I can say that we had over 150 interstate visitors who, along with ourselves, thoroughly enjoyed themselves—through every hour of that "glorious week in May". Our sincere thanks go to those companies which so generously supported the symposium. (Our acknowledgements to these companies appears in the speech given by Geoffrey Marlow at the official opening, this speech appearing later in this magazine.)

We sincerely thank the speakers who gave us some of their valuable time, presenting a wide spectrum of topics on Northern Australia which was very much appreciated by the audience.

The Symposium director was Geoffrey Marlow, who did a tremendous lot of work to make this Symposium the success it was. Thanks a million Geoff!

THE BALL

One of the social highlights of the year was the ball, and at this point I might say that the publicity coverage of the ball and in fact the whole symposium, was very gratifying. Being part of the symposium, one could not help but feel that it just had to be a success—and that it was. All credit goes to Roger Humphreys and his ball committee who did so well.

TUG-OF-WAR

With the emphasis on "War", the annual Meds. vs. Engineers Tug-of-War was held, with customary ceremony, across the River Torrens under the University footbridge. The meds. had the high side, and the result was inevitable, they winning two to one. However it is our turn next year, and with anything like a team we should be able to eat them. It was good fun, eggs and all.

THE IMMEDIATE FUTURE

Nominations are now being called for the next S.R.C., and I take this opportunity to congratulate those who are successful, and I feel confident of a good representative of engineers who will guard our interests.

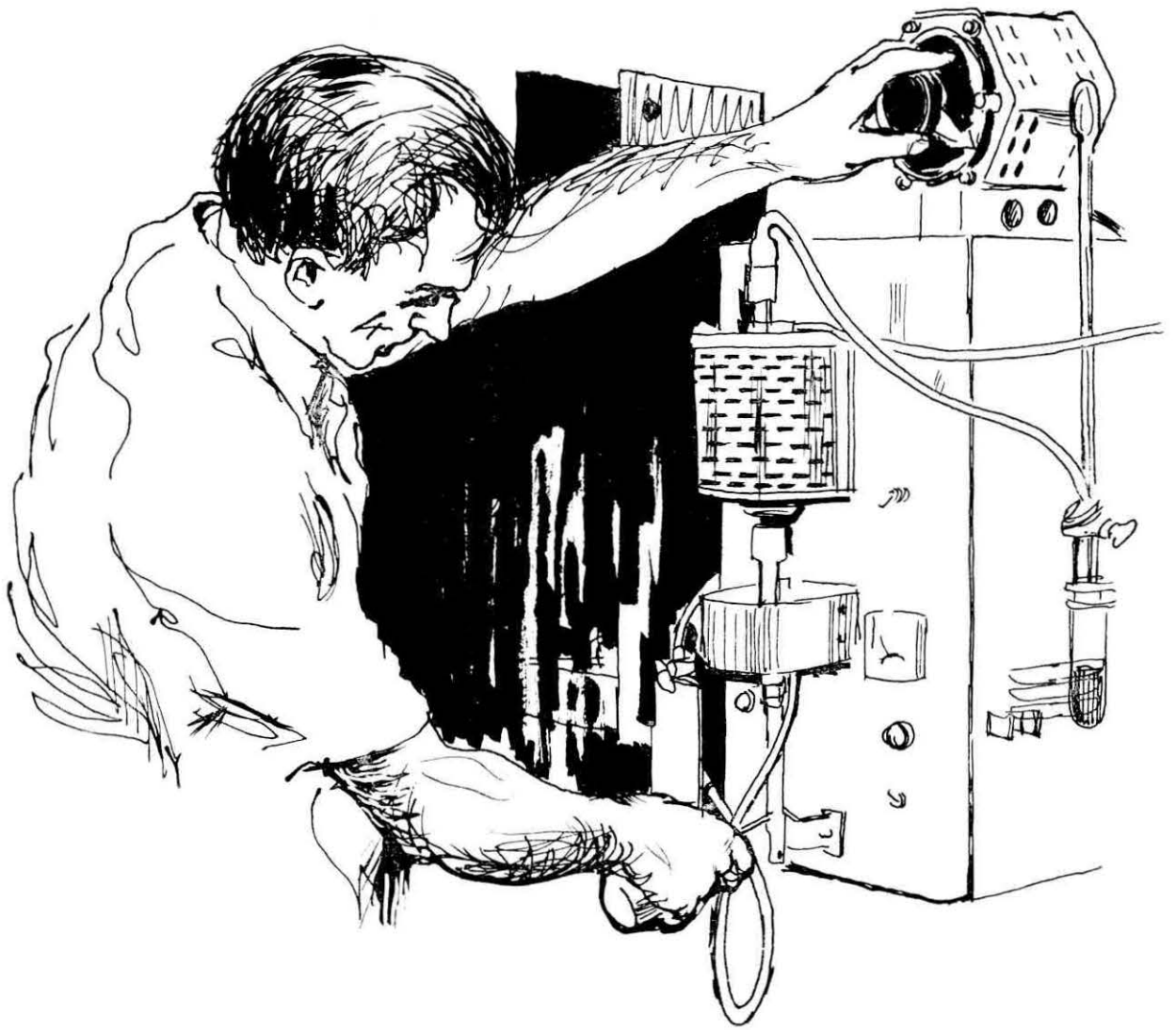
The annual dinner is in capable hands, and will be held on Wednesday, 5th August, at the Gresham Hotel. This event is always worth going to.

At this time also, the annual elections will be held, and I would like to take this opportunity to congratulate next year's president, and wish him and his committee all the very best for the coming year.

Finally I would like to thank sincerely, all those who helped so much during my term as president. I would especially like to thank the committee who worked very well together, everyone pulling his own weight, and striving particularly hard for the success of the symposium. I thank Mr. Farrent, his staff, and the typists who lended a helping hand wherever it was needed, and particularly our auditor Mr. Fowler.

I feel honoured to have been associated with the society, and cannot fail to see the brightness of the future.

PETER WATERS,
President, 1964.



Some people are never satisfied . . .

Steelmakers, for instance, are constantly searching for still higher quality, still better production techniques. B.H.P. has laboratories at all its steel centres to cope with day to day problems. The longer term, more fundamental research takes place at the Central Research Laboratories, at Shortland, near Newcastle. Science plays a big part in steel.

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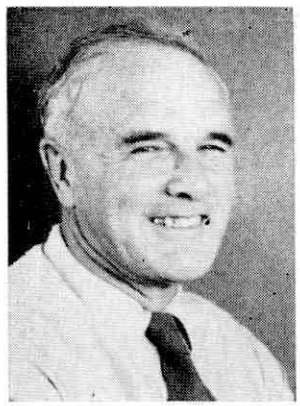

THE DEAN'S PAGE

Two recent events, the twentieth anniversary of D-Day in World War II, and the revelation of the existence of a Nazi party in Australia, twined my thoughts to that mighty war, upon which it was borne in on me that surely few of my readers would remember anything about it; fewer would remember its beginning.

From such thoughts it was but a step to consider what changes had occurred since 1939. A quick selection culled up pre-stressed concrete in general use, radar and television, atomic energy, rocketry and space travel, radio and X-ray astronomy and the turbo-prop and jet aircraft, to name some of the more outstanding; all within the lifetime of most of us.

How is it that the human personality can accommodate itself to such rapid change? In a search for an answer I twined again to a commemoration address given by the late T. Brailsford Robertson, Professor of Biochemistry and General Physiology, in 1926. It was entitled "The External Inheritance of Man".

Briefly the argument runs thus:
The lower forms of animal life, such as a wasp, is born with chromosome controlled instincts which make it immediately fully effective in its normal environment, but render it entirely incapable of adapting itself to unusual circumstances, whereupon it will die. The higher mammals, and we shall consider man above, are born with potentialities represented by innumerable newrones in the brains, most of which are not nearly fully developed even at death. Indeed the rate of development decreases with age, from babyhood. The development of those which are involved brings about a spontaneity of behaviour which the wasp lacks, and enables an adaptation to all sorts of circumstances. This can be considered to be man's internal heritage. Were that all, each person would still need to start from scratch, but communication, in the form of speech, will feed to tradition, (which might atrophy thought), but more especially in the form of the printed word, endows man with a heritage from the ages, external to himself. A natural selection of ideas becomes part of his life's work.

Now how does all this affect us as an Engineering School? Let us remember that since World War II began there have been three major revisions of course structure, and another is upon us, to conform with the new Matriculation Statute. It will be operative from 1967 (Electrical Engineering Courses are likely to be changed next year) and the changes to be made have received, and will receive, earnest attention from those responsible. Each change so far has in my estimation, made courses more difficult, unless the student wills to see to it that the necessary newrones of his brain are in fact developed. That will mean deliberate selection. It can mean a narrow efficiency; it can mean a development of the all round man, with a speciality to use in the service of his fellows, yet, and of his God. The idea of consecration must be decided in the right way if it is the selection of other ideas will be easier.

I have faith that the same efficiency with which you organised the Symposium on the Development of the North will be used to preserve and to develop both your invaluable internal and your external heritages, as men and women, and to hand the external one on to the next generation.

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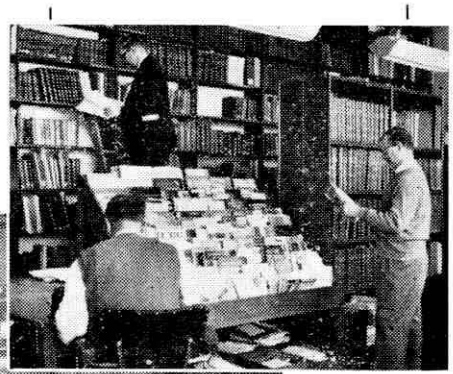

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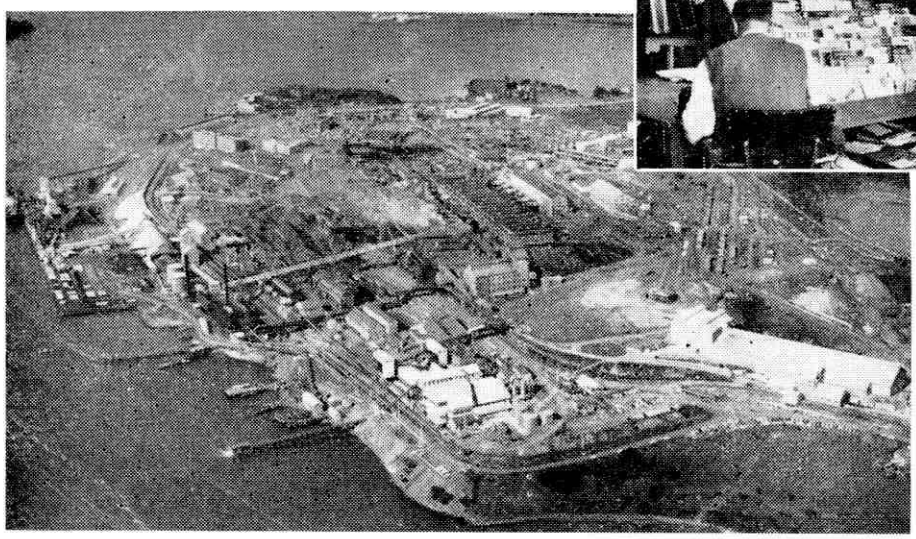

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SOME ASPECTS OF THE SNOWY MOUNTAINS SCHEME

By JOHN HUTCHINSON

INTRODUCTION

The Australian continent is a "wide brown land": it takes up nearly 3 million square miles of the driest land on the face of the earth. This is a "wilful lavish land" and her whims and fancies set a true challenge to her engineers.

In one of the most picturesque parts of the country this challenge is being met in a very important project: "The Snowy Mountains Scheme". In the mountainous south-east corner of New South Wales Australia's most reliable and largest water source is being harnessed, to help make the red earth productive, and bring light to the dark nights.

Where the "Man from Snowy River" rode between the ranges dotted with beautiful names like Jindabyne, Adaminaby, Munyang, Talbingo, and Tantangara, men have gathered from all over the world to investigate, design and build one of the seven wonders of the Modern World.

Only about one quarter of this vast, dry land received enough natural rain for any form of intensive primary production. Of this quarter, much is not suitable for agriculture because of its ruggedness. It can be seen, therefore, that we will be depending ever increasingly on irrigation schemes for our continued development.

Irrigation schemes depend on harnessing the water flowing down our rivers, and diverting it to the orchards, vineyards, and crops which supply our food. Australia's annual runoff (i.e., what gets into our rivers) is equivalent to only 1.3 inches of water spread over the whole continent. Compare this with a world average runoff of 9.7 inches per annum. Is it any wonder that a third of the continent is desert?

Not even the eastern and coastal regions of our country have really regular rains. The last 15 or 20 years have generally been years of plenty, but crops have still been lost occasionally and water restrictions have been applied frequently.

The snow falls around Kosciusko each winter make up a large source of water which we can tap.

Three main river systems rise in these snowfields. The two westward flowing systems are the Murray and Murrumbidgee Rivers, which flow through hundreds of miles or dry, but fertile land. Flowing to the south, through fertile, but well watered lands, the third major river, the Snowy, finds its way to the sea near Orbost on the eastern coast of Victoria.

The 2 million acre feet per annum of the waters of the Snowy rise high in the Alps and are thus very suitable for inland diversion to irrigation schemes and hydro-electric power stations.

It is fitting that up to this point, I have spoken only of the need for irrigation water as it was this which prompted early investigations in the Snowy Mountains area.

Not until Mr. C. E. Blomfield was examining proposals for sites for the Australian Capital Territory at the turn of the century, was attention drawn to the hydro-electric potential of the area. Considering that early proposals for diversion of the Snowy were made in 1884, it can be seen that Hydro-electric power was then only a second thought. Not so today.

The very rapid growth of Australia's secondary industry has doubled the per capita power consumption in the last 12 years. With coal burning power stations to handle the "base load", the developing of the hydro-electric potential of the Snowy Mountains has become an economic necessity. Hydro-electric power stations can be put "on line" in seconds, but coal burning stations may take 12 hours or more to build up steam. The peak load periods during the working day, can be well handled by hydro power stations, and it is to this end that development is being pressed ahead in the Australian Alps.

ESSENTIAL FEATURES OF THE SCHEME

Development in the Snowy area is based on two main sections—The Snowy Tumut development and the Snowy-Murray development. These two developments divert 1.1 million acre feet of water to the Murrumbidgee River system and .8 million acre feet to the Murray on the west of the main range from the Snowy River on the eastern side of the range.

The Central pondage, Lake Eucumbene, acts as the connecting link between these two sections.

As I have mentioned earlier, even the snowfalls in the Snowy are not consistent. This fact becomes comparatively unimportant in view of the storage capacity at Lake Eucumbene: 3.8 million acre feet—nine times the capacity of Sydney Harbour!

Lake Eucumbene, built on the Eucumbene River, stores water from the head waters of the Murrumbidgee; these are diverted to storage from Tantangara Dam through the Tantangara Eucumbene tunnel: as well as waters diverted to it through transmountain tunnels from the Tooma and Tumut Rivers. Waters from the Snowy are also diverted to Lake Eucumbene through the Snowy Eucumbene tunnel (broken through early June, 1964) for storage.

During the months in which snow is melting and swelling the rivers, excess volumes of water are sent to storage in Eucumbene. The remainder is used for power generation. During the dry months, water flow in the tunnels between Eucumbene and the Snowy River and Eucumbene and Tumut Pond Reservoir reverses and water flows out of Eucumbene to augment the river flows and thus generate sufficient peak load power.

In the Tumut River Valley two power stations T1 and T2 are already in operation, and investigations are well under way for a third power station with an installed capacity of 1,000 MW. Originally it was pro-

posed to build two more power stations in the Tumut River Valley, but now these two have been combined to give one much larger station. Investigations so far indicate that the Cumberland Reservoir, the storage dams for the third power station will have to be earth filled, not a concrete arch as was once hoped. Either way it will be a dam which is large by world standards —about 580 feet high.

At the lower end of the Tumut Valley is Blowering Reservoir. Work in this area was begun early in 1964. Blowering will be a low head reservoir, built to control the waters of the Tumut before they are finally released to flow westward through the Tumut and Murrumbidgee Rivers. A power station at Blowering is being considered. The projected 60 MW station is, I believe, under review, and consideration is being given to a pump generate scheme, of larger capacity. Such a scheme uses water during the peak load hours of the day to generate power and at night uses cheap off-peak power from the thermal power stations in other parts of the grid to pump water back into the dam above it from its tailwater storage, thus circulating the water before it is lost down stream for irrigation.

The Murray Snowy Development is best considered by starting at Island Bend Dam (nearing completion) and moving away from it in four different directions.

The Island Bend Dam is a small dam the only purpose of which is to divert water in either of two directions. Island Bend is on the Snowy River below Kosciusko, Gunthega (commissioned 1955) and Munyang Power Stations, and it diverts the waters of the Snowy either to storage in Eucumbene, or to generate power by falling through 2,600 feet into the Murray River valley on the western slopes of the Main Range.

Water from Island Bend generates power by going through the Snowy Geehi tunnel, to the Geehi Dam, where it is joined by waters from the Windy Creek power station and then enters the Murray 1 pressure tunnel to pass through Murray 1 power station under a head of 1,700 feet. It then goes down to Murray 2 power station, 900 feet below Murray 1, and from Murray 2 the water will go into Khancoban Pondage.

Thus we have considered three of the four directions by which we can move away from Island Bend Dam:

(1) The upper snowy works of Kosciusko—Guthega and Munyang.
(2) Diversion to storage through the Eucumbene Snowy tunnel.
(3) Diversion to the Murray Valley power statons, M1 and M2.

The fourth direction is from Jindabyne.

The Jindabyne Reservoir is on the Snowy River about five miles below its junction with the Eucumbene River, and about 700 feet below Island Bend Dam. From Jindabyne Reservoir water will be pumped up 700 feet to Island Bend, where it will join the other waters of the Snowy and fall 2,600 feet to generate much more power than will be required to pump it up the 700 feet.

Waters from the Murray Development are finally controlled by the Khancoban Pondage and then the Hume Weir, near Albury, N.S.W.

SOME DETAILS OF THE SCHEME

(a) Snowy Tumut Development

Eucumbene Dam is an earth and rockfill main wall 381 feet high, with small secondary wall, a short distance from the main wall. This dam was completed in 1958 and is now about half full. Its useful storage is 3.5 million acre feet (c.f. gross storage of 3.86 million acre feet). This dam is of such a size that it was thought unnecessary to provide any spillway: a natural saddle ten miles from the dam wall acts as a safeguard in extreme circumstances should they ever arise.

Three tunnels flow into Lake Eucumbene. The only one way tunnel is to the lake is the 10½ mile, 11 ft. diameter Tantangara Eucumbene Tunnel. It carries water from the upper Murrumbidgee catchment from Tantangara dam into Eucumbene.

From Lake Eucumbene runs the 14 mile, 21 ft. diameter Eucumbene-Tumut tunnel. This tunnel is designed for two-way flow as explained earlier, and ends at Tumut Pond Reservoir.

The situation can arise that the storage level in Lake Eucumbene is higher than that in Tumut Pond. Thus it may be impossible for Tumut River water in excess of immediate need to be sent to storage in Eucumbene because of this Happy Jack's Dam has been built at the junction of Happy Jack's and Tumut Rivers. This dam is 300 feet directly over the Tumut-Eucumbene tunnel. Just behind the small diversion dam is Junction Shaft which diverts the headwaters of the Tumut River system vertically down into the Tumut-Eucumbene tunnel. This water thus can be diverted to Lake Eucumbene by gravitation.

Water also comes to Tumut Pond from Tooma Dam. Tooma is a 220-foot high earth and rockfill dam with a free flow spillway with a capacity of 44,000 cusecs. The Tooma Tumut tunnel, nine miles long and 11 ft. in diameter has four vertical intake shafts from dams on creeks vertically above the tunnel. These intakes are of a self priming syphon type and vary in diversion capacity up to 400 cusecs.

Tumut Pond Reservoir is the beginning of the Tumut Valley power generation system. It is a 280 ft. high concrete arch dam with enough capacity for about five days' operation of T1 and T2 power stations.

T1 is an underground power station operating at an average head of more than 1,000 ft. Its installed capacity is 320,000 KW from four Francis turbines.

From T1 water discharges into T2 Pondage, the headwaters of the second power station in the Tumut Valley. Both T2 and T1 have the same flow at peak output (7,200 cusecs), the smaller output of T2 (280,000 KW) being due to a lower operating head. Should T1 go out of operation the river gates on Tumut Pond are designed to pass 7,200 cusecs so that T2 Pondage level may be maintained while T2 continues operation.

T1 and T2 both generate at 12.5 KW and step up voltage to 330 KV in the power station transformers. From each of these power stations 330 KV transmission lines go to Upper Tumut Group Control Centre where connection is made to the grids of N.S.W. and Victoria.

