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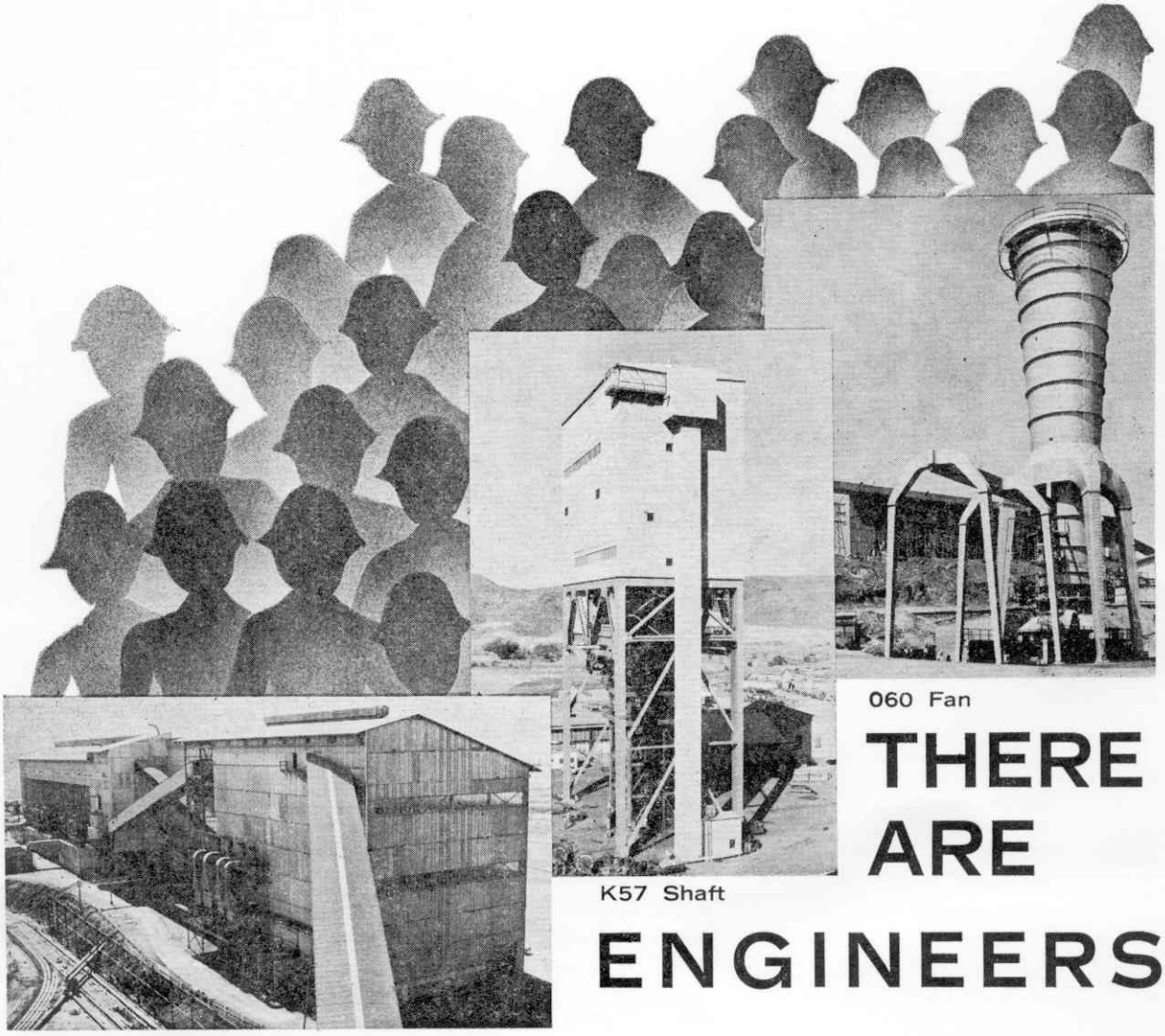

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HYSTERESIS

1969

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PREFACE

This year the Year Book has had two editors. Together we have had an interesting and rewarding time, experiencing the problems associated with the production of a publication such as this.