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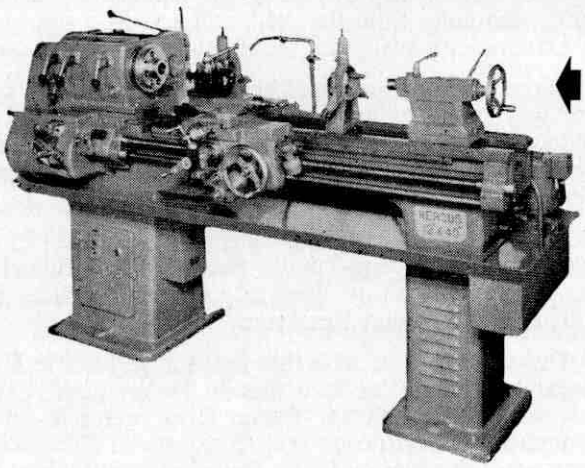

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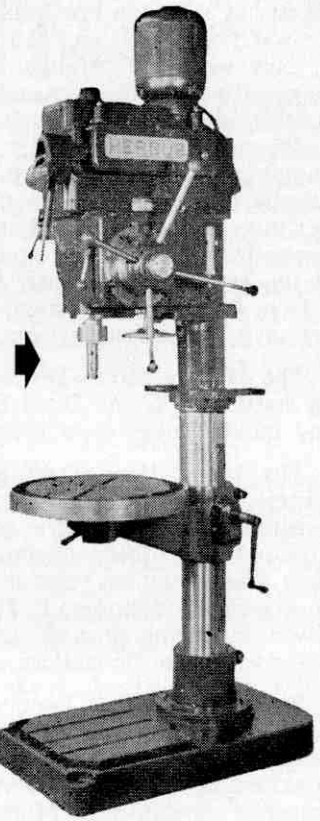

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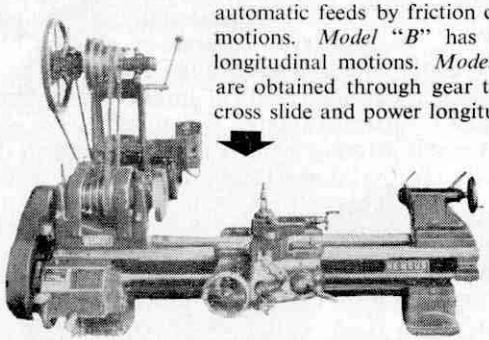

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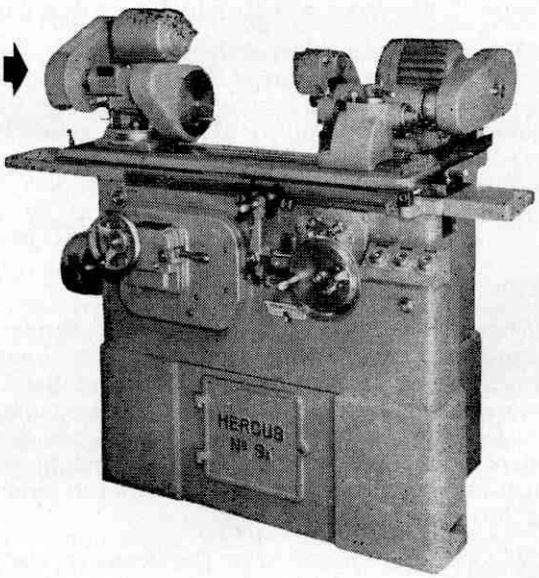

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U.T.G.C.C., situated three miles from Cabramurra, is the control centre for the upper Tumut region. Duplicate controls exist in the power stations, but these are for emergency use only.

The nearby township of Cabramurra was established as the works centre for the Upper Tumut region. Now with a much smaller population than the peak of over 4,000, Cabramurra remains as a small permanent town for maintenance and operations staff. It is the highest permanent township in Australia, 4,800 feet above sea level, and is snow bound for many months of the year.

(b) Snowy Murray Development

In contrast to Cabramurra, Khancoban works centre for the present Snowy-Murray development, is in the Swampy Plain River Valley, only 1,000 feet above sea level.

Khancoban is a township with a population over 3,000 and instead of snow it has a beautiful swimming hole which is dependent on "Coldwater" Creek for its water, and lives up to its name.

A few miles out of Khancoban at almost the same altitude is the Murray 2 Power station site. Here work has only just begun. The S.M.A. has completed excavations for the power station and the pressure pipeline bench, and now the area is being left for a few months before contractors move in. Nearly 1,000 feet higher than Khancoban, and several miles into the mountains on Khancoban Back Creek is the Murray 2 power station site. Work is well advanced on the 950 MW M2 power station and by now the S.M.A. electrical and mechanical branch personnel have started to install the first of the ten vertical axis Francis turbines in this station. This is typical of all contracts—S.M.A. does all its own installation of machinery, and most of the site preparation where soil conservation measures are to be taken.

The few details I have chosen to mention are indicative of the general nature of the scheme. Its vastness is shown by the volumes of detail which have previously been published.

CONCLUSION

The work of this massive scheme (£400 million) is being designed and supervised by the Snowy Mountains Authority. Established in 1949, the Authority is an entity unto itself, not like any other government department.

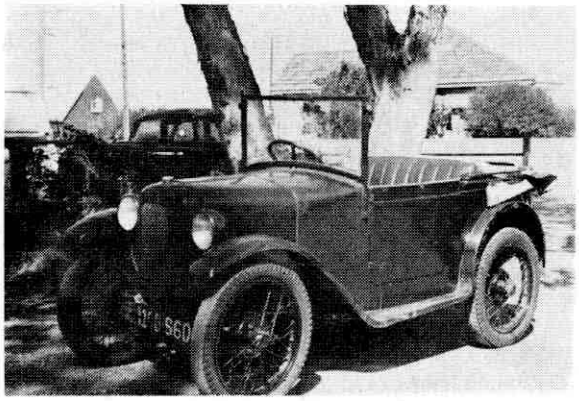
Organised in groups and divisions covering all facets of the scheme; this matter is properly the subject of an entire paper, and shall not be discussed here.

It is also important to point out that investigation, experimentation, re-thinking and experience have been continuously modifying the scheme. One of the results of this, and a very significant result is that in 1953 the estimated cost of diverting 2 million acre of feet of water an installed capacity of 2.7 million KW was £378 million and in 1961 an estimate of costs to achieve the same result was £374 million in spite of eight years' upward change in the economy's price cost structure.

Also the 1949 estimate installed power capacity was about 3 million KW whereas the estimated output now is somewhere near 4 million KW (this increase is largely due to the introduction of several pump-generate stations). Simultaneously the estimated capital cost per KW installed has dropped considerably. This "ear to the ground" attitude by the S.M.A. has led to several radical changes from conventional methods of design and construction all with a view to meeting the demands of a rapidly growing nation, in a country which presents its engineers with a really challenging future.

THE VINTAGE MOTOR CAR

By IAN POLSON



THE AUSTIN 7

"A vintage car is one manufactured between 1918 and 1931 and containing such features of design and construction as to make it superior to a normal mass produced motor vehicle." This was the definition of a vintage car which was written into the constitution of the Vintage Sports Car Club of Australia, when it was founded in 1944. To a large extent, this definition is still valid, although the word "superior" is a source of many arguments.

The vintage car was a product of its time, benefiting technically from the manufacturers' aero engine experiences during the first world war and being manufactured by a much larger proportion of skilled labour than is usual today. This was because such labour was still cheap and plentiful. Another feature of this era was that there was a greater market for expensive and very expensive cars. An example of this is the Leyland 8. Mr. J. G. Parry Thomas, the Chief Engineer of Leyland's was instructed to design a perfect car, regardless of cost. The finished product was exhibited at the Olympia Motor Show in 1921 with a chassis price of £1,875, the price of a complete car being £2,700 Conservative translations of these prices to present day figures would be £A12,000 and £A16,000 respectively. Cars of similar quality (and price) were built by Napier and Lanchester in England, Hispano Suiza in France, and Isotta Fraschini in Italy, among others. Although not quite as expensive as the luxury cars listed above the sports cars of this era were also technically interesting and very well made. Several

U.T.G.C.C., situated three miles from Cabramurra, is the control centre for the upper Tumut region. Duplicate controls exist in the power stations, but these are for emergency use only.

The nearby township of Cabramurra was established as the works centre for the Upper Tumut region. Now with a much smaller population than the peak of over 4,000, Cabramurra remains as a small permanent town for maintenance and operations staff. It is the highest permanent township in Australia, 4,800 feet above sea level, and is snow bound for many months of the year.

(b) Snowy Murray Development

In contrast to Cabramurra, Khancoban works centre for the present Snowy-Murray development, is in the Swampy Plain River Valley, only 1,000 feet above sea level.

Khancoban is a township with a population over 3,000 and instead of snow it has a beautiful swimming hole which is dependent on "Coldwater" Creek for its water, and lives up to its name.

A few miles out of Khancoban at almost the same altitude is the Murray 2 Power station site. Here work has only just begun. The S.M.A. has completed excavations for the power station and the pressure pipeline bench, and now the area is being left for a few months before contractors move in. Nearly 1,000 feet higher than Khancoban, and several miles into the mountains on Khancoban Back Creek is the Murray 2 power station site. Work is well advanced on the 950 MW M2 power station and by now the S.M.A. electrical and mechanical branch personnel have started to install the first of the ten vertical axis Francis turbines in this station. This is typical of all contracts—S.M.A. does all its own installation of machinery, and most of the site preparation where soil conservation measures are to be taken.

The few details I have chosen to mention are indicative of the general nature of the scheme. Its vastness is shown by the volumes of detail which have previously been published.

CONCLUSION

The work of this massive scheme (£400 million) is being designed and supervised by the Snowy Mountains Authority. Established in 1949, the Authority is an entity unto itself, not like any other government department.

Organised in groups and divisions covering all facets of the scheme; this matter is properly the subject of an entire paper, and shall not be discussed here.

It is also important to point out that investigation, experimentation, re-thinking and experience have been continuously modifying the scheme. One of the results of this, and a very significant result is that in 1953 the estimated cost of diverting 2 million acre of feet of water an installed capacity of 2.7 million KW was £378 million and in 1961 an estimate of costs to achieve the same result was £374 million in spite of eight years' upward change in the economy's price cost structure.

Also the 1949 estimate installed power capacity was about 3 million KW whereas the estimated output now is somewhere near 4 million KW (this increase is largely due to the introduction of several pump-generate stations). Simultaneously the estimated capital cost per KW installed has dropped considerably. This "ear to the ground" attitude by the S.M.A. has led to several radical changes from conventional methods of design and construction all with a view to meeting the demands of a rapidly growing nation, in a country which presents its engineers with a really challenging future.

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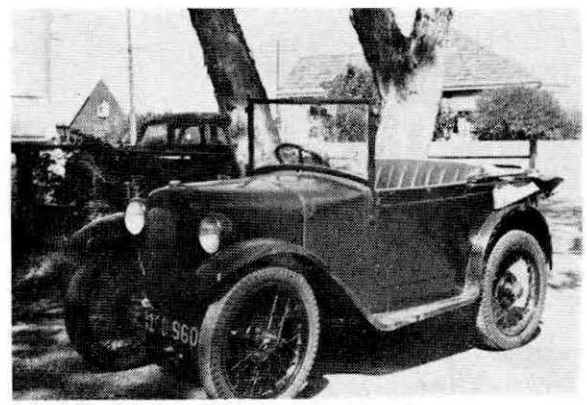

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manufacturers, including Bentley, Vauxhall, Bugatti, and Sunbeam, produced cars capable of approaching or exceeding 100 m.p.h. As these cars were highly geared and fitted with large slow revving engines they were extremely pleasant to drive and very durable.

The most significant cause of the demise of the vintage car was the depression, which eliminated the market for luxury and sports cars and forced European manufacturers to adopt mass production techniques. These methods had been developed in the U.S.A. where skilled labour had always been expensive. The change in character of the cars produced after 1930 was so significant that the first club to cater for vintage car owners, "The Vintage Sports Car Club of Great Britain", was founded in 1934, when the youngest vintage cars were only four years old.

I will devote the remainder of this article to vintage cars with which I have had personal experience.

I first became interested in vintage cars after reading an account of Bentleys racing in 1928 at Le Mans, which was contained in an extract from Sir H. R. S. Birkin's book, "Full Throttle". I was about 10 years old at the time and four years later I acquired my first car, a 1926 Humber 9. My next two years motoring were my most economical ever, as I could not use the car at all. After I obtained my licence I used the car for six months and it had only two faults:

(a) It was the middle of winter and the car had no hood.

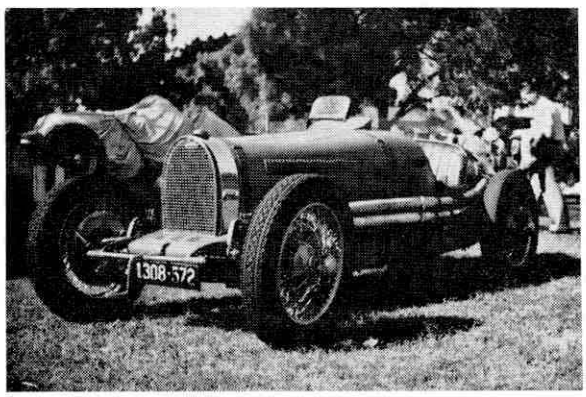
(b) I had replaced the bottom of the petrol tank which had rusted out, and rust flakes caused petrol blockages every few miles, which meant disconnecting and blowing through the fuel lines.

This Humber was followed by four others, two of which were used, the other two eventually being wrecked. I then came across a 1926 14/40 Sunbeam which was in very nice condition. It was a pleasant car to drive, with very light and precise steering but was sold to provide funds for a new suit—very sad. Other cars which I owned around this time but did not use because of insufficient money included an A.C. and a Minerva which had sleeve valves. In 1961 I bought the 1928 Austin 7 which has provided me with economical transport ever since. Among other things this car has been driven to Renmark and back, driven across the Torrens Weir (and back), driven right to the top of Mount Barker (i.e. adjacent to the trig. point) and competed in trials, sprints, rallies etc.

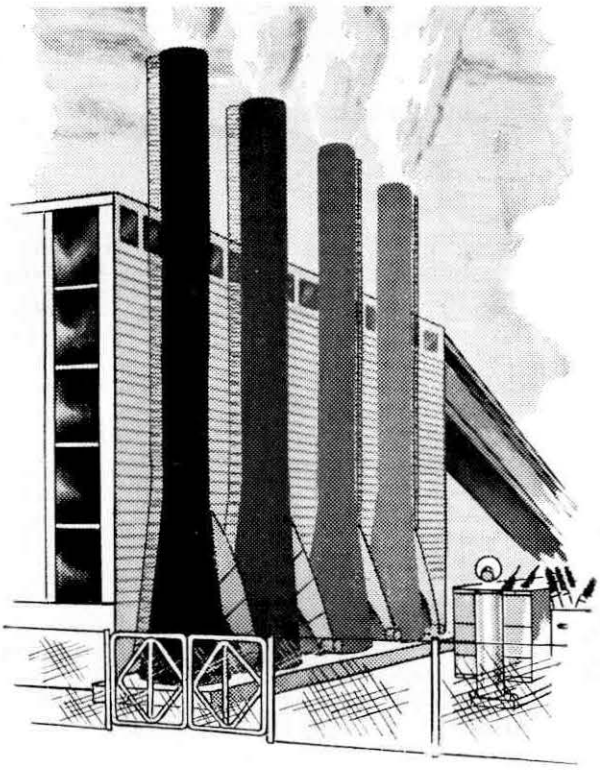
In 1960 I obtained my first 12/50 Alvis and I have since had two others. These are a straightforward vintage sports car of 1½ litres with overhead valves. They are rather nicely made and are capable of 75-80 m.p.h. and 35 m.p.g. One of these has also been used for trials and hillclimbs. Early last year I was offered a loan of a 1930 Frazer Nash to drive to Victor Harbour for a rally. The offer was immediately accepted and turned out to be great fun, as the car was very lively and was capable of cruising effortlessly at 65-70 m.p.h. These Frazer Nash's featured a unique transmission system using four chains running between a transverse countershaft and the solid back axle. The drive sprockets were individually clutched to the countershaft and each gave a different gear ratio.

Other interesting cars which have been borrowed from time to time include two 30/98 Vauxhalls, one in Adelaide, the other in Sydney. Last May I had my first ride in a Grand Prix Bugatti. This was the actual car which won the 1929 Australian Grand Prix and its performance was most impressive.

At present I am slowly rebuilding an Alvis and I have another stored away in pieces, the Austin still providing transport. In recent years I have found that lectures, tutorials, exams etc. interfere with my rebuilding programme which is rather annoying.



A GRAND PRIX BUGATTI



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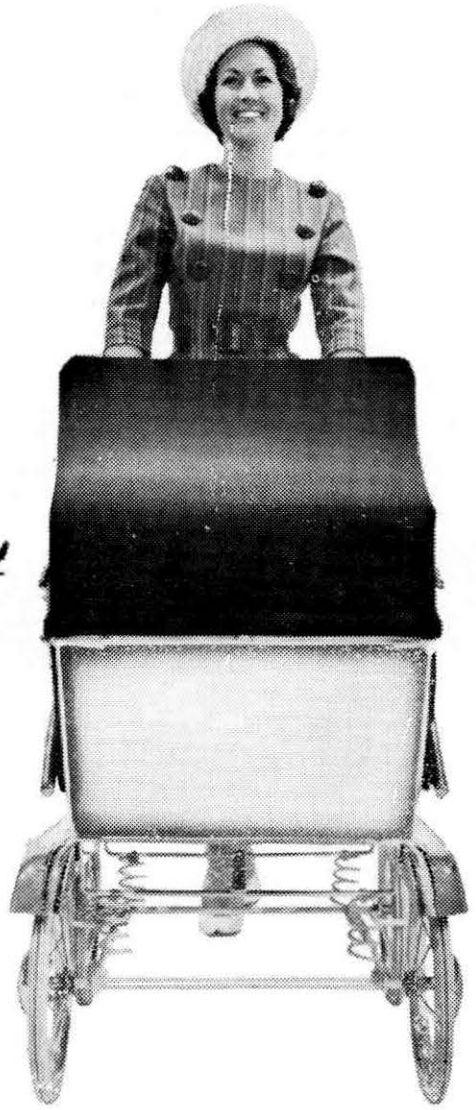

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'64 SYMPOSIUM REPORT

This year the E.F.B. Symposium was held in Adelaide for the first time since 1958. For those not of pure (engineering) blood, most reputable dictionaries will define a symposium as being something along the lines of "a drinking party, a merry feast, a collection of papers on the one subject"—and so the committee set out to achieve these three objects (plus female company) as best it could.

The theme chosen (during a moment of true inspiration) emerged as "The Development of Northern Australia". This proved to be most appropriate and opportune as the daily papers gave this subject a terrific build up in the weeks immediately preceding the symposium. No effort or expense was spared in the search for experts to speak on this topic, and there was general agreement that Adelaide had the best line-up of speakers ever presented for a symposium.

After last year's successful raid on Sydney, about 160 students from all States began arriving in Adelaide on Sunday. There was the story of ten bearded and bleary-eyed Melbourne engineers pulling the director out of bed at 10.00 a.m. on Sunday morning, and asking directions to a non-existent flat.

All visitors managed to turn up at the Chapman Theatre on Monday morning to hear of the week's doings and also to pay for such (much to the relief of the local treasurer). This proved to be a relatively quick and painless operation, after which most grabbed the opportunity to sample the local ale for the first time. Came 2.15 p.m. and Union Hall was well patronised for the Official Opening by Sir William Spooner, Minister for National Development. Sir William took us over a broad survey of current and future development in the north, advocating the necessity for steady and planned expansion. This was followed by a most enjoyable sherry party for speakers, chairman and representatives, from other unis., who were fortunate enough to receive the hot word during the morning scramble.

Tuesday dawned bright and sunny and there was an enormous attendance for the morning lecture by Mr. H. E. Hunt from the Public Works Department of W.A. This proved to be a most interesting and informative paper on the Ord River Scheme, well supported by slides and a colour film which showed clearly what had been achieved and what was being attempted. Our special thanks to Mr. Hunt for filling in at such short notice.

In the afternoon, Mr. R. W. Turnbull, from the P.M.G. Department, Melbourne, talked on telecommunication development in the north. This was again well supported by slides plus a wonderfully produced booklet on the subject. We were most honoured that Mr. Turnbull should have gone to such lengths on our behalf. Mr. Turnbull attended every lecture during the symposium and our special thanks to him for showing such a great interest.

Considering the activities of the two previous nights, the attendance was amazingly good to hear Mr. C. Stewart from C.S.I.R.O., Canberra, speak on agricultural prospects in northern Australia. He mentioned reasons for failure at various places e.g., Humpty Doo, but again, as did all our speakers, showed that there was considerable optimism for the future in proper, well-planned development, such as that taking place on the Ord River. It is vital that there be sufficient research and field trials before any new large scale agricultural development is attempted in the north was one of the main points that he emphasized.