Apathy amongst our fellow students left us with no other choice but to write many of the general and society articles ourselves, an unfortunate occurrence which should not have been necessary.

In future years it might be advantageous to have an editorial committee, consisting of an editor and several assistants to be responsible for advertising, photographs, society articles, etc.

We have strived in the idealistic way of all editors to produce a "bigger and better" publication, particularly in regard to presentation and articles.

However, because of the difficulty in acquiring sufficient advertising, we have been able to introduce few of our planned innovations, and the reader will find little difference between this year's effort and that of last year.

ACKNOWLEDGEMENTS

The Editors wish to express their sincere thanks to:

All contributors

Kay and Maxine for typing

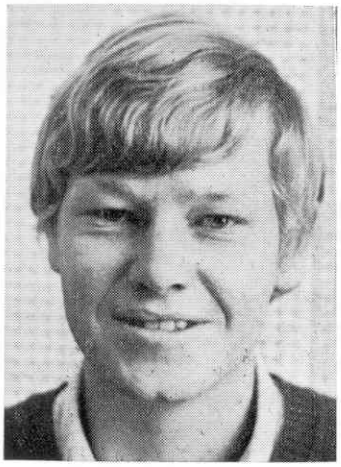
Mr. T. J. Duffy for valuable advice on Advertising

Staff members for assistance with reports and articles

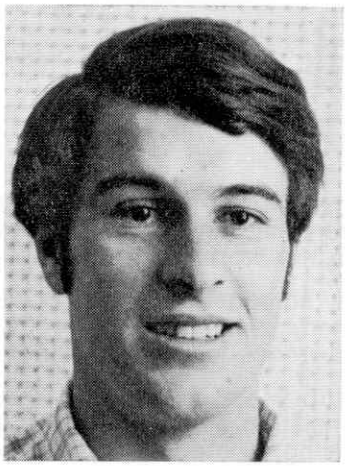
Advertisers

Printers

EDITORIAL



JOHN SANDLAND



ANDREW FLETCHER

As professional engineers of the future we will be facing an ever-expanding array of complex techno!ogical problems. Naturally, technical know-how will continue to broaden at a similar rate, hence, since any individual can absorb only a limited amount of information, specialization will become increasingly evident.

Any major problem will demand that a larger number of specialists, both within the bounds of engineering and outside it, will be working towards a final solution. However, as Professor J. K. Galbraith of the "Affluent Society" fame once noted:

"The world to its discredit does not naturally divide neatly along the lines that separate the specialists."

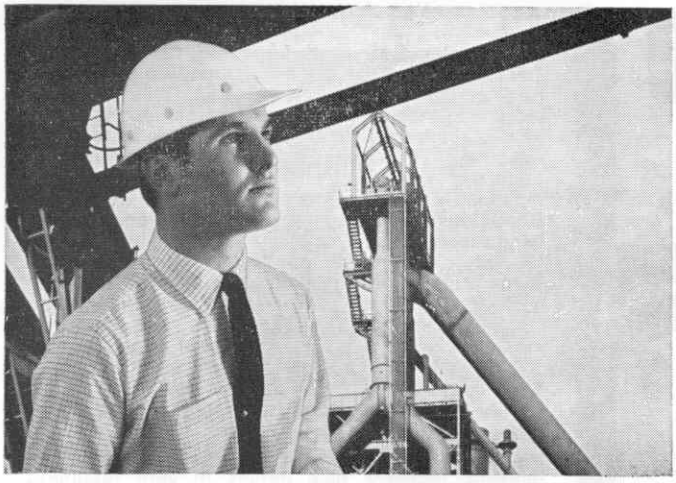
In order that the solution most beneficial to society be found these individual units must be able to effectively communicate on a common level so that their respective contributions will synthesise in the proper perspective to form a workable answer.

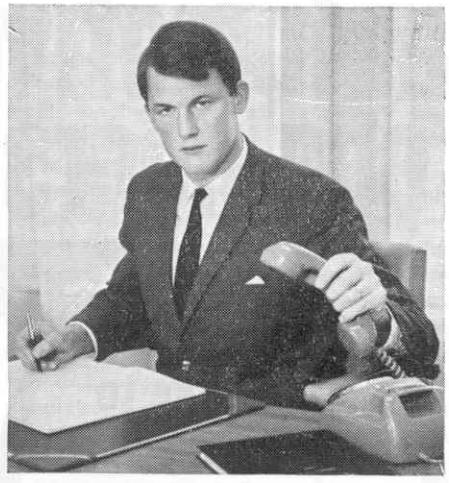
The art of communication can easily be overlooked by an engineering student if his response to his university education is limited entirely to his engineering course. Because of the large quantity of technical information which must be absorbed in a relatively short time, the course can make little provision for this broadening process which is an essential part of any student's education.

It is essential then that the engineering student go outside his course and, of more value, outside his faculty and take advantage of the unique university environment so readily available to him. Here he can meet and talk to all kinds of people with all kinds of ideas, backgrounds and personalities. To ensure successful communication with people a great deal of experience and variety is essential and it is best and easiest to learn whilst still young. We should join as many clubs and societies as practicable and enter fully into the true University life. The experience gained, especially in committee work, can be of much value in future professional life.

In connection with this is the increasing use of engineers in more general administrative and executive positions in industry. This means that, broadly, we shall be dealing with both materials and men. It would seem, then, that if some sort of management training were squeezed into the course the overall education of the student would be benefited.

At the present time there is a drive to improve the status of the engineer in the community. For this to be achieved the engineer himself must be willing to branch away from the conservative and narrow path along which tradition seems to have led him. At university the engineering student learns the basics, and only the basics of his chosen profession. Surely, too, the campus is the place to learn the "basics" of human relations and the ability to communicate with other specialist sections of the community. Then, with time and experience, the graduate engineer should become a capable leader and a respected man in the community, thus contributing in a real way to the improvement of the status of the engineer.





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THE DEAN'S PAGE

by Mr. G. Sved
(Dean, Faculty of Engineering)

NINETEEN SIXTY-NINE— A YEAR TO REMEMBER

Every year is memorable to some of us perhaps because it was the year when we first went to high school, or first went to the University, or had our first date (not necessarily in this order), or for some other reason; however, 1969 has some common memories for all of us. None of us is likely to ever forget the day on 21st July, 1969, when one of the greatest—and costliest—engineering projects of all time accomplished its aim—before our incredulous eyes Neil Armstrong made the first human footprints in the moon dust. We listened eagerly for his first careful prepared spontaneous words, "That's one small step for a man, one giant leap for mankind", and were perhaps a little disappointed when the cosmonauts did not leave the flag of "all mankind" (or at least 5/6th of it), the flag of the United Nations behind. We were all proud to belong to the profession that—with some help from our brethren from other professions—made this triumph possible. It was a project in which engineers of every kind co-operated to provide the launching facilities, the structures, the engines, the mechanisms, the combustion processes, the computers, the communication facilities (including a T.V. camera that worked on this occasion, even if it let us down the next time), and we were proud to know that Armstrong and the two members of his crew were graduates in Engineering! For the next few days every engineer walked, worked and slept with his fingers crossed and only when the three cosmonauts stepped on the recovery vehicle did we breathe a sigh of relief: another "scientific triumph" was achieved, thus avoiding the stigma of another "engineering failure".

Turning to our micro-cosmos, the University, we saw some important changes. Although the long-debated revision of the University Act is probably still going to be debated for a long time, we have now two "student members" on our Council—even if one of them, Peter Balan, a final year Electrical Engineering student, is really a graduate. (Peter, who is also the current President of the S.R.C., was awarded a B.Sc. degree earlier this year.) The Faculty of Engineering set up a committee, called the Dean's Committee, with equal representation from staff and students. Although the mechanism of electing the student representatives (Andrew Fletcher (Civil), and Michael Makestas (Chemical), Warren Marwood (Electrical), Ray White (Mechanical) and Ross Patterson and Mark Gilbert (general representatives)) delayed the start of the Committee's work, we had two useful meetings and I for one look forward to the successful operation of the Committee next year.