The next lecture was on Thursday morning. Although the casual on the previous night was our one "dry" show, there seemed to be no lack of "wet" parties to finish off the night at various flats around the suburbs. However it was again surprising and gratifying to see another very good attendance to hear Professor Rudd of Adelaide speaking on our mineral wealth. Anyone listening to this paper could not help but be impressed by the effect that huge mineral discoveries and discovery of oil and gas will have, and is having, on the development of this region. There seems no doubt that northern Australia is still one of the great mineral resources of the world.

The final paper, on Thursday afternoon, was presented by Sir Archibald Grenfell Price and concerned the history and problems of New Guinea. This proved to be a most interesting and challenging address as the future of New Guinea is of importance to us all. Although we are handling a long and difficult job in a competent manner, it seems only a matter of time before increased pressure is brought on us to give New Guinea independence. Can we yet do enough in time? Anyway, Sir Archibald was able to answer one question for us "What to do with women who are too hot?" His solution? Race them up into the hills to cool them off!

Having read through this impressive list of speakers and subjects, let us hasten to assure you that as "All work and no play makes Jack a dull boy,"—there was at least an evening up process taking place each night.

On Monday night, the Smoke Social enabled everyone to meet each other over a tankard, a smoke or a song, or in most cases over all three. Due to noise and a lack of light, only more or less unofficial boat races were held, but it is the writer's duty to record that Queensland proved to be the champions, due mainly to some queer method of upending glasses on one's head, a new trick that requires undue concentration considering the consumption by that time. One hundred and eight gallons for the night—i.e., a good show.

Tuesday was a great night. Women arrived by car, foot, taxi and bus—and the guys were moving well. "How about a dance?", "A beer?", "Chop or sausage?", "Another dance?" What a night! What a combination! A few hardier souls even tried a lap of the pool. Perhaps they felt frustrated, although there seemed to be some unwilling bods who eventually ended in the drink. Ah well, a good start with the birds.

Educational trips were the order for Wednesday afternoon. Three busloads saw G.M.H.'s assembly plant at Elizabeth and what an eye opener that turned

out to be. The Philips' factory at Hendon was no less interesting and the few hardy souls who visited the Brewing Company were still (just) capable of walking away afterwards.

Wednesday night was the Casual Dance in the Uni. Refectory. A new batch of women were provided and fellows who missed out the previous night were invited to try again. At one stage, there was an excess of women and a few were seen stalking out the door. Another great night!

The Symposium Ball was on Thursday night and proved a fitting finale to the previous nights. Free beer, supper, two floorshows and a good band. During one floorshow, featuring some scantily clad young ladies, it wast most gratifying to see S.C.I.I.A.E.S. still taking an interest in the never ending fight for purity. For those interested, it was decided sometime during the night, or that week anyway, that next year's target for mass destruction will be Melbourne. Anyway, the Ball was another great show.

Friday—ah, that was a day! Three buses from Lincoln and one from Aquinas set off for the Barossa Valley after the fellers managed to drag each other out of bed. It was a fine day, the sun was shining, engineers were singing—and the object of all their happiness—Gramp's Orlando Winery. When we arrived we were split into small groups and shown over the entire operation, most interesting too. Then—and then—came lunch and we were invited to sample the stuff. "If you want any more wine, just ask" he said, and we did.

Dry sherry, and another, and another (m-m-m, not bad!), and another, fish (just in time you say), Starwine, again, chicken and potato salad, Barossa Pearl, peaches and icecream, more Barossa Pearl? Certainly. Enough to make your head swim? It was. It did. Each of us was given a free bottle of brandy in a decorative bottle to take with us. Some tried it on the way home—the bus stopped for them. A great way to finish a Symposium and our special thanks to Gramp's for putting on such a fine show.

This about ends this brief account of events. There were several parties on Friday night, not the least being the one in the "scrungy flat" at Glenelg to which the Society donated an eighteen. This was really hitting the high spots when there was a rude knock on the door and the men in black requested the party to break up. In answer to the question of what would happen if we didn't leave, came the reply "Then, I'll have to put yee in the joog, lad!", at which time Bill thought perhaps it was time to leave, too.

SOCIAL

No matter the State, the weather or the topic, each Symposium is best remembered in later years for its social activities and acquaintances made. This year was no exception, for Geoff Marlow and his committee made every post a winner in their programme. Evidence of careful planning and foresight was obvious—there was never a lack of suitable refreshments.

The show started with a smoko under the stands at Memorial Drive. Sufficient is to say that nine kegs and thirty-four light sockets were emptied in under four hours. Yet the main event was still to come. The barbecue at Maccabi was scheduled as a "dry" night but, unperturbed, Melbourne ploughed through seven kegs, the swimming pool and two plate glass windows.

It was now evident that grog was to be the source of all evil, so a sedate Casual Dance was planned for Wednesday in the Wills Refectory. This succeeded, with Melbourne at last realizing some other pleasures of life.

Finally came the Ball, convened this year by Roger Humphreys. After hours of cajoling he obtained a licence, breaking the established "dry" for the first time in years. Even then 12 o'clock closing did not suit our interstate guests. The Ball itself was a superb success—the rather archaic surrounds were highlighted by topical (?) posters, while subtle use of lighting really transformed the atmosphere. The Palais Executive provided pleasant music, while the floorshows were appropriately enticing and enjoyable.

Thus it was a rather quiet collection of individuals who boarded buses at 10.00 a.m. on Friday for the trip to Orlando winery. What a touch of genius this trip was! Imagine the effect of 500,000 gallons of wine on our spirits. Having acquired a thirst we were presented with an excellent chicken dinner and wine sampling (?) The trip back remained merely a memory of numerous stops.

Thus ended the Symposium, a roaring success for all who attended, even if their memories are somewhat hazy. I hope this refreshes them slightly.

In Soho the other evening, a night-club dancer's costume caught fire.

Fortunately, somebody had the presence of mind to put it out with a small glass of sherry.

★ ★ ★ ★

A policeman saw a small boy crying and asked: "What's up, son?"

The kid said: "My Dad's over there fighting with another man."

"And which is your Dad?" the cop asked.

"Dunno," the kid said, "that's what they're trying to settle."

★ ★ ★ ★

FURNITURE SALESMAN: "I understand you're interested in 'period' furniture?"

NEW BRIDE: "Yes, we shall need a period of at least three years to pay for it!"

★ ★ ★ ★

YOUNG BRIDE, bursting into tears: "You rotter, Fred—I spend hours and hours slaving over our first meal, and all you can do is sit there and eat it.!"

1964 ENGINEERING SYMPOSIUM

OPENING CEREMONY AND FIRST PAPER

MR. G. MARLOW, Symposium Director:

Mr. Chairman, Sir William, Distinguished Guests, Ladies and Gentlemen . . .

It is my pleasure to welcome you on behalf of the Adelaide University Engineering Society to the 1964 Engineering Symposium. Our theme is "The Development of Northern Australia". We feel that this subject is of vital importance to our country at this stage of its development.

At this time, there is a great deal of public interest in the North due largely to current events and the amount of publicity given this subject over the past few months. We have been fortunate to obtain for the symposium today, and over the next few days, men who are leaders in their field and who will be able to give us an insight into the requirements for developing our North. I desire to thank these gentlemen for giving up their time to come here and address us. There has been one unavoidable alteration to the programme which I should mention now; Mr. Munro from Western Australia, who was to have spoken tomorrow morning, has been unable to come at the last moment, but has kindly arranged for Mr. Hunt to come in his stead. Mr. Hunt was in charge of the Ord River Dam project, and so his paper will be on essentially the same subject as Mr. Munro was to have covered.

I would like to thank in particular those firms which have helped us financially with this symposium. As you no doubt realise, a meeting of this kind involves a large outlay and we have attempted to keep the cost to you chaps as low as possible. Our endeavours in this regard have been successful due to the generosity of the following firms:

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If any representatives of these companies are here today, we say "thank you" to you personally.

MR. FARRENT (Dean of the Faculty of Engineering)

Sir William, Distinguished Guests, Ladies and Gentlemen . . .

As I see my task here this afternoon, it is four fold. First of all to thank the Engineering Symposium Committee and the Engineering Society for asking me to take charge of this opening ceremony.

Secondly, on behalf of the University of Adelaide we extend a very warm welcome to each of you to this Symposium. We are proud of our University and we like to think it is close to the community life of our state, and we like to think too, that it is a place to which people from interstate can come and hold conferences and we welcome you most heartily.

The third part of my task as I conceive it, is just briefly to outline the reasons and the origins of this Symposium. It dates back to 1896 when a newsletter circulated among the Engineering Societies of the Universities of several of the States, asked for a conference which was held, I think, in December of that year. At that conference some resolutions were taken, several of them which are of interest. The main one which is of interest to us today is, that there should be held an Annual Symposium—the first Symposium was held in 1957 at Sydney on the subject of automation. The next year it was held here in Adelaide and the subject was "Engineer, Man of Destiny" and a little booklet was published giving a precis of the talks of that Symposium. Other Symposia have been held in the seven States of the Commonwealth, including such subjects as "Space", "The New Orbit in Engineering" and on Antartica.

In 1958 the Premier of South Australia at that time (and there are no prizes for guessing his name, I'll give you one clue—he was an apple grower) helped us by opening the Symposium. This year we have turned to the Federal Government, and Sir William Spooner has kindly consented to come along to open the Symposium for us.

In 1958, eighty attended; this year there have been one hundred and eighty registrations from interstate, it doesn't look as though everybody has come. Possibly there have been floods between here and Perth or here and Melbourne or somewhere and held some up. In 1958, of the papers given (there were ten of them) there were nine by Engineers and one by a Psychologist; this year besides the opening address which Sir William will give us, there will be two and a half by Engineers and two and a half by Scientists. Now you no doubt will wonder where you get half an Engineer from; I don't see Professor Rudd here today, but I count him as half an Engineer and he is Professor of Economic Geology and I think he has a foot in each camp. He is consultant to the Snowy Mountains authorities as well, so I say that two and a half Engineers and two and a half Scientists will speak to you. That shows the change in thought, nine Engineers and one Psychologist, changes to two and a half Engineers and two and a half Scientists.

My fourth duty is to introduce our guest speaker for today, Sir William Spooner. Sir William was born in December 1897, and he commenced his education at Christchurch School in Sydney. In 1915 he enlisted with the 15th A.I.F. and served with the 15th Australian Field Ambulance; He gained the distinction of the Military Medal and 1918 he changed to the Australian

Flying Corps and was promoted to Lieutenant, which I understand was the rank he retained when he was discharged in 1919. He has taken the diploma in Economics and Commerce at Sydney University and he is a Fellow (most of our Professors are imported and I usually introduce them by saying they've been educated in Adelaide). He is a Fellow also of the Institute of Chartered Accountants, in his business he is a member of the firm of Spooner & Co. who are Chartered Accountants in Sydney. He entered Politics in 1949, being elected Senator for N.S.W. and was re-elected in 1951, 1955, 1961 and 1963. In December 1949, therefore soon after his election, he was made Minister for Social Services; in May 1951, Minister for National Development and Member of the Council of Defence; in November/December 1952, he attended a Commonwealth Financial and Economic Conference in London and in September 1954, was made Acting Minister for Trade and Customs, and in 1956 became Commissioner of the River Murray Commission, and here I might add, that he is touching Engineering very closely, because that highly respected body in my opinion, pre-dates the renown Tennessee Valley Authority by many years.

In October of 1956 he was made Deputy Leader of the Government for the Senate and in 1958 he was made Vice-President of the Deputy Council. February 1959, he was made Leader of Government in Senate and Member of the Senate Standing Orders Committee, Member of the Australian Delegation to Commonwealth Association Conference in Canberra. In January-July 1960, he visited Japan, United Kingdom, France, United States and Canada for discussions on Atomic Engineering, and in December 1962, was Acting Prime Minister while the Prime Minister was abroad. In 1963 he was made Minister for National Development again and Leader of the Government in the Senate. The Queen included him in the New Year Honour Lists 1963, and he was made a Knight Commander of the Most Distinguished Order of St. Michael and St. George.

In view of all these activities gentlemen, you will wonder what he did for recreation, well, it was golf, and he is a member of the Manly Golf Club and others besides.

I have introduced to you our speaker today, I think it only fair sir, that I introduce to you some of the audience. Sir, these people have joined together and have come from every State in the Commonwealth to hear you, and I submit sir, that in the field of National Development you have is here Par Excellence.

Ladies and Gentlemen, I introduce Sir William Spooner and ask him to open the Conference.

SENATOR SIR WILLIAM SPOONER

Mr. Chairman, Mr. Marlow, Ladies and Gentlemen . . .

I start, Mr. Chairman, by thanking you very much for your welcome. Only one complaint I have, you read out the list of all my experiences which I'm afraid is likely to encourage in the audience a hope that I'm going to deliver a far better speech than I really am, still, I'll do my best.

I was very glad to receive the invitation to talk at the opening of this Symposium through my Parliamentary colleague, Senator Clive Hannaford. He made such strong representations that I couldn't say no, but I think Mr. Chairman that it goes beyond the line of duty when he attends this afternoon to listen to me, because it is his misfortune to have to listen to me so often while the Senate is sitting.

I thought what I'd take for my theme is in many ways a layman's description of the engineering work that's now in operation and what is in prospect in the North of Australia, thinking that that might be of interest to an audience such as this. I've got no doubts upon the point that there is a great volume of professional work for the engineering profession in the north of Australia, not only now, but for many years to come. What's really happened in the north of Australia over the last decade has been the unearthing or discovery of a very great, basic natural resources, which have only been unearthed or discovered quite of recent years. A very large construction programme, some of which I'll outline, already commenced, other large ones in contemplation and indeed, one of the great problems of developing northern Australia is to obtain sufficient professional men to supply its needs. We are fortunate we've got a good number of professional people dedicated to northern development. May I introduce a commercial Mr. Chairman by saying that I hope that this symposium will result in more younger professional men becoming interested in this tremendous task.

Never before in the Australian history has the challenge to develop northern Australia been felt so strongly because it's only in recent years that we've become truly conscious of the great contrast there is between the great development in the more densely populated parts of Australia, and the relative emptiness of the north. We are a fortunate people, we've obtained a rate of economic growth and a standard of living that ranks among the highest in the world, and in reaching this stage we've come nationally to appreciate what can be done by the application of skill, by the application of capital enterprise, provided the basic resources are present, you will find me coming back to that point if I stick to my notes throughout what I've got to say.

In the southern parts of Australia the basic resources were readily discovered, fairly rapidly developed and the experience we've gained in southern Australia in agriculture, in mining, in secondary industry, we're only just now beginning to apply these different techniques in the areas north.

We've had dramatic developments, prospective doubling of the already large sugar industry, great expansion of beef cattle production, most exciting new mineral discoveries; these again are the first fruits of the research and survey work that's been carried out; and these no doubt are figures that are familiar to you all, but one always feels the need to throw them in to present the picture. When we talk of the north of Australia, we talk of no less than well over one million square miles, we talk of no less than forty per cent. of the total area of Australia laying north of the Tropic of Capricorn, we're talking in terms of more than half of Queensland, over one-third of Western Australia

and eighty per cent. of the Northern Territory, all that is what we include in the term North Australia. We come into the situation that constitutionally it's divided between the Queensland Government, the Western Australian Government and the Northern Territory Administration. The world keeps moving on throughout the whole story of the north.

The Commonwealth has always made an important contribution under the normal constitutional activities of the P.O., Civil Aviation, health, C.S.I.R.O. and all normal Commonwealth Departments; but then over this last decade has been this most interesting development of the Commonwealth stepping in increasingly in programmes of basic research, of exploration programmes, or special work in mining, in cattle, in agriculture and in particularly, in water resources, so that you've got a situation that basically is in the hands of State Governments, you've got a rend of the Commonwealth Departments going about their lawful occasions, and you find with the development of C.S.I.R.O., with the development of the Bureau of Mineral Resources, the Bureau of Agricultural Economics, and continuing trend of research work on the part of these Commonwealth activities, and that has lead almost inevitably to the next stage which we are now commencing, and that is the Commonwealth Government providing substantial sums of money for specific developmental projects in northern Australia helps very largely at meeting the great national need to expanding Australian export income.

And all this is building up a picture, in 1961 there were in total only 379,000 people excluding full blood aboriginals, we have 379,000 out of our then population of ten and a half million odd in the tropics, but between 1947 and the next period of 1961, the population grew by no less than 108,000 over forty-one per cent., we had a forty-one per cent. increase in tropical Australia and this shows the progress they made, this of Australia and we have always got to remember this, only compares with thirty-nine per cent. in other parts that the north of Australia is predominantly a rural area, and as this audience should know, I hope, that in rural areas throughout Australia the trend is towards lower populations, smaller populations.

In 1824 before the first permanent settlement in Western Australia, South Australia and Victoria, Port Dundas was abandoned, we went to Port Essington, that was abandoned, then it wasn't until Darwin which was then called Palmerston, was established in 1868, that we really put down the foundation which has remained. We almost always learn lessons from experience. Over this one hundred year development programme of northern development there have been many failures, due to the lack of appreciation of the difference between the natural environment of the north and the south. Failures due to ventures being commenced without sufficient capital resources, failure to take into account all the great problems that come from isolation, particularly before the days of modern transport. Much of the area is arid over the large part, and in that which is not arid the rainfall comes entirely within the three months period. Daytime temperatures are high, a high rate of evaporation, a great difficulty with dealing with water resources, an inhospitable coast where the engineering skills are really needed to provide port facilities, because of the contrast between the tremendously high tide and long sandy ridges.

The land of great contrast; there are many, many areas in the north where soils are fertile, where water is available, which are undoubtedly going to be areas of close settlement in the future. It is only within the last decade that we've realised the mineral riches of the north. The north of Australia is known by the accepted standards as one of the great mineral provinces of the world.

When you look at it realistically and you try to look in the future, into the immediate future of the north, the development will continue to be based on beef raising and mining. If you live one side, that rich part of the north-eastern coast where sugar cane plays such an important part, without doubt the closest settlement is going to fully develop the water resources. This is one interesting point which has yet to be determined, and which is going to have a most profound effect on northern development.

Up to this stage, no fossil fuel deposits have been discovered. My view is, the geological conditions don't favour the possibilities of fossil fuel deposits; this doesn't again apply to the eastern coast of Queensland where we have good and rich coal deposits as far north as even Collinsville. As those who are interested in Mt. Isa know only too well, Collinsville is a long way from the areas in which there is a big demand for power, and the way we stand at present is that we know that the north of Australia contains some of the best mineral deposits in Australia, and we lack the fuel by which these mineral deposits can be economically smelted.

The point I want to make is, that this could change so dramatically, because I believe that we're just on the threshold of important developments during which nuclear power will become available, and of course, it is going to give very great advantages indeed to these mineral deposits. With nuclear power, the minerals could be extracted, refined and smelted right on the mineral deposit, with the result of economic advantages. There again, recent work indicates the possibilities of deposits of natural gas. We're only just turning over the pages of mining history in Australia. The natural gas in S.A., and only over this weekend, the natural gas just out of Perth opens up a vista that I think this generation of Australians hasn't yet got the experience to openly envisage the uses that are going to be made of it, and the changes that are going to occur in the Australian economy, if or when we get, nuclear power, because as far as nuclear power is concerned it is only a case of when, not if. When we get nuclear power at economic costs, and when we get natural gas in the north, then we have a completely different picture altogether of northern Australia. Let me illustrate it by giving a few facts and figures about minerals in the north; we are already in the north of this Tropic of Capricorn in a scale production for copper, lead, zinc oxide, iron ore, manganese ore, coal, gold, tin, and asbestos. Each of these enterprises showing strong developing growth, the most remarkable being Mt. Isa, a major copper producer as well as lead zinc; Production of 38,500 tons in 1958, 70,000 tons five years later in 1963, and 100,000 tons two years later in

1966/7, a programme by one company alone. It is going to cost no less than sixty-four million pounds, of which forty-two million pounds has already been invested.

Needing a Mt. Isa-Townsville railway, the thirty million pound railway construction programme is being financed two-thirds by the Commonwealth and one-third by the State Government. Practically the whole of this Mt. Isa development is leading to increased export income to Australia of the order of ten million pounds a year; Yampe Sound, seventy-four million tons of high grade iron ore; Cockatoo Island with a recent development programme completed; Coolen Island going into production this year up in Yampe Sound after seven million pounds expenditure. I think it's as well, maybe a little prosaic, maybe a little dull to reel off facts and figures like this, but I think it's as well for an audience such as this to try to get this picture of what's happening in mining in northern Australia.

Measured and indicated reserves of first class coal in Queensland estimated at 950 million tons, the Kiangarra, Muirra field have now opened just out of Gladstone, already with export orders for a million tons of coal, estimated export business, 12 million tons per year; anticipated, a new railway line linking the coalfield with Gladstone, the best part of half a million pounds now in course of being spent to develop and improve the Gladstone Harbour works to take this coal trade; the programme already out of date because in that same area will go the sixty million pound alumina factory, or whatever the term is, to treat the Weipa bauxite.

Practically all of our asbestos comes from the Hammersley Ranges in Western Australia. One half of our tin production comes from north of the 26th parallel, so much of it from Herbert just out of Cairns. Tennant Creek is the main mining area in the Northern Territory with a production of well over three million pounds a year, by comparison of one and a half million pounds a year, a few years ago.