None of the 71 young engineers who obtained their degrees last year, nor the 98 whose names will be included (we hope) in next year's list, should have any difficulty in finding suitable employment—thanks to the unprecedented peace-time expansion in Australia. Of course not all of the 98 will work in Australia. This number includes 18 who came to us from neighbouring countries to get their engineering education in Australia. We all hope they enjoyed living and learning here as much as we appreciated having them with us; we trust we have formed the same lasting friendships with them that we formed with earlier overseas graduates.

To finish on a sad note, I remind you of the deaths of two of your colleagues, Raymond Beames (Mechanical) and Geoffrey Clark (Chemical); we all extend our sympathy to their relatives and friends. We also extend our sympathy to all who get hurt, maimed, or killed by the misuse or abuse of the work of engineers on the roads, in Biafra, in Vietnam, and other tragic spots on this Earth.

FACULTY OF ENGINEERING STAFF

CHEMICAL ENGINEERING

Professor and Head of the Department:

ROBERT WILLIAM FRANCIS TAIT, B.Sc. (Edin.), Ph.D. (Birm.)
Appointed Senior Lecturer, 1950; Reader, 1955; Professor, 1963.

Professor:

DAVID ROSS MILLER, Ph.D. (Melb. and Camb.), Materials Science.
Appointed 1966.

Senior Lecturers:

TERENCE NORMAN SMITH, B.E. (Syd.), Ph.D.
Appointed Lecturer, 1959; Senior Lecturer, 1964.

CARL PATRICK JEFFRESON, B.E. (Syd.), M.Tech. (N.S.W.).
Appointed Lecturer, 1965; Senior Lecturer, 1969.

Lecturers:

DAVID REGINALD GLYNDWR WILLIAMS, Ph.D.
Appointed 1965.

MALCOLM JAMES MESSENGER, Ph.D.
Appointed 1966.

MICHAEL JOHN STORY, Ph.D. (Camb.), B.E.
Appointed 1968.

Part-time Lecturers:

ROBIN GUION ELIX, B.E.
Appointed 1964.

GRAHAM JAMES HADDOW, B.Tech.
Appointed 1966.

CIVIL ENGINEERING

Professor:

FRANK BERTRAM BULL, M.A. (Camb.), B.Sc. (Lond.).
Appointed 1952.

Readers:

GEORGE SVED, Dip.Mech.Eng. (Bud.).
Appointed Senior Lecturer, 1950; Reader, 1958.

ROBERT CULVER, B.Sc., B.E.
Appointed Lecturer, 1949; Senior Lecturer, 1954; Reader, 1966.

Senior Lecturers:

ARTHUR JAMES ROBINSON, B.C.E. (Melb.).
Appointed Testing Officer, 1937; Assistant Lecturer, 1940; Lecturer, 1946; Senior Lecturer, 1950.

DONALD HENRY TYLER, B.E.
Appointed Lecturer, 1953; Senior Lecturer, 1960.

MAURICE ARNOLD, B.Sc. (Eng.) (Natal), Ph.D.
Appointed 1960.

DAVID BEAVINGTON CRAWLEY, M.A. (Camb.).
Appointed 1963.

DAVID STIRLING BROOKS, Ph.D.
Appointed Lecturer, 1958; Senior Lecturer, 1967.

DENIS ARTHUR CUMMING, M.A. (Oxford).
Appointed 1967.

JOHN ROBERT EWERS, B.E. (W. Aust.).
Appointed Lecturer, 1965; Senior Lecturer, 1969.

Lecturer:

DAVID JOHN MALE, M.A. (Camb.).
Appointed 1967.

ELECTRICAL ENGINEERING

Professor and Head of the Department:

JACK LIONEL WOODWARD, B.E. (Cant.), M.A.Sc. (Tor.).
Appointed 1966.