The largest single deposit of manganese in Australia found by the officers of my department, the Bureau of Mineral Resources, found at Groote Eylandt, less than six months ago. This is the story of the north, we yet don't know the riches and prizes that lie ahead of us. This is the biggest manganese deposit in Australia discovered within the last twelve months. It's only a few years since the bauxite was found at Weipa, among the world's largest deposits, we're already exporting to Japan, we're sending it down to Tasmania to the aluminium smelters at Bell Bay.

There are firm plans going ahead for the construction of the aluminium plant at Gladstone to the capacity of 600,000 tons, at a cost of at least fifty million pounds. The Gove deposits at Arnhem Land have not yet been fully tested, or fully prospected; work is going on and you'll have seen the newspaper reports of the great interest there is overseas; and Australian companies anxious to obtain tenements for these Gove deposits for the purpose of attracting or establishing alumina/aluminium industry there. There is without a doubt, I say that as a layman not as a professional man, that on the advice I have there is, without a doubt, oil in the north of Australia. Last year's total programme throughout Australia is something of the order of twenty-three to twenty-four million pounds.

I hope Mr. Chairman, I am not repeating things that the audience already knows, because to an engineering audience this is going to be, in my opinion, basic work for your profession for a long while to come. It's only a few years ago that we didn't have enough iron ore in Australia to service our Australian steel industry. In 1959 we estimated our reserves of iron ore in Australia at 368 million tons. Doubts were raised, a school of thought said that there was no incentive to search for iron ore, because there was only one market for it, let us export iron ore and you will find people will search for it; so we removed the embargo on the export of iron ore, a courageous decision in the light of the facts as we then knew them, as a result of that the search for iron ore developed—the Premier of Western Australia recently said that the iron ore deposits in the north of Western Australia are now estimated at 15,000 million tons; if you can get a picture of what 15,000 million tons means, all I can say is "you're a better man than I am Gunga Din", I can't envisage it. But look at the position in 1958, our reserves were 368 million tons, today in the north of Western Australia alone the estimate is 15,000 million tons. From all the potential development that follows from such vast resources, one company already immersed or contemplating or negotiating a programme of thirty million pounds for the mining and shipping of ore from Western Australia, is prepared when that is successful, to consider the possibility of a further forty million pounds into a plant and steel works.

The mining side of northern development is the dramatic side. On the pastoral side, pastoral activities are also going ahead, but the story doesn't follow as easily; the fruits of what's been done, if you can get fruit from cattle, have not yet become available. We're exporting something in the order of eighty million pounds in beef and veal, most of it from the north. We've investigated, we've surveyed, or whatever the right word is, the answer comes out that the great thing to encourage cattle production in northern Australia is to provide better road transport; and so at the present time under construction is a programme of some 2,000 miles of roads in Queensland, Western Australia and Northern Territory. Total expenditure, Queensland, eight million pounds; Western Australia, four million pounds; Northern Territory, four and a half million pounds. From these roads the pundits tell us that cattle production will increase by something of the order of nine million pounds a year.

You can't, of course, talk and think about the north without talking and thinking of the sugar industry, the sugar industry of Queensland. It's production this year will be over seventy million pounds. Just a few years ago we were exporting 30 million lbs. of sugar, last year we anticipate the export will be 70 million lbs. The Queensland Government, the sugar industry meaning so much to the Queensland economy recently established a committee of enquiry which made the recommendation that over the next seven years, sugar production in Australia should be increased by fifty per cent. This again opens up a new vista, a new sphere,

because sugar farming is even more profitable Mr. Chairman, than engineering, it is a good, solid, soundly based industry. There is, so far, only one significant irrigation area in the north of Australia, that's the Mareeba, Dimboola scheme, and that's where Australia's choicest tobacco is being grown. All the present thinking seems to indicate that tobacco, to give the best results needs to be grown in irrigated areas. So we make this only the one water scheme so far in northern Australia. We have got Pilot farms for cattle, for rice; the Western Australian Government is at this present time on its Ord River Scheme, considering the possibility of producing 120,000 tons a year of sugar under the irrigation area. The Ord River is the big question mark of the north. Last year's cotton crops were a great success, the proposal to grow sugar has got, I think, all agriculturalists thinking.

This scheme is a big one and in standard, I think what I have said up to this stage, I hope establishes the point. Really the rate of development in the north is quickening, a recent survey by my department yielded the result it would take what the Governments proposed, what the Governments have done, what private enterprise has done, is doing; there will be capital expenditure in the north over a period in the future, of something of the order of £400 million. Mr. Chairman, the known natural resources of the north are large, they're restricted in areas, they're in pockets, the unknown resources of the north may turn out to be larger than those that we know of, but it would be quite wrong to say that the opportunities for expansion, the opportunities for new enterprise, the opportunities in the north are unlimited. The natural environment, the very isolation of such parts of it, puts restrictions on development; and one of the really great problems of the north, perhaps the greatest problem of all, is the cost of transport, the geological situation, the vast distances, the isolated situation of communities, the sparse population, the lack of a complete road service; all these inhibit transport, with the result that the cost of taking goods to industries in the north, and the cost of taking goods which its industries produce, back to their market really be-devils every aspect of northern development.

Every way in which you turn, the cost of getting what you want and the cost of selling what you produce is the great problem. It has been overcome very greatly by the expansion of the Civil Aviation Services, it has been overcome somewhat by improvement of shipping services, the beef roads programme is going to make a magnificent contribution to it.

But all throughout any theme about the north you come back to earth with the cost of transport; it is not only the cost of getting corrugated iron or cement, it comes down to the cost of sending the kids away for the school holidays, the cost of getting to a dentist, the cost of having to travel to get into hospital. Every domestic problem, every industrial problem, every industry problem always runs sooner or later into this problem—the cost of transport, and I think one of the very good things we've done is to appoint a committee, and we've been very fortunate to get a first class committee of people who are going to take this problem to pieces, put down the facts and figures, analyse it, and let us have recommendation upon what courses there may be available. Everyone interested in northern development must be interested in this committee, and await its findings, to see if it can produce upon which all the Governments, Queensland, Western Australia, Commonwealth, Northern Territory, all mining companies and all pastoral companies, can combine and and find answers to reduce transport costs. There is a great need for capital investment in the north, a great need for men and women to go to the north. We ought to look at it in circumstances in which we need to remember that Australia is at a very different stage of its development than it was when the temperate lands in the southern parts of Australia were opened up.

That was the day of the pioneer, the do it yourself rural settlement, we've got to face a situation that do it yourself, rural settlement atmosphere of the last century just won't do in the north of Australia today. That shows that amenities need to be provided and at least a minimum of a good life assured if we are to attract population to the north in the numbers that we need.

I always think that two of the most interesting spots in northern Australia are Mary Kathleen and Rum Jungle. They are two mining communities in which really first class amenities have been provided and most attractive townships built in isolated places. So that one facet of the problem is, that the private development has got to some extent, be preceeded by substantial expenditure on public utilities; by and large, northern development needs to be large scale capital investment, not that there isn't room for the small man in the north. As the water resources are developed, are first of all discovered, made known, examined and then developed, because one thing that's shown throughout the whole of Australia is how land hungry we Australian people are. Every closer settlement that's opened up, there are far more applicants with the capital, with the experience, than there are living blocks made available.

I come back a bit on the theme, the basic thing in northern development, is a thorough assessment of the resources which are available, and a proper evaluation of the prospects of developing these resources, and the right way to go about them. All Governments are joining together; we've got the Queensland Government and the Western Australian Government, but what's happened is, there is increasingly a trend to make northern development a Commonwealth activity; so we're doing a great deal more in our ordinary governmental services than we did previously, mapping, surveying, working with the state Geological Surveys, C.S.I.R.O., with a quite a large impressive programme of animal husbandry, and the most recent of all, and to me one of the most interesting, the recent establishment of the Australian Water Resources Council. About 62 per cent. of Australia's stream flow is in this northern part of Australia, about 62 per cent. of our water resources, and of those water resources, to put it mildly, we need to know a great deal more than we do at the present time.

What we are doing is a comprehensive programme, spread over a ten year period, aimed at measuring the water resources, providing the basic information. We've

got a Bureau of Agricultural Economics, carrying out surveys of areas like the Brigalow Country in central Queensland; road and water transport problems of the cattle industry, and then the Ord River scheme itself.

Well over £16 million is being invested in these road systems to serve the beef cattle areas; £30 million in the Townsville to Mt. Isa railway; £800,000 for the new port at Derby; £1¼ million to replace the jetty at Broome; £800,000 for the wharf at Wyndham; remember what I said, transport be-devils the north, and it is this item of expenditure, roads, wharves, things in that category. The Brigalow country, for those who may have a chance to go and see it, is worth seeing by any Australian with a sense of pride in his country, nearly five million acres of what is in the nature of scrub land, at the present time being fenced and burnt, will be sown to pastures, will make a most impressive contribution to closer settlement, to closer population and to earning export income. Commonwealth contribution to this is £7¼ million; it's a scheme which in all counts and in all ways will envisage total expenditure of something of the order of £15-20 million. Thus in Queensland, you throw your minds over to the north of Australia as the Ord River Scheme, the first stage of the Burson Dam irrigation channel, an irrigation area of 30,000 acres. Again I mentioned Rum Jungle and I mentioned Mary Kathleen, and should have also included in that, the township of Turra Murra which is headquarters for the Ord River Scheme. These three places illustrate the need that we have as Australians, to think increasingly of the sort of living conditions we're going to provide in these tropical areas. In the Ord River Scheme before it's finished, there will be over £30 million invested, commanding a total area under irrigation of 165,000 acres. This is a constant task, this is not something that can be done by fits and starts, there has got to be continuous work.

The Government recently established within my own department, this special division and gave it a charter, not to do the engineering work, not to do the constructional work, but gave it a charter to consider all the angles of the north, to consider the various proposals that the people in the north advance, to consider what sort of policy the Government could produce in terms of transport, in terms of taxation, and most importantly of all, to co-ordinate and continue to watch all these exploration programmes, scientific programmes, investigational programmes; to accumulate, to get together, to put down, so that hereon you may read all available information about the resources of the north. You would be surprised at how much information has been compiled, put in pigeon holes, never used and forgotten about. The task of it all, the art of the exercise is to review what's known and to see what can be done, having regard to the information that is available.

I have spoken too long, most politicians usually do, let me sum it up this way, go right across—and I'm talking now to a group of engineers in being, or engineers in the future, and I've tried to slant what I've had to say in that way, right across northern Australia at the present time, actually in operation, actually in being or in contemplation, are really great construction programmes which call for the talent and skills of perhaps every branch of the engineering professions.

These programmes, I think, have become almost household names in Australia. The Brigalow Country, Mt. Isa, Weipa, Rum Jungle, Gove, Groote Eylandt, the Ord, Whitroon, Pilburugh; these are great names in constructional work. They want mining engineers, they want electrical engineers, they want civil engineers, the mining companies want professional staff. Theirs is a new field of activities, the oil search companies requiring professional staff, the Governments want men, and I claim this—that Australia can take a great deal of pride in what's happened over the last decade in the north of Australia; indeed, one of my pet theories is that the success has been achieved in the north in the last decade to contrast with some of the failures of the early years, it is these successes which has triggered off the great demand that now exists in Australia for an accelerated pace of northern development, and I believe that we've just got to go on from strength to strength continuously, and I hold the view that this new section in my Department is going to make a most valuable contribution, it's going to experience professional men, men who know the north, men who know the cattle industry of the north, men who know the mining industry of the north, men who are civil engineers skilled in water resources. It is going to make a most valuable contribution; if only that, for the first time at the Government level, you will have a band of dedicated men doing nothing else but that one particular task, devoting their whole life to it.

Now I say this, Mr. Chairman, the north not only needs men with professional skill and men with professional knowledge and professional experience, we've got to have imaginative thinking added with it, and that applies throughout the profession. Modern prospecting surely is the application of imaginative thinking to the information that comes from the scientific instruments, and the skills of the operators. The C.S.I.R.O. research work, the experimental work has got to be based upon a vista of the success that experimental research work is going to mean to northern Australia. It is one thing to build beef roads, to transport cattle; it's another thing to have imaginative thinking people on the properties, who are going to improve breed of the cattle on the properties, to increase the turnover.

In every direction in the north, we've got these challenges, and you go only to meet a challenge in my view, by sense of adventure and even more important, a sense of service. Great things have been done, great things; even greater things remain to be done. Look at the task of developing 15,000 million tons of iron ore deposits. Look at the task of developing what's probably the greatest bauxite deposit in the world; look at the difference it's going to make to northern Australia with the discovery of natural gas or petroleum; look at the challenge there is in the benefication of lower grade areas, so that these fields can be developed; look at the task that's going to take the next decade to finish and that's the measurement and development of our northern water resources; look at the job that lies ahead to plan and develop townships, housing and all the amenities that go with it, to make northern living conditions attractive. You won't mind me repeating Mr. Chairman, that these are all tasks which are the responsibility of the engineering profession. This is your job, and you

know that results can't be achieved quickly, it takes years to test, prove and develop the mineral deposits, years to carry through the road programme, to measure water resources.

All that I say to you, perhaps as part of the outgoing generation is, that a very good foundation is being laid with the work that's being done at the present time. But it's no more than a foundation for an area which is 40 per cent. of the total area of Australia. All that has been done up to this stage is to put down the foundation.

Well, I conclude on a poetic note. In America in the last century the watchword was, "Go West Young Man, Go West". In this age and generation in Australia I'd like to hear it, so far as your profession is concerned, translated into "Go North Young Man, Go North".

"I'm going to give you a spanking, son."

"Were you spanked by your father, Dad?"

"Yes, son."

"And was Gran'pa spanked by Great-Gran'pa?"

"Yes, son."

"Isn't there some way to check this hereditary sadism?"

DEVELOPING THE KIMBERLEYS

By H. E. HUNT, B.E., M.I.E. (Aust.)

Chairman: Mr. W. M. Anderson, B.E., A.M.I.E. (Aust).
Deputy Engineer-in-Chief, E. & W.S. Dept. of S.A.

Mr. H. E. Hunt is Engineer for Construction, Major Hydraulic Undertakings, with the Department of Works, Western Australia. He has been intimately associated with the Ord River Project and is consequently familiar with the north of Western Australia and the current development there.

The Kimberley Region comprises the northern portion of Western Australia and lies between the latitudes 14 degrees and 20 degrees South. The climate of the area is sub-tropical and the country receives its rain from the north-east monsoon in the months from December to March; the other months of the year are for the most part dry and hot. The bulk of the area consists of an extremely rugged and dissected plateau of pre-Cambrian sediments and basalts bounded by the lowlands of the Ord River in the east and the Fitzroy River in the south which are of Devonian and Permian age.

The general level of this plateau is between 1,500 and 2,000 feet, the highest point being Mt. Hann, whose flat-topped summit rises about 800 feet above the general plateau level.

The deeply indented coast line with its long narrow gulfs trending in a north-west/south-east direction are suggestive of rift valleys which have been subjected to a subsequent general submergence, accounting for the archipelago of islands which everywhere fringe the coast. This same system of faulting is evident in the river systems. Most of the rivers which flow south into the Fitzroy have cut deep, narrow and spectacular gorges through the great fault escarpment suggesting rift valleys rather than erosion.

The rainfall distribution of the Kimberleys ranges from about 50 inches in the Northern extremity down to 15 inches in the southern portions in the vicinity of Halls Creek. The rugged central portion is in the 25 to 50 inch isohyet. This rainfall has led to particularly fine rivers and the region generally is one of the best watered in Australia.

Rivers such as the Ord, Fitzroy, Margaret and Lennard with their fertile flood plains naturally suggest irrigated agriculture, but until recently the region has not gone beyond the pastoral stage. The spark to settlement came with the explorations of John Forrest from the De Grey River in the north-west of Western Australia through the Fitzroy Valley and the East Kimberley area to the Gulf in 1879.

Settlement followed, firstly, in the West Kimberley Area where sheep were introduced on holdings on the lower Fitzroy and Meda Rivers, and then rapidly extending along the Fitzroy River. Settlement of East Kimberley followed in 1884. The first stations at Ord River, Lissadel, Argyle Downs and Rosewood are well known as they trace the intricate journeys of man and stock across the north of Australia from Queensland. The area had filled quickly by the turn of the century except for the rugged, but well watered North Kimberley region where there were several transport difficulties which have had to await recent beef road development.

Holdings of up to 1,000,000 acres are held in long term pastoral lease. With such a pattern of land use it is not surprising that the Kimberleys have remained a large empty land. Today, the population of 6,000 white and coloured and about 4,000 natives, are mainly concentrated in the ports and the towns of Fitzroy Crossing, Halls Creek and Turkey Creek. Cattle numbers today are about 500,000 and sheep numbers are little under half of this number. The financial return from these pastoral pursuits are in the order of £2,000,000 per year and it is significant to note that the stock numbers are fewer today than in 1910.

Remembering that the Kimberleys are 1,500-2,000 miles from the populated south of the state and so lack local markets, their remoteness makes them a high cost region both in respect of wages and materials. They have had to wait for improved technology.

To the economist, it seemed that development could be best achieved by:

(1) Production of cash crops under irrigation which in the long run would be exported;

(2) Crops complementary to the cattle industry.

(3) Adopting a scale sufficiently large to achieve the economy in production costs to offset high wages, freights, etc.

A number of suitable areas existed, but none seemed to offer better prospects than the alluvial valley of the Ord River, near Wyndham.

Since the 1930's investigations both agricultural and engineering have proceeded. The establishment in 1945 of the Kimberley Research Station was a landmark. It enabled many problems associated with the farming of cotton, sugar cane, rice and oil crops to be tested.

A greater Ord Scheme was postponed.

Research and pilot farming had satisfied the Commonwealth and State Governments to launch the scheme, although initially on a restricted basis of 30,000 acres, by constructing first the Diversion Dam. This was an integral part of the whole and on this basis without extra capital expenditure a further testing time was available.

At this stage the Diversion Dam has been built. It was opened by the Prime Minister in June of last year. The equivalent of 23 farms of 600 acres nominal area have been allocated. Cotton, rice and oil crops have been grown. Turning to the Diversion Dam, this con-

sists of a graded structure which raises the water level some 45 feet to provide command over the irrigation channels. It consists of a concrete sill with slender piers at 55 foot centres. This particular design provided for a minimum efflux, for a maximum design flood of 1¾ million cusecs., and a facility to handle large quantities of silt and floating debris. Combined with the structure is a road bridge providing the only all weather crossing of the Ord River to the East Kimberleys.

When the main dam is built back in the ranges, irrigation can be extended from 30,000 to upwards of 150,000 acres. It is felt by the State Government that time has now arrived to enlarge the scheme and a case has been submitted for the consideration of the Commonwealth Government. This main dam will be located 30 miles upstream from the Diversion Dam. It will be a multi-purpose dam having as its major function the annual supply of 1,250,000 acre feet of water each year to the irrigation area. Of lesser importance but still of value to the establishment of light industry in the area the dam will incorporate a hydro-electric scheme of about 30 megawatts capacity.

The annual flows of the Ord River are extremely variable having been recorded within the range of 100,000 ac. ft. to 10,000,000 ac. ft. This is, of course, not uncommon in rivers of Australia. A median flow is about 2½ million ac. ft. per year.

The proposed reservoir with a maximum depth storage of only 13 ft. will contain a storage of 3½ million ac. ft. Provision will be made for a flood storage of 7¾ million ac. ft. and this will have the effect of reducing the peak discharge through the by-wash to 1,000,000 cub. ft. per second. A rock fill dam has been designed of maximum height, 180 ft., and the spillway will be constructed through rock in a natural saddle nearby.

I referred to certain criteria required of a scheme for closer development in the Kimberleys. How does the Ord scheme fall within this framework?

Firstly: It is located within 60 miles of the only deep water port in the Kimberleys.

Secondly: The present population is 700. Development will generate a population not less than 20,000 and probably more with a sugar industry.

Thirdly: The crops immediately envisaged are cotton, sugar, rice and oil crops. There is an assured Australian market for cotton at a guaranteed price. Present indications suggest that the yield and quality of cotton produced in the area will within a few years enable the industry to withstand competition on the world market. A proposal to produce 120,000 tons of sugar per annum is under close examination. The rice grown in the area is of a semi long type, a premium quality. To date yields have not come up to expectation but it is felt that this is purely a matter of developing the right strains to meet local conditions. However, yields of 30 cwt. per acre have been obtained and it is felt that rice will shortly be an economic crop. Oil from the oil crops has an Australian market and the by-products have their application in the cattle industry.

Fourthly: This development is complementary to the cattle industry. Protein meal is available as a by-product from cotton and oil seed crops, and can be used for supplementary feeding. It has been estimated that 25,000 breeders die annually in the East Kimberley.

TELECOMMUNICATIONS DEVELOPMENT IN NORTHERN AUSTRALIA

By R. W. TURNBULL, M.I.E. (Aust.)

Chairman: Mr. K. Cramond, B.E., A.M.I.E. (Aust.)
Chairman, Adelaide Division, I.E. (Aust.)

Mr. R. W. Turnbull is Chief Planning Engineer in the Australian Post Office. He has had a very distinguished career with the P.M.G. Department and is well qualified to discuss proposals now under consideration for development of communications in northern Australia.

The telephone policy of the Australian Post Office is to bring telecommunication facilities to all parts of Australia as soon as possible and at least cost. However, the sparse populations and long distances between relatively small centres in the north do pose some unique problems. Despite careful planning, up-to-date techniques and extensive use of mechanical aids, such areas are far more costly to serve than more densely populated places.

The telecommunication needs of the north have been included in a Master Plan which will steer the future provision of telecommunication services throughout Australia. The rate of implementing this Plan in the north will be dependent on the relative priorities in relation to public demand which can be allotted to the works involved. These undertakings, some of which are at present proceeding, must be financed from the limited capital works budget available to the Post Office. It is quite certain that, in some areas at least, this expenditure will not yield an economic return on the capital investment. It must be subsidised from some other part of Post Office or national activity. However, such projects, once they can be financed, are regarded as a national investment.

The financing of communications in a country like Australia is a more onerous problem on a per capita basis than in countries with much smaller distances to span, and higher taxable populations. The comparative distances that must be covered by communication services in Australia and on the Continent are such that an Australian telephone circuit between Perth and Melbourne, or Adelaide and Darwin, is equivalent in length to an international circuit connecting London and Moscow, and traversing several intermediate countries.

The Post Office is a national organisation and plans on a national basis. These plans for the future are based on the certain development of the North. It would not be realistic to work on any other assumption. Despite the limitations a great deal of essential work has already been done and, as we stand today, there are very few inhabited localities that are completely without communications. Many major projects designed to open up a high quality communication service to the north have either been completed or are well in hand.

There are, of course, difficulties associated with the establishment of telecommunication services in the north that are not encountered in the more densely populated areas. The sheer remoteness of many of the operations in itself introduces many problems.

One might then mention periodic cyclonic winds, heavy rainfall and other vagaries of our northern climate. However, these problems are not common to the Post Office, nor are they insurmountable. They do involve a little more in the way of technical planning and design, but the main impact is on the local Post Office staffs, the technicians, linesmen and postal staff who man the remote stations. These are the people who bear the brunt of any difficulties associated with the provision and maintenance of telecommunications in outback areas, and no note on this subject would be complete without some reference to the resourcefulness and dedication they have shown in keeping the service going.

Darwin and its environs, including intermediate points, is served from Adelaide by a main open wire route that follows the Stuart Highway. This route has a rather interesting history. The initial telegraph route connecting Darwin to Adelaide was completed in 1872, within ten years of the first crossing of the continent by the explorer, McDouall Stuart. In competition with Queensland the South Australian Government of the day offered to build a telegraph line a total distance of 1,975 miles from Adelaide to Darwin, to connect with a submarine cable that was being laid from Singapore to Darwin. The centre portion of this route was across practically unknown and desolate country, and presented an extremely difficult and hazardous undertaking to the construction teams under the direction of the late Sir Charles Todd. Even today, with our modern methods and equipment, a job such as this would be an imposing task. A century ago, it must have been a truly momentous concept; the equipment included wagons, bullock drays and numerous working horses and bullocks. All materials, provisions, etc., had to be hauled from Port Augusta to Darwin by horse, bullock or camel. Most of the construction parties took months just to trek to their part of the route before commencing their work.

This original line comprised a single iron wire conductor. It was erected partly on wooden poles, but the local ants made short work of these and before long the whole route had to be constructed with metal poles. When completed in 1872, the line gave direct telegraph communication via the submarine cable between Australia and Britain.

In 1898 a copper wire was added to the route to give a second telegraph circuit. It was not until 1942 that another copper wire was added to provide a balanced copper pair of wires upon which could be operated a

three-channel carrier telephone system. It was only then that the Darwin area came into telephone contact with the rest of Australia via Adelaide. Later in the war a second pair of wires was completed to Darwin and, as a wartime measure in 1943, the aerial route between Townsville and Camooweal was extended to Tennant Creek on the north-south route. A further pair of wires was erected north from Tennant Creek, providing for the first time a direct telephone and a telegraph link between Brisbane and Darwin.

In recent years a twelve-channel carrier system has been installed between Alice Springs and Darwin connecting up Alice Springs with a similar system from Adelaide. There are now five direct telephone channels between Darwin and Adelaide plus a number of telegraph channels. The route also carries numerous additional wires to serve intermediate establishments, particularly the area immediately south of Darwin as far as Adelaide River.

The initial single iron wire route, surveyed and erected by the pioneers of 1872, has thus grown into a substantial aerial route that is now the backbone of our communications to the Darwin area, with connections to Camooweal, Mount Isa, thence to Townsville and other parts of Queensland. Even in the event of a serious breakdown south of Tennant Creek, Darwin would still have telephone contact with the rest of Australia via Queensland.

It will be possible to meet requirements for some time by extending this route, but ultimately it will have to go the way of all main aerial pole routes and be replaced by the most up-to-date type of broadband system offering a wide band of frequencies that will permit the operation of large groups of channels and possibly a television relay.

In the north-west a £500,000 line reconstruction project is at present under way to extend the existing aerial route connecting Perth and Talgarno to Broome and Derby, a distance of over 240 miles. This project will be completed this year. It will make a further six circuits from Port Hedland to Perth, a further three circuits between Broome and Derby. By the operation of electronic carrier equipment over the open wire lines, it will be possible to fully satisfy the requirements of Broome and Derby for southbound circuits, and to extend these circuits as required to areas further north. In addition to the line construction and electronic equipment, the project involves the erection of major amplifying station (repeater) buildings at Walgoo, Peak Hill, Nullagine and Talgarno, and extension to an existing building at Cue. The new circuits will meet the world specifications of the International Telecommunication Union as regards speech volume and quality. In fact, the national trunk network is designed to enable any subscriber to make international calls.

Derby is at present served from Perth by a high frequency radio system providing two telephone circuits plus limited telegraph facilities. Following the completion this year of the Talgarno-Broome-Derby aerial construction project, the radio terminal will be transferred from Derby to the North-West Cape, where it will assist to provide telephone and telegraph service to the U.S. Navy communications centre. The North-West Cape area where the U.S. Navy is establishing a communications centre could only be served by radio in the time available.

Telephone development will ultimately justify the extension of the open wire system from Derby to Wyndham, probably following the new beef roads and serving intermediate points. This will be a major project, but the Post Office will certainly undertake it as the development matures. Wyndham will be the gateway to Kununurra, the commercial centre of the Ord River Scheme. In the meantime, radio telephone systems have been installed between Kununurra and Wyndham, and Wyndham and Derby, thus giving Kununurra and Wyndham telephone connection into the Australian trunk network for the first time. The Derby to Wyndham system will be replaced towards the end of this year by two higher quality two-channel high frequency independent sideband systems. These systems will provide a total of three telephone and three telegraph channels between the two towns by early 1965. The extension from Wyndham to Kununurra and the Kimberley Research Centre is provided by a single channel VHF radio telephone system.

Further high frequency radio telephone systems are also on order to serve Onslow and Wittenoom from Port Hedland, and Halls Creek and Fitzroy Crossing from Derby. These will be independent sideband systems, each capable of providing two speech channels. or alternatively one speech channel and three telegraph channels.

The next move will be the provision of a radio telephone service between Wyndham and Darwin. This will be an essential link, as at present there is no communication either by telegraph or telephone between these two towns.

In the north-eastern part of the continent, the more heavily populated eastern coastline from Brisbane to Cairns is clearly in a different category to the sparsely populated central and western regions. The open wire route serving the east coast and points inland has been specially built up and equipped with electronic carrier systems to keep pace with the great development that has taken place. However, the demand for telephone service in Northern Queensland, particularly over recent years, has exceeded even the most liberal estimates, and the stage has now been reached where the heavy coastal development has exceeded the capacity of the present open wire route.

West of the Dividing Range, we have a different situation. Apart from the larger towns, the country is only sparsely settled. Yet a great deal has been done to extend the trunk system to these inland areas. On many of these routes, both the number of circuits and their quality have been advanced by the use of carrier systems. Twelve-channel carrier systems, giving high quality circuits, are operating from Townsville to Cloncurry and from Rockhampton to Longreach. From Cloncurry, three-channel systems extend good quality circuits to other inland centres, including Mount Isa. To the north-west a single-channel carrier system operates from Cloncurry to Normanton, from where further carrier systems give a good standard of trans-

mission to centres such as Burketown, Wernadinga and Croydon. An aerial line exists to Bamaga in the far north of Cape York Peninsula, and Thursday Island, our most northern outpost, has trunk telephone service. The Weipa Bauxite field is connected by radio to Atherton.

Looking now at northern Australia as a whole, the reader will see that the Post Office is carrying its trunk line system as rapidly as possible to all of the more important centres. It is true that there are some very important places that still lie outside the trunk system. In general, these are districts where very costly construction would be necessary to take a trunk line to the area, and even then, the potential subscribers are separated by great distances. Once the national trunk line system has been extended to a particular area, it is still necessary to establish local telephone exchanges and lines to connect the individual subscribers. It is the more remote and scattered subscribers who offer the greatest problem.

Once an exchange has been established, the Post Office will provide a certain amount of departmental construction from the exchange towards a subscriber or group of subscribers. In the case of a subscriber who wants an exclusive service with no other parties connected to his line, the Post Office will run up to six miles of wire on existing poles, or sixty chains of new poles and wire. If the subscriber agrees to the future connection of further parties to his line, a greater distance of departmental line will be run. In the case of a six-party line, the Department will run up to 16 miles of wire on existing poles. The rest of the construction beyond that point must be paid for by the subscriber. He may either erect the line himself to standards specified by the Post Office, or pay the Post Office to do the job. The charges here are very reasonably based. Nevertheless, subscribers living a considerable distance from the nearest exchange can be faced with a heavy capital payment to obtain a telephone service which is the big difficulty in more remote areas.

Some 7,000 telephone exchanges are established throughout the Commonwealth, and a good number of these are distributed through some very remote areas. The more distant exchanges are mostly manual, but as a means of improving service, the Post Office is mechanising them as rapidly as resources will permit. In 1950, for example, there were only 300 country automatic telephone exchanges. This number has since been increased to approximately 1800, but there are large areas still not served by Post Office exchanges. As has been explained, these are areas so sparsely settled that the cost of providing the residents with telephone services of standard performance cannot as yet be met.

It is at this point that mention must be made of the outpost radio systems conducted by the Royal Flying Doctor Service and other authorities. This system is purely a message-passing medium, but has been of great value to people living in isolated areas to which it has not yet been possible to extend the Post Office network.

The present system, developed from the original experiments conducted by the Australian Inland Mission, founded by the Presbyterian Church, which established the first Outpost (Royal Flying Doctor) Control Station at Cloncurry in 1928. The earlier experiments at homesteads employed Morse transmissions with power from pedal generators. These days, only one or two pedal generator sets remain in use. Most modern outpost station equipment is powered from accumulators operating in conjunction with vibrator units. All stations operate under similar conditions and provide service without secrecy and at considerably less than the standard required for connection to the main telephone network. Approval for outpost stations requires, in the first place, that the homestead be situated some ten miles from any departmental construction, and that provision of communication facilities by more normal means is not feasible. It is hoped that ultimately the Post Office will be in a position to offer a good quality telephone service to people in all areas of the Commonwealth and to integrate them as subscribers into the main telephone network. It is expected that this will be facilitated by the rapid advances that are taking place in telecommunication technology. New techniques are reducing the problem of long, costly and generally poor performance multi-party lines. The Post Office is examining the possibilities of higher performance subscribers' radio telephone services, somewhat similar to the outpost radio services at present operating by the Royal Flying Doctor Service and other authorities, but using modern single side band equipment incorporating selective calling of the different stations, and considerably improved performance that will permit the through connection of the stations into the trunk network. It is expected that the greater use of transistors and other modern design principles will reduce the cost of such systems. There are other solutions that may apply in particular cases. In areas where subscribers are remote from an exchange but near an existing departmental route, rural carrier systems perhaps associated with line concentrator units may be useful.

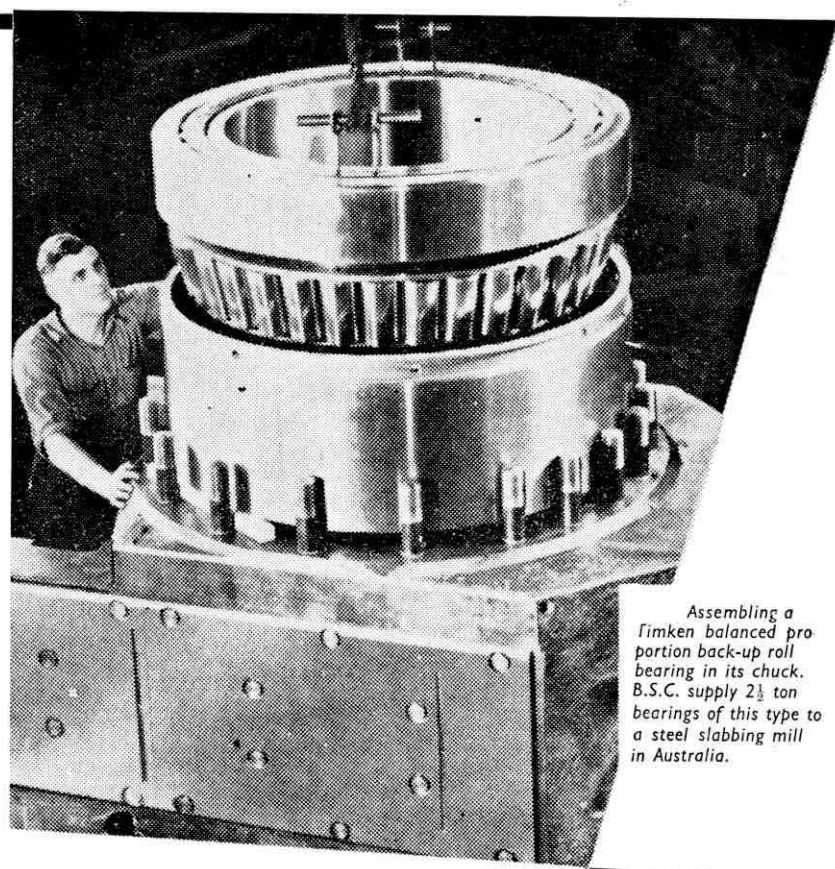
It is certainly the intention of the Post Office to continue to take advantage of all technological advances that might be used to improve the service to outback places.

Clearly, the Post Office, as a Department of State, has an important responsibility to provide and develop a high quality telecommunication system that can be used in the development of the northern part of our continent. That is the basis on which the plans for the future have been laid.

The prospect of transmitting via satellites to improve communications to the North is also being closely watched.

A great deal also remains to be done to improve the position of those people who live and work in places far removed from the telephone network, but who still need a telephone service at a reasonable price. Lower cost solutions will certainly be found.

In the pursuit of these objectives the Post Office will continue to co-operate fully with all who are concerned with the development of the north.



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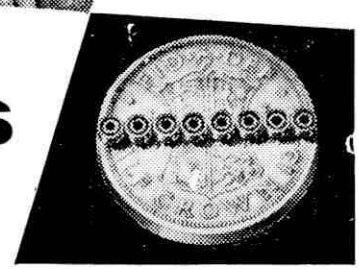

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WHAT ARE THE PROSPECTS FOR AGRICULTURE IN NORTHERN AUSTRALIA ?

By G. A. STEWART, M.Agr.Sc.

Chairman: Dr. J. Melville, M.Sc. (N.Z.), Ph.D. (Lond.)
Director, Waite Agricultural Research Institute.

Mr. G. A. Stewart is Chief of the Division of Land Research and Regional Survey, C.S.I.R.O., Canberra. Under his guidance, research into the problems retarding development and assessments of productivity have reached new heights particularly with regard to the Northern Territory where many trials and experiments are now bearing fruit.

Mr. STEWART:

The intention of this paper is to give a summary, in not very technical language of the results of our achievements—the results of our investigations over the last eighteen years, particularly in the most northern part of Australia—excluding the east coast of Queensland.

There is of course a very good reason for not having very many people in the centre and north of Australia. It is arid and semi-arid—too dry for any kind of cropping and will remain pastoral land and unfortunately the state of our country is such that we don't have any snow-capped mountains in there with large flowing rivers as in Egypt or India, or places like that. The potential for irrigational development is not very large. The area we are concerned with is the north; above the 25 inch rainfall, from about Derby across to Burketown northward of that, right up to about 60 inches at Darwin. The first setlement was made in 1824, 140 years ago, end yet we still have no agriculture other than the cattle industry and a few market gardens in that area.

In the north, most of the rain occurs around January, in fact there is a very reliable summer wet season of about four months from December to March. In this main rainy period, very high falls occur in Darwin, up to about 14 inches in a month; far in excess of plant requirements for growth, but the other outstanding feature is the extreme dryness of the four months—June, July, August and September. The total rainfall in a month for these three months is only 60 points. There is no part of Australia that is dryer than this for four months (Oodnadatta has 4 inches of rainfall, and is likely to get it spread more through the year. Originally we thought this was quite a problem but we are now finding that this extreme dryness is quite an agricultural advantage.)

The climate is very warm, and completely frost free. During the dry season the winds blow a steady south-east out of the arid zone. There are no dews except near the coast and no rain or frost for four or five months of the year.

In October-November it is extremely hot, the mean maximum is over 100 degrees—the mean maximum, cooling off at night to a cool 75 degrees. It is not a comfortable climate for four to six months of the year, however the winters are delightful, cool nights, warm days, clear and sunny, without any chance of rain for three or four months.

Now this periodic climate is reflected in very periodic river flow. All of the rivers are extremely seasonal. The Daly River, into which the Katherine flows, has the lower part nearly a half a mile wide, about 60 feet deep, and may run a banker in years of highest rainfall. It is fed through the dry season by springs, and still has about 20,000 acre feet of water going down in a month in the driest months, but most other rivers are completely dry. Their flow stops within about a month or six weeks of the last rain.

The cattle industry is the main agricultural enterprise, cattle being first moved into the area in the 1870's. Quite a lot of the country is rugged and stony with no soil cover at all. Even though the cattle industry has been there for 90 years, it is still a very primitive industry. In fact, places further inland, in the lower rainfall areas are better developed in this regard. The prime factor responsible for this is the nature of the dry grass that the cattle have to eat. The grass grows very rapidly in the first two months of the wet season, is in flower by the middle of the wet season, and dries off at the beginning of the dry season. We've found that this grass translocates the protein from the leaves back into the butts and roots, and is left standing with an extremely low protein content.

The general stocking rate accepted on cattle stations is about four beefs per square mile—160 acres to run one cow. The cattle are mostly wild, and the properties mostly unfenced. The survival of breeding cows must largely depend on the frequency of little soaks and springs and edible shrubs and so on which the breeding animals can nibble on during the dry season to increase the protein content of their intake.

Many attempts have been made at agriculture right from the early days. In fact there were even sugar plantations established near Darwin at one stage, but within a few years, all of these projects have faded right out (the latest example of this was the Humpty Doo rice development). This is largely because of a lack of appreciation of the characteristics of this particular environment.

Surveys were commenced after war in 1946 by teams of scientists looking at land, and by "land" we mean the kind of rocks the land is formed on, the shape of the land, topography, the soil cover, vegetation and climate. This whole complex we think of as "land" and the surveys were made by aerial photographs to a large extent in order to cover large areas rapidly.

Surveys have been made in the west and north Kimberleys, northern Victoria, Katherine, Darwin—there is a gap through Arnhem Land to Roper, and also the Barkly Tableland to Alice Springs area—in fact about 80 per cent. of the north has been covered by these surveys. Thus we know the native land with its climate variations and in the experimental work that has been undertaken subsequently, the data from these surveys has been used so that experimental work could be sited on land characteristic of quite large areas in the north.

The centres where agricultural investigations are taking place are the Katherine Research Station (the Northern Territory Administration have worked there too); investigations there are mainly on dry land crops grown with the natural rainfall. This includes peanuts, cotton, sorghum, fodder crops and pastures. On the Marakie alluvial lands south of Darwin, the Northern Territory Administration is carrying out investigations on rice and pastures, on the sub-coastal alluvial land, adjacent to the area of the Humpty Doo project. On the Ord River there is the Kimberley's Research Station which is operated jointly by the C.S.I.R.O. and the Western Australian Department of Agriculture. This research station is carrying out a wide range of investigations on irrigated crops—rice, cotton, safflower, linseed, sugar, winter and summer growing cereals, fodder crops and pastures.