Professor:

ERIC OSBORNE WILLOUGHBY, M.A., B.E.E., B.C.E. (Melb.).
Appointed 1946.

Senior Lecturers:

DAVID CHRISTIAN PAWSEY, B.E.E. (Melb.).
Appointed Lecturer, 1952; Senior Lecturer, 1960.

BRIAN HARTLEY SMITH, B.E.
Appointed Lecturer, 1961; Senior Lecturer, 1965.

DONALD WARD GRIFFIN, B.A., Ph.D.
Appointed 1965.

DOUGLAS ALBERT PUCKNELL, B.Sc. (H.-W.).
Appointed 1967.

PETER HAROLD COLE, B.Sc., Ph.D. (Syd.).
Appointed 1967.

Lecturers:

GEORGE KAROLYI, B.E.
Appointed 1961.

BRUCE RAYMOND DAVIS, B.Sc., Ph.D.
Appointed 1964.

Part-time Lecturer:

ROMAN MARIA ANTHONY OLESNICKI, Dip.Eng. (Lvov.).
Appointed 1955.

Honorary Consultant in Communication Engineering:

ALBERT J. SEYLER, Dipl.Ing. (Munich), D.App.Sc. (Melb.).
Appointed 1966.

MECHANICAL ENGINEERING

Professor:

HENRY HARGAN DAVIS, B.Sc., B.E. (Syd.), Ph.D. (Camb.).
Appointed 1946.

Reader:

JOHN MANNAM, Ph.D. (Birm.).
Appointed Senior Lecturer, 1959; Reader, 1963.

Senior Lecturers:

WILLIAM DEVON DOBLE, B.E. (Syd.).
Appointed 1955.

ANTHONY GEORGE THOMPSON, B.E. (N.Z.), Ph.D.
Appointed Lecturer, 1958; Senior Lecturer, 1962.

ALLAN SHAW, B.A. (Brooklyn), B.M.E. (N.Y.), M.E.
Appointed 1962.

MAXWELL KENNETH BULL, B.Sc., B.Mech.E. (Melb.), Ph.D. (S'ton.).
Appointed 1964.

JAMES HENRY FOWLER, B.E.
Appointed Lecturer, 1956; Senior Lecturer, 1965. (On leave.)

JAMES ROSS DYER, B.E., B.Ec.
Appointed Lecturer, 1961; Senior Lecturer, 1965.

PETER ROBIN SANDERSON, B.E.
Appointed 1969.

Lecturer:

JOHN MARTIN PICKLES, B.Sc. (Brist.), Ph.D. (Camb.).
Appointed 1967.

Honorary Lecturer:

ROBERT BRUCE KING, B.Sc. (Syd.), M.Eng.Sc. (S'ton).
Appointed Lecturer, 1959; Senior Lecturer, 1963; Honorary Lecturer, 1969.

TERRAIN PROFILING USING AN AIRBORNE LASER

by F. F. Thonemann
Australian Defence Scientific Service,
Department of Supply,
Weapons Research Establishment,
Salisbury, South Australia.

Radio altimeters, either of the pulse or frequency modulated kinds, have been in use since 1940. While these instruments are capable of measuring aircraft altitude to within a metre or so, uncertainty about which part of the spot irradiating a rough ground surface of varying reflectivity contributes energy to the radar return renders them unsatisfactory for the determination of terrain profiles having the detail required for mapping applications. Since diffraction limited electromagnetic waves in the far field are radiated from an aperture D in a cone of apex angle 2.44 λ/D radians, where λ is the wavelength, it is easily seen that a radar dish of aperture in the order of 100 metres would be necessary to produce a 3 cm. radar beam having an angular divergence small enough (about 10^{-4} radians) to meet the terrain profiling requirement. Such a large dish is obviously impracticable in a light aircraft installation.