The Northern Territory Administration has departments working throughout the north. The Northern Territory Water Resources branch has established over the last few years a very comprehensive stream gauging system. It has set up close to 200 streams that are not being gauged in the top area of the Northern Territory, and is rapidly accumulating stream flow data. The Bureau of Mineral Resources and private companies are giving quite a lot of attention to mineral resources. From the agricultural point of view, one that is of interest is the phosphate deposits that have been found near Rum Jungle. However the one body is not large, and unsuitable for manufacture of superphosphate. The C.S.I.R.O. is undertaking some joint work with the Bureau of Mineral Resources, in trying to assess ways of simply converting this deposit to forms of phosphate useful to plants, and the results are quite encouraging. This could be an advantage to agriculture development because the cost of obtaining phosphate in the north is a very significant cost in agriculture.

The Forrester Committee appointed three years ago to look at the possibilities of close settlement in northern Australia, has spelled out a step by step progress in agriculture, calling for investigations on a small scale, then larger experimental investigations, followed by a limited number of pilot farms to test the economics of these findings in normal commercial agriculture.

At Katherine the most extensive agricultural soils are deep red soils, mostly six foot deep and quite often deeper. They are red, very well drained, have a loamy surface and a clay subsoil. They are extremely deficient in phosphate, and have a rather low moisture holding capacity for plant growth. The next most extensive soil is one not unlike the soils on Kangaroo Island and the sand plains of Western Australia—a very sandy surface, ironstone-gravel layer overlaying a clay layer. These are fine engineering materials, but from the agricultural point of view they pose a lot of problems. They're very infertile, having poor moisture retention and the C.S.I.R.O. has not had any success with this soil. There are a number of other soils, but these two are the most extensive—fortunately most of them are not as bad as the latter.

Katherine has 35 inches of rainfall, the growing season normally commencing about mid December and ends early in April. At Katherine we are experimenting with cropping under natural rainfall during the three and a half to four months growing season. We've introduced a wide range of crops—peanuts, sorghum, forage crops and a very wide range of crops have been tested. Peanuts is the crop which has had most agronomic success. In peanut patching growing at Katherine, a few good yields have been grown along the river on the river soils which are rather different from the more extensive type of soil.

Peanuts grow very well, but the problem is that the Australian market is very limited. The prices are good but the supply comes from Queensland and economically there is no justification for starting up peanut growing in northern Australia. The world prices of peanuts grown for oil extraction, for which we do import some into Australia, is so low that we could not compete with it with our highly mechanized agriculture and high labour costs. In the future we are not likely to be doing anything significant on this crop.

Grain sorghum is a well adapted crop. The American grain sorghum has given good reliable yields over a few years, but as an export crop (putting an emphasis on the crops we foresee as giving an opportunity for large scale development—which means export, or feed to local animals—as a cash export) sorghum is not very promising. There is a small outlet for it in local poultry and pig raising, but the cattle industry is so primitive that the growing of much grain in sorghum will not be required for a few years. It is economics which stop the development of this crop which is well adapted to the area.

What can we do in the land's activities which would help the existing cattle industry? The native pastures grow very rapidly and in mid wet season in February you can already see the long thin stalks of seed heads on the grass. The trees are fairly open and there is a lot of bare space between tussocks of perennial grass which make up a big portion of the dead space on this country. The productivity is low, as at this time of the year there would be no more than about three-quarters to one ton of dry matter if a large area of some square chains was dried out.

The protein content would be about four per cent., but in the dry season this reduces to about half a ton with only one to two per cent. protein content owing to the protein transfer to the roots and butts mentioned earlier. This protein content is extremely low.

However, during the wet season, cattle will gain about 160 lbs. of live weight. By November they are reduced to scrawny looking animals, even if they are run on one beast to 20-25 acres. With the stocking rates that are practised, the cattle only eat a fraction

of the dry grass and over most of the country the dry grass is burned each year. We fed the animals on this grass with supplements of protein and energy food and found that the only thing they needed was protein. One animal had been losing one pound a day for five months, using his own state as a protein supplement, but given ½ lb. of protein supplement a day they will maintain weight and given another ½ lb. protein a day they will gain weight up to 1-1½ lbs. a day.

The energy value of the dry grass is quite reasonable and it is only the lack of protein that has restricted the cattle industry in this area. Then we had to find the cheapest way to give the protein. In our experiment we have been giving them peanut meal, but we look to cheaper sources of protein. When we first started looking at alternative feeds, in the traditional pattern we thought the thing we needed was a mixed grass pasture, and we have found a grass well adapted to the area. In the wet season we found that we could run at least a beast an acre and get 200 lbs. liveweight. This is a substantial increase over a beef per 20 acres. However, in the dry season, grazing on the mixed pasture, they gain only about 90 lbs. per beast. Running through the dry season at one beast per acre, we have got a very significant change—instead of losing about 160 to 200 lbs. liveweight, they have gained about 90 lbs. weight. However, grazing on Townsville lucerne (a constituent of the mixed grass) with no perennial grasses, only a few volunteer annual grasses, some beasts have gained up to 200 lbs. liveweight and areas of dry grass have lain idle during the months of no rain. It takes only about one inch of cumulative rainfall before all the dry grass is completely spoiled, but on climate records this is not likely to happen till about mid October and it may even go as late as November. This, as far as I am aware, is a pretty unique kind of haymaking, where we plant a plant that produces protein, but in maturation it leaves that protein above ground where animals can get it, and nature has provided us with a five month natural hay-making season which saves us all the bother of making hay and feeding it back to the animals.

These kinds of pastures are being tested in many places throughout the north. Townsville lucerne and one or two other components; just by ploughing between the trees has given quite good establishment. There is still some distance to go in assessing the possible economic problem. On the first stage assessment it appears only marginally economic, because of the high cost of clearing so that we are looking for techniques to reduce the cost of establishment of our pastures.

One other way of providing feed is by growing forage crops and initially we grew bullrush millet, growing about nine or ten feet high, with intentions of making these crops into a traditional feed, but this plant works equally well for our dry-standing hay.

We grow a crop, it matures in late May; we can put the cattle in any time up till mid July, and they'll gain weight rapidly while they eat the heads and the upper leaves. They will gain up to 3 lbs. a day, and while eating the rest, the stalks, they will hold their weight until there are no dry stalks left. The average yield for this crop is six tons an acre, but yields have got up as high as nine tons an acre—a very high producing, well adapted crop with a good protein content. The protein content of this annual plant is adequate for a long period of maintenance. Again, one inch of rain spoils this as a dry standing feed. Crop grazed at the rate of two beefs per acre for five months has still quite a lot of seed left on the ground, showing that the stocking rate could have been somewhat higher.

It is hoped in the near future to have enough evidence to put forth proposals for pilot farms at Katherine.

Turning to the Marakie lands on the Adelaide River where investigations are being carried out by the Northern Territory Administration. These are low-lying valleys that run into higher timber country. They are flooded naturally for periods during the wet season and are better adapted to crops like rice, because water control can be provided. Rice growing has given quite promising results. Asia bean and Townsville lucerne have also been very successful. A proposal has already been made for three pilot plants on the Adelaide River about 60 miles south of Darwin. The crops work in rotation—the rice for its grain, the stubble for grazing and the protein rich alluvium pasture which provides protein rich feed during the dry season and nitrogen for the following rice crop. This land has grey silty soils which don't pose many agricultural problems, but do need quite a lot of phosphate. Thus pilot farming is already on the road.

The Humpty Doo rice project was further down the Adelaide River on the sub-coastal plains, and it got to a peak area of 5,000 acres in 1959, but there is no rice being grown there commercially now. The land is low lying, has far more clay, is more difficult soil to work, and is similarly phosphate deficient. It has another toxity, in certain parts of the area, but there are other parts where good results have been obtained. The best yield was more than 1½ tons per acre, the average being 1 ton of rice per acre. However, owing to many and various factors, the average weight that actually got into the bin was less than 1,500 lbs. per acre. (This was because of management, not environment.) There should have been about 1¼ tons per acre as an average over the whole area. One of the major problems was that the rice grown all matured at the same time. To get good quality rice, it must be harvested within ten days of maturation. An attempt was made to spread the maturity of the rice and we can spread our harvest quite a bit, but it means using some other practices. We've introduced varieties that have been bred and selected on the area and one variety has been realeased for over two years now and we have several others which will be released shortly.

Experimenting with the fertility problems over a long term project, one area received two cwt. of ammonium sulphate and one cwt. of superphosphate and the yield was two to three times that for the same area with no fertilizer. We have been getting 1½ tons per acre off of our permanent rice crop.

A well adapted pasture has been found for this land, a blue pea, which we hope can be worked in rotation with the rice on this low lying wet land. This year we have found that by using the right variety we have had a very successful set of trials with seeding of rice into

water. This is used very extensively in the United States. We've also made quite a lot of progress in mechanised bubbling of rice boys when there is water in them. There is also the possibility of growing a crop of rice, then re-irrigating and growing a second crop from the same plants. This practice is being widely followed in Texas, for one particular variety, the production there having risen something like 20 per cent. in the last four years because of this fact. There, they have a very cold winter, whereas here we have much greater freedom because our winter is much warmer than theirs. In fact, last year we matured a seed grown crop in mid winter. All these facts combine to give us a completely new outlook on how to grow rice in these areas.

Turning to the Ord River, the soil there—quite an important factor in irrigation development—is a packing clay soil. The important thing is that we have a very uniform soil of about 150,000 acres—soil that, from the field scientist point of view, is extremely uniform, and we expect that the agricultural response of this soil will be uniform. We can predict pretty accurately what is going to happen over the whole area of irrigational development, if we know how part of the area behaves. This is in striking contrast to many irrigated areas in southern Australia where there is, in many cases, an extreme soil diversity over quite short distances. Rice and safflower are grown and a lot of land is now being prepared for cotton growing. Safflower is a crop that is grown in the dry winter months, maturing in about October. Cotton, grown during the wet season—November-December and harvested in April, May, is the main economic crop at present time. The yield over the last two years has been promising, about one ton per acre. In this, the first year in which five commercial farms have grown rice, the first part of their harvest yielded ¾ ton per acre. For farmers who have never seen cotton before and some who had never irrigated land before, this is a remarkable achievement. I look to the future with cotton with a lot of confidence.

Insect problems have caused a lot of concern at times, but we are confident that we will be able to contain these problems in the near future.

Sugar cane was grown in experimental works about five years ago, but only a small museum remains to maintain some varieties. The results were very good and there were no problems at all with sugar, but at that time there didn't appear to be any marketing possibilities. There are now proposals for exported sugar production in Australia and the Western Australian Government has asked the C.S.R. to examine the possibility of sugar growing on the Ord River with the objective of growing about 120,000 tons. This would be something like 30,000 acres under sugar cane. One field to which we are giving some attention now, which we think is a very important one, is the possibility of growing forage and fodder crops for the benefit of the surrounding industry. We can grow wheat, oats, field peas or any temperate crop in the dry season. It is cool enough to do this, yet it is still warm enough to grow sorghum for instance. One planting of sorghum in December yielded two forage crops in February and August and two grain crops in June and October—four crops in all. Our winters are warm enough to do this, a marked agricultural advantage of the environment. It's cool enough to be able to grow virtually all temperate climate crops, yet warm enough to have subtropical climate crops continuing to grow.

We have done the same thing with cotton crops, but little can be said about the commercial aspect of cotton growing until we have the full answer on insect control.

In conclusion, I would like to emphasise the distance and transport problem. It is just as far by boat from Darwin and Wyndham to Tokyo as it is to Adelaide. The other disadvantage for Europeans is that it is not a comfortable climate for four to six months of the year. We have to think of our conditioning in the north the same way as we think of heating in the south. It has those disadvantages but it has some advantages, some very marked advantages. The water resources are far greater than those in south-east Australia. Largely untopped and very seasonal, it offers the biggest future for better use of water in Australia. There is the possibility of hydro-electric power in the Kimberleys and it has been shown, as a first estimate, that one small project at Wyndham could provide as much power as the whole Snowy Mountain Scheme and this is only one of about fifty possibilities around the Kimberley coast.

The weather in the north is so seasonal and so reliable that there have been no real failures of established crops which can be attributed to climatic conditions or seasonable changes. One aspect which exemplified this as well as the cattle dry-grass already mentioned, is the dry season cotton crops. Maturation of these crops takes place in May and the cotton may be left on the plants until August without risk of deterioration of the quality of the cotton and without loss of yield. There is no rain, dew or frost to spoil the cotton on the plant. This means that one cotton picker can be used to harvest more country.

We are getting to the stage where we can really appreciate these advantages and really look forward to planning types of agriculture that will fit them. We have great scope for versatility in irrigated agriculture in the north and we can now look forward with confidence to planning agriculture that fits our environment rather than trying to take an agriculture from someone else and force it on an environment to which it is not adapted.

The Ord River is devloping and if present plans go ahead the big dam will be built and completed in about five years time and there will be a great expansion of agriculture over the next 10-15 years. Beef roads are being built to assist the beef cattle industry, a central abattoirs had been set up to process cattle from the area, the pilot farms are being established. I would like to see it go along at a steady rate, progressively from this rather than say expend 10-15 million pounds and develop northern Australia in say ten years. I think very quickly we would then be right back where we started. We are going along fine but we do want somebody to keep some agricultural expansion going on up there.

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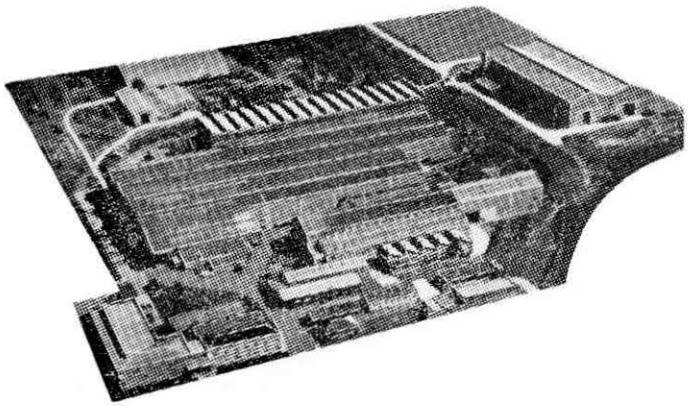

Babcock & Wilcox opened offices in Sydney and Melbourne in 1886, and established works (pictured at left) for the manufacture of boilers and ancillary equipment in 1922, at Regents Park, N.S.W.
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MINERAL WEALTH AND NORTHERN AUSTRALIA

By PROFESSOR E. A. RUDD, B.Sc., M.A. (Harvard)

Chairman: Mr. L. W. Parkin, M.Sc.
Deputy Director of Mines, S.A.

Professor E. A. Rudd is Professor of Economic Geology in the University of Adelaide. He is geological consultant to the Snowy Mountains Hydro-electric Authority and an Australian authority on mineral resources and their economic extraction. His wide experience in this field makes his overall comments on the north and its wealth of particular value.

We often approach the problem of Northern Australia with a feeling of guilt because it is so sparsely populated in contrast to the dense settlement of the islands and lands immediately to the north.

We should remember that the people of these areas had the opportunity to settle in northern Australia long before Europeans arrived in Australia. The emptiness of the north results from the marked contrast it presents to say the islands of Indonesia.

Whereas the islands are mountainous, verdant and fertile that part of Australia which faces them is relatively flat, barren and inhospitable. Under normal conditions there would be no doubt as to which is the most desirable terrain.

There is no doubt that we have developed Australia by settlement in the east and south-east as if we have turned our backs on Asia and indeed the rest of the world.

We had at our back some one thousand miles or more of inhospitable country. To some this has seemed a good measure of defence and in the past it undoubtedly was. There are those people who can prove conclusively that it is more economical to develop southern Australia and ignore the north. It is very difficult to prove that any new development is economically sound. One can imagine the doubts that must have existed in Great Britain in the early days of the settlement of Australia.

To those people who would delay development of the north so that it remains unattractive to others the reply can only be that it is already too late. Times have changed. No longer is a thousand miles of inhospitable country a sufficient shield to shelter us and already there has been discovered in Northern Australia sufficient mineral wealth to make this area attractive to others.

It is hard to define the southern limits of northern Australia because there is no physical barrier which divides it from the centre and the south.

If we judge the empty north on a population basis then the north starts very close to the southern shores of the continent.

It is even more difficult to define the northern limits of northern Australia. In the past the coastline was the obvious limit but nowadays the continental shelf is considered an integral part of the land mass.

That part of the continental shelf which adjoins northern Australia is extremely extensive and it adds perhaps another half a million square miles to the one million or more square miles of the land area.

In some cases this continental shelf extends to join part of Indonesia as in West New Guinea or in other areas extends very close to the Indonesian coastline.

Already we are exploring the continental shelf for mineral wealth and this interest will increase with time.

In addition to the somewhat harsh conditions of northern Australia the two serious drawbacks to settlement have been remoteness from the cities of Australia on the one hand and the difficulties of the climatic conditions during the "wet" season.

A minimum qualification for anyone who wishes to discuss the development of northern Australia should be that he spends at least one "wet" season in a remote part of the north.

Modern transport, particularly air travel and air-conditioning, if readily available to the people of the north, can alleviate both these disabilities. One factor which has seriously handicapped the advance of the north has been "absentee landlordism" where the owners of enterprises such as cattle stations lived in Melbourne or Sydney and only visited their properties occasionally or briefly.

Those of us who know the story of Mt. Isa Mines Ltd. believe that its ultimate success resulted largely from the policy of the Chairman and Managing Directors living at Mt. Isa. "Absentee Landlordism" can apply to individuals, companies and organisations. It can equally well apply to Governments and its officers. The permanent inhabitants quite rightly resent the "winter tourists" from Commonwealth Departments who visited the north during the very pleasant part of the year and then retreat to Canberra during "the wet".

It is apparent that the north will only become stabilised when centres of population are established which inhabitants regard as their permanent home and believe themselves to be as well off as inhabitants of the south.

The lack of facilities in northern Australia is readily apparent if we consider such items as harbours, power supply, water storage or engineering workshops.

Excluding Darwin, which like Canberra is a very expensive and artificial development, and the two mining centres of Yampi Sound in the north-west and Weipa in the north-east, there is not a useful harbour between Geraldton in Western Australia and Townsville in Queensland. These two ports are literally thousands of miles of coast apart. With a few exceptions similar remarks could apply to the other facilities.

When we refer to mineral wealth in Australia we normally include a great deal of material that is depen-

dent upon proximity to large centres of population for its value. This includes sands, gravels and aggregate for construction, clay for brick making, materials for cement and similar rocks and minerals.

Obviously this type of mineral production will not make any marked contribution to the development of the north until such time as large construction is required for other purposes.

Similarly some mineral deposits are only valuable if the transport distances are short. Generally these will not be valuable in the north unless we develop markets with Indonesia and this seems unlikely for some time.

The mineral deposits in northern Australia that are, or will contribute to its development, will be valuable, and usually no large quantities which will be amenable to cheap mining. The products will have to stand the cost of transport to the south or overseas.

Any mining operation of any size requires a minimum number of facilities without which production would not be possible.

In order to attract and hold a suitable labour force and technical people housing of a high standard must be available and this will need to be supplemented with amenities of all types.

There will be the need for good transport facilities both to bring people and materials to the locality and to take away the product. This will call for the provision of good air services and airports, good roads and railways if the mineral deposit is away from the coast, and almost certainly a good harbour with adequate loading and unloading equipment.

An adequate and assured water supply will be a necessity which at the same time may provide an amenity in the form of a recreation area for fishing, swimming and water sports.

The mining operation will usually require a substantial power supply and there will be the need for engineering workshops capable of the repair and fabrication of the great variety of equipment used in the operation. The mining centres have to provide these facilities in order to function and they will thus automatically become available for other uses.

Normally they will be required at the mineral deposit or on the coast adjacent to it.

In addition to these aspects the mining operation results in a centre of population that creates a demand for foods, some of which may be grown locally, and other goods.

Bases are created from which other exploration may originate and these also form centres in which research into local conditions can be conducted.

Already in northern Australia there is established a number of these centres.

Mt. Goldsworthy, an iron ore deposit and Wittenoon Gorge, the source of asbestos are typical examples. Yampi Sound, where Cockatoo and Koolan Islands are the source of iron ore for the Australian iron and steel industry is a strategic centre on the north-western part of Western Australia. It has the only useful port facilities between Geraldton and Darwin and is in marked contrast to the towns of Broome, Derby and Wyndham. Rum Jungle in the Northern Territory is a good example of how mineral wealth can provide the basis for a well established town. Its production of uranium in the first instance and now copper has provided the reason for the carefully planned town with housing suited to its location, as well as a considerable contribution to Australia's economy.

Mount Isa is an outstanding example of what mineral development can contribute to the north. A large and well established community has all the normal amenities available necessary to make this an attractive place to live. Its influence reaches to the coast about six hundred miles to the east. Because of Mount Isa there will be a first class railway system to Townsville and this will be available to the pastoral industry. Because of the refinery at Townsville this will be a much more developed centre.

Mary Kathleen, although now on a caretaking basis, is an example of superb planning and its township is comparable to the best in living standards.

Weipa, the bauxite centre, on the tip of Cape York is now a harbour and a township in an area where few if any such facilities ever existed before. Like Yampi it could be an important strategic locality in the north of Australia. These towns and centres already exist and more are on the way.

Based upon the vast rich iron ore deposits of the Hammersley Ranges of Western Australia there will probably be extensive developments which could involve at least two townships, two railways and a major port. This in turn would require airports and water storage and could transform this area which at present is sparsely settled and little developed.

Similarly at Gove Peninsula on the north-east tip of Arnhem Land where there is another vast bauxite deposit there are prospects of a mining operation, a treatment works and possibly a smelter of great size. This would necessitate the development of a modern town and harbour in what is at present an isolated mission station area.

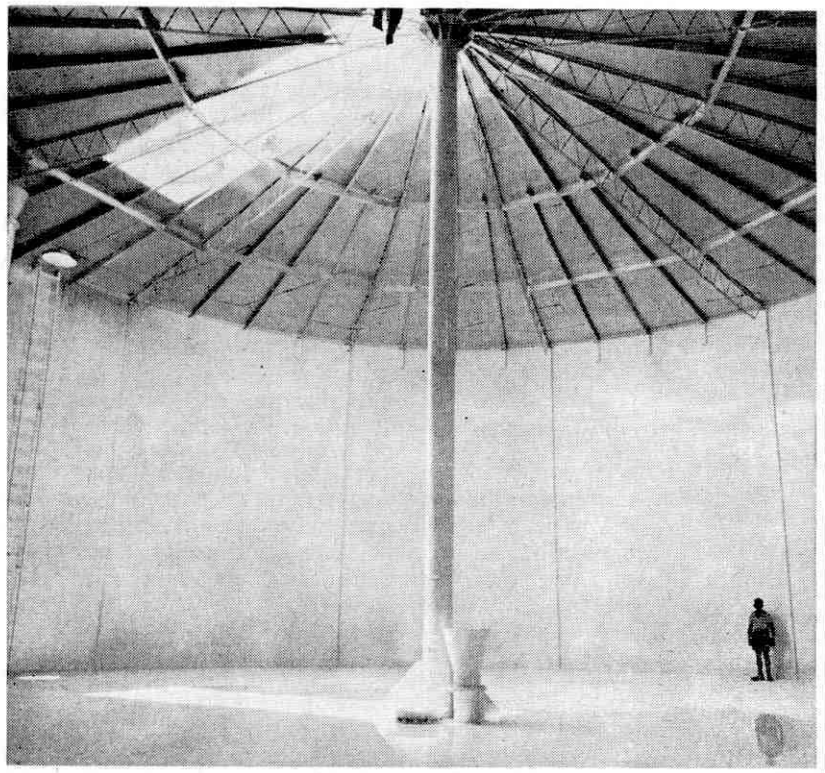
So one can visualise a series of significant towns and harbours across northern Australia based upon mineral wealth. These resources could easily form the basis for a lasting development of this part of our continent.

There is no doubt about the resources, but their development will rest largely on the resourcefulness of the Australians—scientists, engineers and technicians—who will need to contribute the knowledge and the skills that will be necessary.

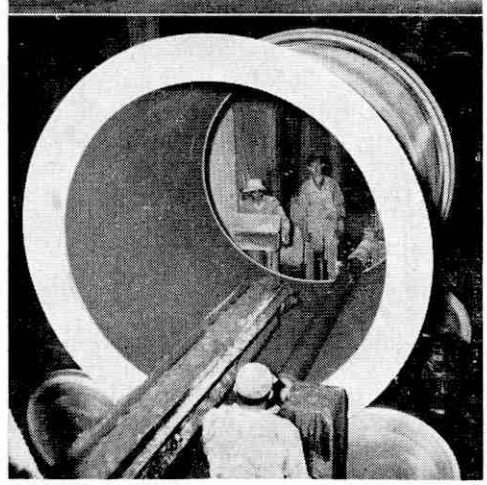
A do-it-yourself husband was left hanging from the roof gutter when the ladder slid away from under him. "Don't just stand there," he yelled at his wife, "do something!"

"I will when I can," said his young bride, "but I've just varnished my nails and they're still wet!"

ON THE INSIDE



of water conservation in Northern Australia



This umbrella-like structure shown above is a 500,000 gallon steel water tank, designed and built by Humes — "the pipe people". It's at Nightcliffe, a suburb of Darwin, which relies on Humes help in water reticulation.

Humes believe in development of Northern Australia, and do something about it in concrete engineering terms. Of course, Humes have a factory at Darwin, making concrete centrifugally spun pipes. Part of the process is seen at right — centrifugal force spins concrete on steel wire cage with gradual build-up to required diameter.

At Alice Springs, to make life better in the "dead heart" Humes are now making pipes for the sewerage system. On the Ord River in the Kimberleys, at Kununurra, there's a Humes factory making concrete culverts for the 500 mile beef road to Derby.

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"THE AUSTRALIAN TROPICS – THE HISTORY AND PROBLEMS OF NEW GUINEA"

By SIR A. GRENFELL PRICE, A.C.M.G., D.Litt., F.R.G.S.

Chairman: Professor F. B. Bull, M.A. (Cantab), B.Sc. (Lond.), B.E., M.I.E. (Aust.)
Professor of Civil Engineering, University of Adelaide.

Sir Archibald Grenfell Price is Chairman of the Council, National Library of Australia and of the Advisory Board of the Commonwealth Literary Fund. As a distinguished geographer, historian, and politician, he is well equipped to present an account of the large island so intimately associated with Australia and which is such an important part of our northern development.

In his recent book, by far the best to read on New Guinea, Garin Suiter calls the great island—"The Last Unknown". Now why should that be? Well of course it is due to the geography and the anthropology. To begin with, the Papuan word now for New Guinea, is "Irian", and Irian means "Hot", and that is pretty well truthful—it is an intensely hot country, hot all the year round unless you are in the highlands, and it is a frightfully rugged country. The soldiers' description of the Kokoda Trail—"up on your hands and knees, and down on your backside", and a good many of the inland journeys in New Guinea today can be described in that way. Then the natives of course were responsible a good deal for it being the last unknown; they've been described as cold black stark-naked savages and man-eaters, more like monsters than human beings. I'm not referring to today, but that is for instance how the Dutch described them. It was only in 1901 when they ate the Reverend John Charles, with a goodly following of religious people. I never know quite why they always cooked their missionaries in sago, but on one occasion when Billy Hughes was holding forth, and they asked why he changed his opinion, and why he was going to allow missionaries into the dangerous areas of New Guinea, he said, "Far be it from me to refuse a New Guinea native to have a little piece of missionary in his sago".

Paul Hasluck said, not long ago, that they were unbelievably primitive—and that's the truth. There is about two million of them—they live in historically hostile groups, and they have numerous languages, quite a number of them in fact, which makes it extremely difficult for our interpreters. Our patrols have too often taken several interpreters to cover quite a small area, because of the different languages, and Lord Hayley said that what we were facing in New Guinea was radically different from that being handled by the Mandates Commission in other areas. New Guinea has been described as a vast bird of prey, hovering over Australia. It is the second largest island in the world, about 300,000 squares miles in area, and our area consists of about 183,000 square miles—in two areas—Papua, the long standing British area in the south, about 90,000 square miles, and the old, very badly named—German New Guinea, New Guinea being a Celt name, of about 93,000 square miles. In other words, each of those areas is about the size of Victoria, but to get mountains going up to fifteen to sixteen thousand feet is a very difficult problem. In many ways, the area is Australian. It's on the Australian continental shelf, and separated from Asia by very ancient deeps. It has a considerable percentage of Australian flora, and the fauna is almost wholly Australian.

Now, the way the people probably got in, there is what has been called a reason of retreat. They were driven in, in the days about 8,000 years ago when the seas were all dry land—same thing down to Tasmania —or they came over by canoe. The first lot were possibly regraids, likewise the people of Tasmania, now extinct—they were very nice people. Then you get a sort of Australian type invading the country—then you get oceanic negros, fuzzy-haired people like the people of Fiji, and finally, some of the delightful Polynesian people, like the people of Tahiti, who just came in at ports and coast settlements. You can imagine the problems that face the Australians, with those incredible mixes. After eighty years, in 1961, there were about 14,000 white males in Papua, and 10,000 females, as against about 1,800,000 Papuans. In other words 24,000 whites, and 1,800,000 Papuans in an area twice the size of Victoria, and the fact that there was such a big predominance of men, white men over white women, this shows that it is not a very good country for white women settlement—unless you take them up to the hills. If you take them up to Baroga, they cool down.

There are usually in these sorts of colonizations, three stages. The first is the moving frontier, which is not well controlled, it merges on both sides, whites and natives, and in Australia, as well as other places, it has been a pretty unpleasant business. Then the missions come in—in places like Canada they control the whole show—in other places like New Guinea they were just very important without riding the country. Finally there is the stage of scientific management, which we've got now in New Guinea, and although the missions are very, very strong, and doing some very good work, their powers are gradually passing to the government. The stage of the moving frontier in New Guinea was not as bad as in other countries—people were killed and eaten, but there wasn't the slaughter as was the case with the Australian aborigines, or the Canadian and American Indians. The missionary stage has been very important—for instance there have been recently, 99 mission hospitals to 100 administration hospitals—and 174,000 children in the missionary schools, and only 21,000 in the administration schools. Thus you can see how strong the missions are. Also, the Christians claim that they've got 900,000 Christians already—almost half the population, 400,000 Roman Catholics, 200,000 Lutherans, 100,000 Methodists, and

50,000 Anglicans, and there is no doubt that the churches have done a very, very good job in New Guinea, though everywhere the churches are inclined to destroy the native social life, and sometimes they don't put anything in its place.

The third stage, I shall deal with later on, is very interesting, putting secondary, tertiary and technical education, and agriculture. Sir George Powie, the great retired vice-chancellor of the University of New Zealand has just been advising on arrangements for the new University of New Guinea. One of the most important things is health. Now this is extraordinarily interesting. If we white people go into a country like Japan or China, we usually don't affect our health much because usually the worst diseases have come out of those countries to us, through Asian peoples and their various invasions of the world—they have brought various diseases with them. Then if we go back, we are only returning the compliment. Of course, there are certain diseases we've brought in. Malaria for example, probably came in a fast white sailing ship, and wrecked Batavia, which was a most healthy place, in about 1750, but where disease becomes so terrifically important is when we white people, or the Asians who come with us, bring disease amongst a non-immune people. Cortez conquered Mexico because of smallpox—three and a half million Aztecs died. Then small pox got up into Peru, and this country was conquered for the same reason. One of the things which has made it very difficult to get information about disease in New Guinea is that we have no record of when disease such as T.B. were brought in—and another thing of course, is that parts of the island are so isolated—you've got these immense valleys and rivers and as the various tribes only saw one another in order to eat one another, this was a very good quarantine against sickness—you don't give disease to people you are just about to eat.

There is no doubt that the rule throughout the Pacific, and including New Guinea, is that depopulation follows a visitor where visitors come in. These visitors bring diseases and very often, depopulation follows. We've spent a tremendous amount of money on native health, and have been doing some very good work, and so did the Dutch.

Now, going to the very little and brief history of New Guinea: As soon as the Portuguese got into the east, and learnt the winds they could sail by, and as soon as the Spanish got across the Pacific from Mexico, again with winds they could sail by, you get a discovery of New Guinea. The first people to find it were the Portuguese, they came in 1526-1527, and called New Guinea the Portuguese name for "the fuzzy-haired people". Then Columbus got across the Atlantic, and Magellan got across the Pacific, Cortez conquered Mexico, the Spaniards began building cities and harbours on the far side, the west side of Mexico, and they began to get across the Pacific.

The actual mapping out of New Guinea—the northern coast, was due to something most interesting. The Spaniards came with the trade winds, and they didn't realize, that to go back they had to go far north and go across to British Columbia, and then down the coast in westerly winds. However they kept trying to get back across to Mexico against the "Trades". They were thus blown back and back onto the New Guinea coast where wrecks may be found every fifty to one hundred leagues right along the coast.

The Dutch came in next. One of the men who discovered the south coastal area was the famous Dutchman Jans, the discoverer of Australia, who has very little to his memory. He was a very fine admiral, and fought for the Dutch against the British, and then joined with the British against other powers in the Pacific, but in 1606 he examined the south of New Guinea and came further down and discovered the coast around the Gulf of Carpentaria. Various other captains followed, but they did not stay long, for the natives immediately rebelled against any intimidation or control.

Then the great Tasman came along, and also the delightful pirate-scientist, Dampier, the first Englishman in these areas, also discovered bits of New Guinea, and I'm glad to say that there is a Dampier Strait today—he thoroughly deserves it. Then Cook came through on his first voyage. He should have been eaten up there, but he had the luck to land on a very lonely coast where he struck only about a hundred Papuans who drove him away. He landed on the beach with practically no followers, his boat was some three hundred yards away, and the ship was anchored out of gunshot range. If he had struck the coast anywhere nearer a village, or anywhere where there were canoes, he would have been killed there instead of later on in Hawaii.

That carries things on till about 1770, about 250 years of indifference. Then people began to get interested in the Pacific. Missionaries, traders whalers, planters, and gradually there was an occupation of places in the Pacific. There was the discovery of places like Port Moresby, and other important New Guinea ports, as well as several important inland expeditions. There was a most amusing fellow named Dalbertis, who took a small steamer of about forty tons up one of the two big rivers, the Fly, and he devised a method for handling the natives—firecrackers. He threw some of these in the villages, and the noise from these little explosions absolutely terrorised the natives. However when his vessel came back is must have looked like a porcupine.

The first settlement was up on Bird's Head. Attempts were made there to get around the monopoly of the East India Company. The East India Company had many stations in various parts of the Indies, and their idea was to try and grow nutmeg plants. They did find a species of nutmeg, but it wasn't a very good one. The Dutch at that time were too busy with Java, and that group of islands now known as Indonesia. However, when Swan River was founded, Britain realised that she must have the whole of Australia, so she founded stations in the north at Raffles Bay and Melville Island and various other places, and she annexed the whole continent. She might very well have gone on and annexed New Guinea, but she thought it was far too expensive and too big a problem for her to take hold of.

Just at that moment, Australia started to move forward, making up its mind that New Guinea was so close that it just must be interested. In 1863, Queensland established a station at Somerset on the north tip

of York Peninsula, a humid fever ridden place, and finally moved across from Somerset to Thursday Island, and they founded the famous Thursday Island station. It was working from there that people like Moresby suppressed the pirates, discovered Port Moresby and helped the missionaries who were just beginning to examine the coast near Australia.

Now we come on to the 1880's. By then, Australia was really getting worried. The French had founded New Caledonia, and had sent out in a short time, more convicts than Britain had sent to Australia. The Americans had grabbed Hawaii. The Dutch had definitely said that they had half of New Guinea, but the most dangerous of all were the Germans who settled in the island near Queensland and New Guinea. Queensland, while all of this was going on, got very worried indeed, and finally when the British Government wouldn't do anything unless Australia paid all the expense, the great Queensland premier, Sir Thomas McGilraith sent the police magistrate from Port Moresby and annexed the whole of the western end of New Guinea. Queensland, with a handful of people, annexed, in the name of the Queen in 1883, the whole of that end of New Guinea. This caused the lordly statesmen to absolutely stand on their heads. Nobody had ever heard anything like it—they had proceeded to set up a doctrine similar to that in the limited States: Queensland did the same thing, it annexed New Guinea, and nobody could come in without the permission of Queensland. To be quite fair, the Australian colonies stood right by Queensland —they had a conference in Sydney, and New Zealand came in, and they passed a resolution that the annexation of any part of New Guinea by any foreign power was detrimental to Australia.

The Sydney conference shook Gladstone, the Prime Minister, but he still couldn't believe that the Germans were serious, and he hadn't realized that Bismarck had turned to a policy of annexation. The British Government fooled about, telling Germany and other countries that they were annexing part of New Guinea, but they agreed to annex only the south until they had a conference with the Germans. There was never the faintest idea that the Germans were moving to annex the northern part of New Guinea. Then on November 16, 1884, they heard that the Germans had sent out a steamer with an officer and that they had annexed the whole of the north of New Guinea. That's one of the very main reasons for Australian federation. The Australian colonies absolutely stood on their heads. Sir Thomas McGilraith in Queensland said that it was the greatest piece of treachery, on the part of the English Government of the colonies, that had ever been perpetrated, and James Service, the premier of Victoria called the actions of the English Government, one of the most melancholy and marvellous illustrations of political imbecility that had ever been recorded in history. It was finally agreed in 1888 that Germany have the north, Australia the south, and the Dutch should have the west of the island. Thus in 1888 Britain declared her sovereignty over 60,000 square miles of savage country with over half a million savage inhabitants.

Now from 1888 till 1946 comes the delightful era of paternalism—benevolent government. Britain started it off—most unhappily—their first special commissioner, Peter Seratchley, died of fever before he could even examine our new black elephant. Then fortunately they sent over the tough Sir William McGregor who was the governor of Fiji, and he really carried on quite satisfactorily for ten years. However, things got really bad when McGregor went. Le Hunte was all right for a time. The next commissioner committed suicide, and then Papua went into a period of intense unhappiness until Australia took over in 1906.

The officials were weak and quarrelsome, drunkenness was rife, there was gold mining behind Port Moresby which failed and things were just about as bad as could be managed. The Australian colonies would only give £15,000 a year to keep New Guinea going, because they said they wouldn't be consulted by Britain as to the way the money was spent. To be quite fair to the British, the Germans made even less advance in the north, and when we took German New Guinea after the first world war, there were only seven hundred and forty six Germans in the whole area. They had been beaten by health, having moved their capital along the coast to different places, and everywhere they moved, more people died, so that their state wasn't very satisfactory.

When the first war came, we properly hopped in and seized the north, and at the Versailles conference, we were given C class mandate—the right to look after the north for 999 years—we haven't had it that long yet. We made a tremendous sensation at Versailles. Billy Hughes, who conducted things very vigorously for Australia, simply said that we were jolly well going to have German New Guinea, and that was that. President Wilson who was a university and academic man, said—"do you really think Mr. Hughes; that in certain circumstances Australia would place herself in opposition to the whole world?"—and Billy's reply was: "that's about it Mr. President." Well we got German New Guinea, and we then had the whole eastern area, and for a considerable time, New Guinea was ruled benevolently, paternally if you like, by the most remarkable man—Sir Hubert Murray, of Papua. He was an Irish born Australian who took several wives and religions during his life. He was an amateur boxing champion of England, he rowed in a Magdalen College eight, and he had A grade athletic successes, and served very well in the Boer War. He decided that he would take over the management of New Guinea, and he kept it from about 1906 till 1940 and nobody could do anything with him. He unfortunately didn't get enough money to do what he should have. Australia gave Papua up to £40,000 a year, but it made the north support itself, most unfairly, by the gold discoveries at Bulbola. Everything considered, Murray did a very, very fine job.

Then came the second world war. The Japanese won the most amazing succession of victories, defeating Britain, America and of course Australia and France, in the Pacific. We didn't know if they would invade Australia or not, but it appeared that what they were to do was seize Port Moresby and establish a line of bases from Moresby right up through the Aleutians to the Artic. After Pearl Harbour came the battle of the Coral Sea at which they were defeated, and they were then unable to come around the coast to Moresby. Then the Japanese tried to come across the famous Kokoda

Trail, and there we beat them, largely by the use of medicine. On the average, every man went into hospital four times a year with malaria trouble. The Australians were in a winning position against dysentery however, as we had a good American drug, whereas the Japanese had nothing with which to combat the disease.

Now, I shall finish with the most interesting side of New Guinea today—the post war problems of this fascinating country. After the second world war, we came into a new world. The Japanese had destroyed the myth of the white man's superiority. The division between Communism and Democracy was bad. Finally, the invention of the atomic bomb was playing a dominant part, as nobody dare use atomic weapons.

So it was in New Guinea, a new world. Australia got trusteeship over New Guinea, but immediately, young nations who had achieved independence, started the movement for the independence of New Guinea. From 1946 till about 1960, the pressures on us have not been very strong, and we were able to put into New Guinea a policy which is called "gradualism"—the movement forward slowly of all departments, side by side. However, several things affected us tremendously. First there was the pressure of these natives. Then there was the loss of Dutch New Guinea to the Indonesians, and then their own attitude.

Taking the post war changes very briefly, it was very easy to repair the material damage from the war, but it was very difficult to alter the psychological change. The New Guinea native had changed from a world of barter to a world of money, he had seen how the white man lived, how the troops fed, and he wasn't satisfied. Then we get the rise of cults who preached the arrival of a coloured saviour who would arrive with a whole cargo of white goods and drive the whites into the sea. Even though the coloured saviour and the cargoes didn't arrive there was still the desire of the native for a better thing.

The next thing was the removal of the Dutch. The Dutch had put most of their work into Java. I have had the opinion that, of all the colonial peoples, the Dutch were the most competent, the British were nice and fairly good, the French were delightfully haphazard, extraordinarily incompetent, but got on very much the best with the native people. 1961 the Dutch were really doing their best in New Guinea, getting 77 per cent. of the love and middle possessions in the administrative service into Papuan hands. I believe they stayed in New Guinea because of an earnest desire on their behalf to help the New Guinea people.