For monochromatic light waves of wavelength in the order of 10^{-4} cm. a transmitting aperture of a few centimeters suffices to produce a narrow enough beam. Thus the laser lamp which radiates light of high monochromaticity and intensity lends itself uniquely to range measurements of high angular resolution. Resolution in range (height) of 0.5 metres, r.m.s. required for the terrain profiler application may be obtained by modulation of the laser beam by any of the familiar microwave radar methods.

The Australian Terrain Profiler

In the terrain profiler designed and fabricated in the Weapons Research Establishment for the Department of National Development a continuous wave argon ion gas laser is used as the source of blue (4880Å) radiation. The plane polarized beam emitted from it is modulated in intensity by rotating its plane of polarization by means of an electro-optic crystal (potassium dideuterium phosphate) placed behind a polaroid analyser. The emergent beam is intensity modulated at 3 MHz, and after collimation to 10^{-4} radians divergence is directed with a power of about 50 milliwatts vertically to the ground where it forms a light patch some 30 cm. in diameter when the mapping aircraft flies at its operating height of 2,000 metres. Laser radiation diffusely reflected from the ground is received in the aircraft by a Cassegrain telescope of some 20 cm. aperture and demodulated in a photomultiplier detector. The resultant electrical signal, phase shifted by an amount proportional to aircraft height above ground is compared in phase, in an electronic bandwidth of 25 Hz, with the 3M Hz reference sinoid and the measured phase difference plotted in the form of height variations on a chart recorder to within 0.5 metres r.m.s.

Since profiling sorties are made in full daylight admission of sunlight to the photodetector must be restricted to an amount for which the photon noise of sunlight will not seriously degrade the accuracy of height measurement. For this reason the angular field of view of the receiving telescope is restricted to about 2×10^{-4} radians and an optical band pass filter some 10Å wide is placed in front of the photodetector.

Ancillary Equipment

The extraction of valid terrain profiles from the measured height data requires that deviations of the aircraft from an isobaric surface be recorded together with the height data. This is accomplished by means of a sensitive manometer (stato-

scope) the calibration of which is obtained, in flight, by over-flying at intervals of 100 miles or so bench marks located on the ground at known heights above sea level.

Identification of terrain features along the aircraft's ground track is facilitated by a continuous strip photograph made in a camera which also serves as a ground speed and drift indicator. On both the chart records and strip films elapsed time and identification codes are simultaneously recorded.

Conclusion—

The design, construction, and installation of a precision airborne optical instrument of this novel kind capable of reliable operation over long periods in the outback of Australia has evoked engineering skills of a high order. It is gratifying that airborne trials of the later terrain profiler have demonstrated a performance meeting the specification and that novel applications of the instrument, for example, sea-wave height measurement and line scan television imagery have become evident.

DEPARTMENT OF CHEMICAL ENGINEERING

Head of Department:
Professor W. F. Tait

The research topics being investigated in the Department of Chemical Engineering are varied, but the output has diminished somewhat due to a reduction in the number of graduates from the Department who stay on for a higher degree.

Process Dynamics Control

Prediction of "break through" curves of thermal regenerators and adsorbers has continued. As an example, thermal storage may be achieved by passing hot air through a bed of cool solid spheres. The problem in design is to ensure that when the heat wave reaches the bed exit, as little spreading of the wave occurs as is economically possible. The main factors causing spreading are

(i) resistance to heat transfer between fluid and spheres and within the spheres due to thermal conductivity, and

(ii) conduction parallel to the fluid path. Former complicated prediction methods have been greatly simplified in order that the influence of each of the above factors may be estimated to engineering accuracy prior to commencing a design. The work is to be extended to predicition of break-through curves for packed bed drier systems.

The insertion of a "perfect mixer" into a composition control system, which involves injection of an additive into a continuously flowing stream, theoretically improves control by many orders of magnitude. During the year attention has been given to the approach which may be made to perfect mixing in baffled and non-baffled tanks through which a fluid is flowing. The object is to eliminate mechanical agitations, yet still retain many of the advantages of "perfect" mixing. Current results have been submitted for publication.