They formed the New Guinea Council of Papuans, and were really doing their best to train the Papuans to govern the country. Then, of course, came the take-over by Indonesia in 1963, and at the same time, Soekarno and cholera entered West Irian. It is perhaps a little early to judge whether or not Soekarno will let these people in New Guinea form their own Government. This take-over had a very marked effect on Australia, whose policy changed from gradualism to rapidly galloping advance—I'm calling it impetuosity. It was very necessary for us to be impetuans; for one thing, the Prime Minister came back from England saying that we must get a move on at once, developing southern New Guinea to a state where they could have their own independence, or we could be driven out like the Dutch. In the U.N., the trusteeship council found that we had not produced a single New Guinea university, or even worse, a single New Guinea graduate, and the trusteeship council said very rudely that after fifteen years trusteeship, this did not speak well in the field of education.

Then the U.N. passed a resolution that every people should have freedom as soon as possible, and the U.S.S.R. tabled two amendments. The first was that we must immediately set a date for independence—that was defeated by six votes to one—but six nations abstained: The second Russian amendment was that we should submit to the council a plan for the irradicate self-government of the territory. That gave us a bit more time and it was defeated only by six votes to five. The nations which supported Australia were—U.K., U.S., France, Belgium, Australia and New Zealand; those opposing were Russia, India, Burma, U.A.R., and Bolivia, with China and Paraguay abstaining.

Well, we've passed an act already for a native parliament of fifty-four. We've held the election and on the 6th of June the Governor-General opens this new and delightful parliament. The feeling is that it may shape into quite a decent parliament. The leadership will be in the hands of the whites who have been already elected. In a few areas, actually native areas, the natives have elected whites. It looks to me as if it will be white leadership in the beginning and gradually the leadership will go across, as it should to the New Guinea people themselves.

Paul Hasluck made a statement recently saying that we have civilised 50,000 square miles of savage country; we've got about 8,000 natives and 3,000 whites in the administration; we've got five modern harbours, 5,000 miles of road, four large hospitals and 101 subsidiary hospitals and 100 mission hospitals. We have nearly 6,000 people, whites and natives, in the medical service; about 6,000 whites and natives in the teaching service; 4,000 schools and 196,000 pupils. We've established a forestry department, a great agricultural research bureau and a lands department. The trade has risen to forty million pounds a year and we've given something like forty-six million pounds to health. This means that the average Australian family of five is giving about £20 a year.

What about the future? We've got three alternatives. We could kneel to the pressure of what you might call the irreconcilables on colonialism, we could clear out. What's going to happen to those two million Papuans if we do clear out? These people who were so good and who put up such a good job as carriers and so in the war. I don't think we can possibly clear out. Secondly, shall we ask it to join Australia as the seventh state. I'm very much of the opinion that we must give very serious thought to admitting Papua, if they want to come, as a seventh state. The Americans have done it in Hawaii which is largely Japanese and Chinese and it's been the greatest success. These people are half Christian and I really think that we should think of tearing down the white Australian policy to give them every chance as equal Australians. I think we could do a tremendous lot of good if we did that.

But, however, that is not what most people think. They want us to go on and build up a so called "educated elite" who can really run Papua-New Guinea for themselves. The general opinion is that to do this we may only have from ten to fifteen years, because we will be under pressure all the time from the Russians and so on. It is going to take us some time to establish the New Guinea and we will try to stay in New Guinea for ten to fifteen years entirely to help the New Guinea people.

Whatever we do, I do hope we will act in such a way that we will leave behind us, and go as go we must, and leave behind us a people with stable civilisation with nothing towards Australia but gratitude and goodwill.

YEAR NOTES

1st YEAR NOTES

General Physics consisted of three lectures a week and an informative (!!) tutorial of one hour duration. Lectures (hah!) involved listening to some poor chap give his astounding and most revealing theories on varying topics while comments from the gallery flew thick and fast. If any unwary outsider had walked into the lecture theatre when our tutorial was about to begin he could not have been blamed for thinking it was a convention of aeronautical engineers, since darts of all shapes and sizes filled the room and it seemed as though a miniature battle of Britain was being waged between different sides of the room.

Maths, Ho-hum! Yawn! Now to begin, but where? I think that the only thing worth noting in this subject was the essays introducing different topics which usually managed to bring a "hiss" from the bored students.

In *Chem 1A* we attended two lectures a week (I think) and a chem prac. Before the lecture had begun one could amuse himself by reading jokes inscribed on the ancient desks or add a few himself. When Dr. (Crystalline) Kennedy entered one had to keep awake to follow the constantly changing subject amid gutteral tones as he cleared his throat for the next word. When the prelab in chem was over we entered the Johnson laboratories for two hours of drudgery. However, the monotony was broken at times, when, amid great cheers, a sombre face began to pick up the remnants of glass apparatus which had been dropped from his "hot trembling hands".

Graphics is a subject the least said about the better and it was fortunate we were only tortured with one lecture and practical a week. However, Slaby tells all!!

At lunch time on Tuesday we attended a *General Engineering* lecture given by that most humorous gentleman Professor Bull. It appears that every thing in the engineering world is a "thundering big one".

The only glimpse of *Workshop Practice* I got was when I accidentally walked into the wrong room just in time to catch a glance of the flash of a welding demonstration.

Thus ends this brief report of first year class notes and I must inform the reader that no correspondence will be entered into and the judge's decision will be final.

2nd YEAR NOTES

Take a young, freckled faced exfresher, screw on an industrious mind, oil well with nathon, paint with a smattering of sex, then integrate—the result being the second year engineering students. Yeah, beneath that beatle haircut and angelic face lies a facade of intrigue and corrupt. But can we blame them—these poor misguided anti-socials who are but tools in the hands of the lecturers. Let us then delve deep into the characters of these men who are guiding our future, and reveal the sadistic truth. To place the guilt on those responsible we shall be adamant about names, placenames and subjects.

According to the Physics Department, variety is the spice of life, as was shown by the vague assortment of contrasting personalities endured this year, the most popular, of course, being high strung Bevan who made a big hit with the boys. In striking contrast was Bashful Eliffe, the chap who considers every second student has a personal grudge against him and the lethargic and uninspiring Professor Murray who presented an excellent copy of the last ten years' lecture material. Bashful holds the unique distinction of being the only staff member who can officially walk out of a lecture at 20 past the hour and then spend 40 minutes speaking on what he should have lectured upon.

Mr. Pascoe, a materials lecturer, yet a strong personality, who was on a year's furlough from England, became perhaps the most popular of the staff because of his unassuming ways and his humane interest in the students. Two of his most notable achievements which spring to mind are his research in the forties, which I understand, won the war for us, and his excellent text book which rocketed phenomenally into the best-seller list early in the second term.

Among other things, clock-worshipping became an exciting and lucrative sport on Mondays, Wednesdays and Fridays at 12.30 sharp. It is amazing that this chap, who wouldn't accept a class exercise thirty seconds late, could continue lecturing for sixty minutes without a twinge of conscience. Fortunately the craze caught, and many students spent the time ticking off the seconds. Anyone for seck's, chaps?

Practical experience in telling old jokes without getting a laugh was gained in Mechanics and Hale and Hearty made good as instructor. Especially poignant were his spicy comments on the bottom of weekend papers. An insult—we never cheated! Anyway, who wants to know what happens when a ton lb. weight hits a spring at 15 ft. per second?

However, among all the lecturers was one overwhelming character, a man amongst men, who stood head and shoulder above the rest of the inferior plebs. Who, but this man, could state so confidently in his preliminary lecture that he was the most unpopular lecturer in the whole faculty, and then spend the rest of the year proving, so convincingly, that it was true. He was often seen slinking through the corridors with hands plunged deep into his pockets furtively smoking a filter and looking like an amateurish James Bond. Accounted to be brilliant with a pencil his abilities did not surpass his eloquent and powerful speaking voice which was a joy to listen to, if one sat in the front two rows. Perhaps a classic of his tacturn humour was a challenge in one lecture for a comment on a particularly ridiculous statement. Many voices were lifted in subtle vulgarity.

However, we must congratulate all of the lecturers for the conscientious way they marked the roll each day, for putting up with Rog Humphries and for failing 50 per cent. of us. Yeah kids, let's raise our voices in three tumultuous cheers for these enlightened men and hope and pray individually that we pass.

3rd YEAR NOTES

The year of the class exercise—when the maturing student, beginning at last to see a little of the engineering light penetrating the shrouds of chemistry and physics (etc., etc.,) struggles to maintain equilibrium between "strength" and sex, "E.D. and D" and booze, sex and booze!

Gamely he battles on, as the reports and weekly question papers redouble to engulf him. Further adding to his despair is the separation from his mates—thus the civil alone defends against the pebbly-headed geologists, and the mech. reminisces for W.P.I. as he redons his overalls and falls headlong into the grind.

Let us now briefly summarize the opposing forces. Elec. S—Every word deciphered is a major triumph.

Strength of Materials—The battle of the P's..... .O41P!

Engineering Drawing and Design—In a word—Dynamic!!

Maths II (E)—The Yank's popularity is undoubted—Saw July 4th and the whole class (?) arrived to help celebrate.

Surveying A—Sum for today:

2×3	log 2	·301032
$= 6 \cdot 00235$	log 3	·477093
		·778125

Elec. I—Thought for today:

R-L-C-R-L-C-R-L-C-R-L-C

= Column of three-legged soldiers

Chem. IIA—.....?..... Sheday!

No small wonder that this is the year that knocks them out! However, there are occasional fleeting moments of light (in spite of determined efforts to the contrary in the elec. laboratory) and it can safely be said that the lot of the third year engineer is not an unhappy one. Where else is there found such strength of character, such unity of purpose, such purity of desire?..... anywhere!

4th YEAR NOTES

These here fourth year notes aren't gunna be much cause I'm a typical fourth year crude and I haven't got time to write anything flash, and what's more I'm the only idiot, silly enough to get caught for the job or imposition or whatever the b.....y thing is.

If you think that was long for an opening sentence, you oughta see the cotton-pickin' sentences we write in our lectures, when the carried away lecturers (in a world of their b.....y own), talk and gab and chant and rave and warble .....etc. on and on and on .....etc. and we poor suckers break our scrawny arms trying to keep up with them but all the time wondering what the hell they're raving about and what its got to do with the price of eggs. (N.B. Eggs have got nothing to do with these notes but they're good for a couple of lines, as is this explanation of why I mention eggs anyway.)

We were given a choice of two choice subjects at the beginning of the year, Maths III or Economics. Those would be business tycoons who took Economics found out what a useless time waste it is, cause they don't tell you how to cheat on the Stock Market but just how to sit in a tutorial and argue and scream like a barrel full of half-witted monkeys. Those stars who took Maths found out that, as usual, all that was wanted was BLUD.

I've nearly lasted long enough so I'll summarize the year with the following smart comments:

(a) The best way to finish a crumby lecture is to rattle tea cups.

(b) Looks can be deceiving, some lecturers look human.

(c) Lecturers are to find out what text book the subject is in.

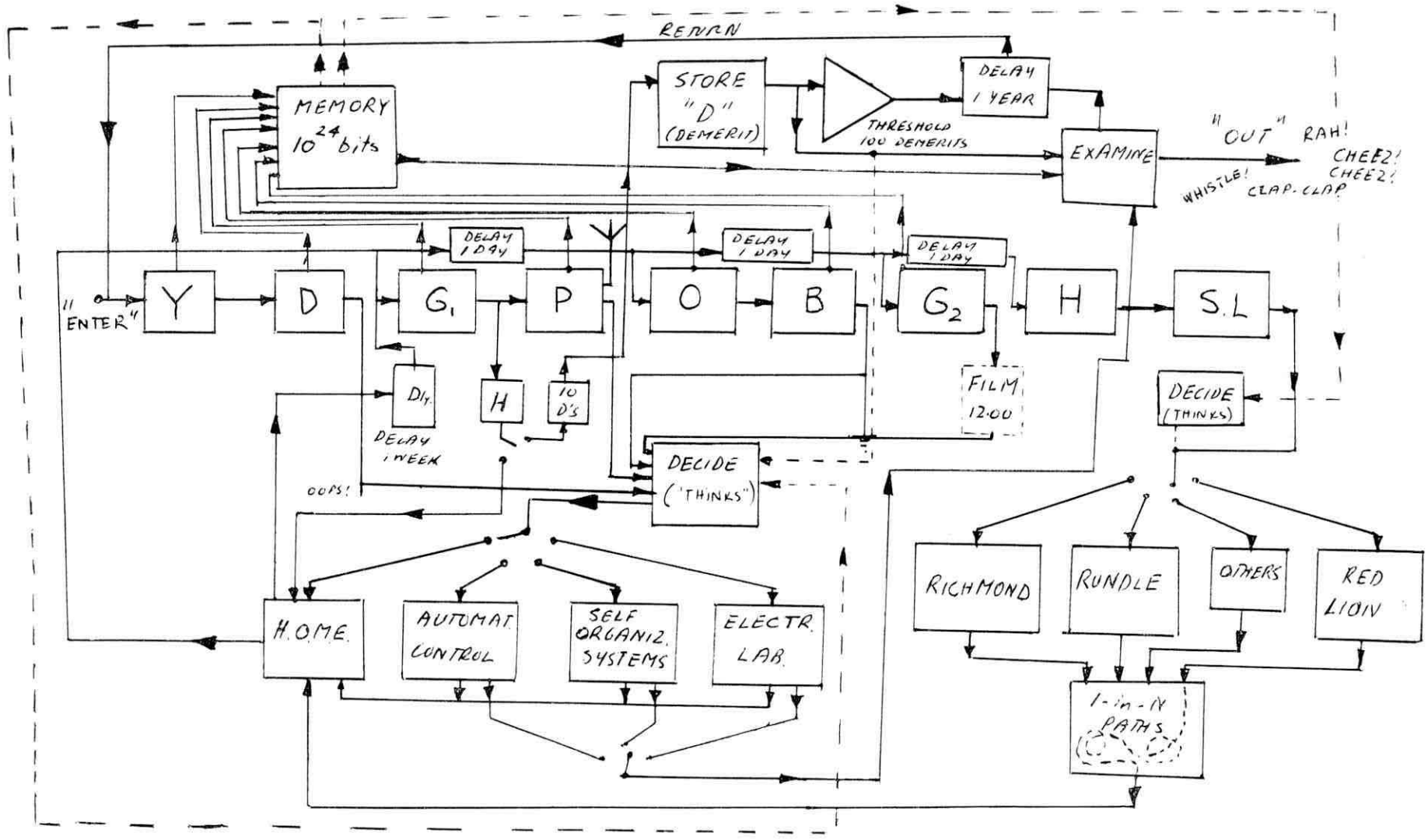
(d) Nothing in the Hydraulic lab. works.

(e) Architecture is learning how to draw on lavatory walls.

(f) There must be an easier way to make a living.

N.B. Note the brilliant John Lennon style of writing an article about nothing, in bad English and getting it published.

(ED. We are sorry to publish this, but as he said, he is the only idiot we could catch.)



SYSTEM DIAGRAM OF FINAL YEAR ELEC.

FINAL YEAR ELECTRICAL NOTES

Explanatory Notes and Characteristics of Main Line Blocks.

Y— at input, response is very sluggish. Y does nothing at all to liven system up or to increase response. Re-examination whether Y is necessary is recommended.

D (D.A.V.E.)—characterised by optimum redundancy arrangement, e.g., an information overlap of 95% when operating in F.O.S.T.E.R. mode.

G,—components produced by G.E. (U.K.). Most sensitive block in system. Initiates a function to check input with output (or if you like output with input) to itself via the F.B. block H (H.O.M.E.W.O.R.K. function). A fault in this F.B. loop, such as absence of H. function is shown by the generation of another output, D, in units of DEMERITS, which are stored and evaluated at given intervals and fed to a threshold device (threshold usually 100 D's), which when an output is given, initiates a new re-entry procedure into system with an inbuilt delay of 1 year.

P— (P.R.O.F.)—function of this block is open to some dispute. Most agree, however, that it is characterised by incessant interrogating to determine whether input is "following". When no results from interrogation are obtained, it radiates (via antenna) signals stating that "Feedback is lacking". Difficult to produce a physical picture of this block.

B— very fast system. In fact so fast that input has difficulty in following it, with the result that a progressive delay of 3-4 LINES of message is quite common. Another disadvantage is the occasional poor resolution of characters and symbols.

O— abbreviation of a damned difficult word to spell. Mostly made from imported components. Aware of its limits, it stops in middle of operations to recharge its local power supplies. It originally replaced system B.O.B., a self programmed component.

G2—Way out staff. Hence digitalized. Has disturbed some "observers" by appearing as an analog system one Thursday morning and has stayed so until date.

H—baffles even the experts. Consisted of a set of unconnected components appearing sequentially for a given period. Function known only to designer. Block H disappeared one day much to the delight of observers. Hasn't been heard of since.

S.L.—Claimed by majority to be a completely redundant block which merely causes an unnecessary time delay to reach blocks following it. Its main characteristic is the large proportion of Phillips components.

SELECTIVE COMMON BLOCKS

H.O.M.E. (not to be confused with OHM)—shows interesting cyclic probity function of entry p (H) over other blocks. Cycles consists of 10 weeks' duration with

$$P(H) = 1 \quad \text{for} \quad 0 < ti < 8$$
$$P(H) = 1 \quad \text{for} \quad 0 < ti < 10$$

ti in weeks

Other factors affecting p (H) are

(1) Time of day in a particular subgroup of time, ti.

(2) Physical condition.

(3) Mental condition (i.e., personal traits concerning humour), ("let's go to labs. for a joke"), surprise, fears of physical violence from lecturer, etc.

A.C. Lab.—A dry joint.

S.O.S. Lab.—So called because anyone wishing to work there really needs help. Others claim it is more subtle than that—the input organises itself to produce an output, with no outside help.

It is characterised by a complete absence of components. Thus the input is faced on entry with an O.C. implying that the internal impedance is infinite which is demonstrated by fact that no output is possible no matter how large the input.

E—Lab—Consists mainly of old components and occasionally no components at all, with the result of a high failure rate. Although it has been known to surprise operators and produce an output on odd occasions. Resonates to the sound of "OHM, SWEET OHM".

GENERAL NOTES.

(1) Total system has a naural frequency of 1 year duration or O. C.P.S.
With natural frequencies of subsystems of duration of 1 week or 0. C.P.S.

(2) High failure rate is inherent is system

(a) Internal impedance too high.

(b) Too many dry joints.

(c) Failure in any one of the main line blocks produces complete failure.

(d) The universal function £ (s. d.) occasionally is inadequate.

(e) Input is sometimes lacking (with disastrous results on output).

FINAL YEAR CIVIL NOTES

The Final Year Civil Engineering class this year has made several major contributions to the science and practice of Engineering.

A study in statistics, aided by practical experience in the "Racing Jackpot" and "Football Pool" whilst not profitable financially (as yet), has produced some good co-operative work indicative of the high intelligence quotient of the class.

Another major scientific contribution has been the invention of the "Linn Game". This is an absorbing intellectual study in three dimensions characterised by random selection in almost infinite combinations and permutations. The frequency of occurrence of four noughts or crosses in a row is statistically astounding.

Other investigations are being made in the realm of soiled riddles, presented weekly on Thursday mornings. Unfortunately, the pure-minded members of the class have made little progress with this work. They have been too busy star-gazing.

Notable community contributions have been made by Messrs. Patterson and Richardson. Their results tend to disprove the theory that there are more males than females in Australia. At the time of printing we are awaiting the results of "Skeet" Ryan's project before jumping to conclusions. Messrs. Phillips and Laslett are hoping to conduct similar experiments next year.

REPORT ON THE ANNUAL DINNER

By our Special Drink Correspondent

The Annual Dinner of the A.U.E.S. was held at the Gresham Hotel, North Terrace, Adelaide, on Wednesday, 5th August, 1964. All present will agree that it was a pretty wet show. Nevertheless, the food was good and floated well in the liquor consumed.

Ten Staff members joined the "boys" for the evening, and I am sure that they enjoyed the occasion as much as the rest of us.

The guest speaker, Mr. Kinnaird, a well known Civil Engineering consultant, and graduate of Adelaide University, spoke briefly on the narrow outlook of the majority of engineers engaged in the profession today. He emphasised the importance of taking a wider interest in the development of the engineering vocation, particularly in keeping abreast of modern trends and innovations. He said that it was the duty of individual engineers to show their initiative and foresight in the planning of Australia's technological progress. As the engineers of tomorrow, it was our professional obligation to pursue these ideas and not become wholly occupied with humdrum, trivial technical problems.

The Dean, Mr. Farrent, took the opportunity, in replying to the toast, "The Staff," to reminisce about the old days of the wars, of which we know little, but which he assured us did have their good points.

John Hutchinson, with miles of paper towel, told us the one about the three women and the automobiles they handle so well.

The Vice-President said too much, but it wasn't entirely his own fault. Most of the words were put into his mouth by other people.

The Civil Engineering Department showed its superiority both in numbers present and liquor consumed. The jocularity of the Fourth Year Class was particularly noticeable.

Those present will agree that the evening was most enjoyable, although the morning after may not have been.