The empirical predicition of "optimum" controller settings from simple plant tests has received considerable attention since Ziegler and Nichols' pioneering work in the 1940's. A current project has established precisely the assumptions and limitations of the "reaction curve" and "ultimate sensitivity" approaches to controller tuning. This has been coupled with a theoretical study of the controllability of processes dominated by dead time or transportation lag. The project will be extended into digital computer controlled systems when the Faculty's NOVA computer has been installed.

Materials Science

The Materials Science group is continuing a study of the high temperature deformation of zirconium. Hexagonal crystallography has facilitated the analysis of dislocation reactions taking place when zirconium is strained in tension over the temperature range 20-500 deg. C.

Internal friction measurements on pure zirconium and zirconium-oxygen alloys have led to a better understanding of the strain ageing phenomena that are observed in these alloys. In conjunction with electron microscope observations, internal friction measurements are being used to study further the phenomenon of strain ageing. The relationship involved between diffusion of interstitial alloys and dislocation movements at low strain amplitudes is being studied by the internal friction technique, The apparatus used for the measurements was designed and constructed in the department and is proving to be one of the best known pieces of equipment of its kind.

During the past year development of research techniques for the study of polymers has commenced. A hot stage microscope is being used to study spherultic growth phenomena in polymers and replica techniques for the electron microscope have been developed. A basic study of process variables in polymer forming and injection moulding is to be carried out. A significant expansion into the polymer field as well as continued activity in zirconium research is envisaged for the next year.

Economic Development

An interesting extension to the previously reported economic and location studies of the Australian chemical industry is that this year the final year students' Plant Design

projects have been interlinked with this work. The projects included a series of feasibility studies for a complex of very large plants to produce caustic soda, chlorine and petrochemicals from South Australian solar salt and Gidgealpa/ Moomba natural gas.

Fluid Dynamics

Work has continued on the study of the flow system where a parallel gas stream propels a liquid film over a solid surface, studies of the flow structure of the gas stream having received particular attention. Of special interest are the transport properties induced in the gas stream by disturbances at the gas stream-liquid film interface. Because of the likelihood of damage by liquid droplets to the hot-wire anemometer used to examine the gas flow, the recent work substituted a solid, wavy surface for the liquid film. The lengths and amplitudes of the sinusoidal wave profile correspond closely in scale with those generated at a gas-liquid interface, in the range of variables of interest. Measurements of turbulent velocity components in the gas stream allowed the wave-induced connective action to be deduced from the analogy between property transfer and momentum transfer.

Liquid Phase Diffusional Phenomena

A new line of research has commenced involving liquid phase thermal diffusion studies, as well as a survey of absorption with chemical reaction. Thermal diffusion sudies on binary liquid mixtures have been made using the laminar flow cell technique. Preliminary results indicate that the "heat of transport" is linear in mole fraction. In order to evaluate this conclusion more thoroughly, and to use the flow cell technique to obtain mutual diffusion coefficients, a more accurate interperometer is required for anaylsis than is presently available in the department.

The absorption survey has revealed that there is a lack of agreement between quoted diffusion coefficients of gases in liquids. A stirred vessel technique is being developed in order that absorption rates may be used to determine diffusion coefficients of gases in liquids. Analysis will be performed with the department's recently acquired gas chromatograph.

The absorption with chemical reaction survey has also shown that "true" interfacial areas in packed towers may be obtained by comparing tower performance with that of a stirred vessel. The method has been used previously to obtain "effective" interfacial areas by dubious means.

Heat Transfer

A large scale electrically heated 2 in. I.D. x 10 ft. falling film test rig is under construction to extend previous work on heat transfer and pressure drop in falling film evaporation.

PUBLICATIONS

Dr. M. J. Story—

"Flow-cell Studies of Thermal Diffusion in Liquids". Part 1 —"$CC1_4$ + Benzene and Cyclohexane + Benzene Systems." Trans. Faraday Soe., **65,** 349 (1969).

"Flow-cell studies of Thermal Diffusion in Liquids". Part 5—"Binary mixtures of CH_3OH with $CC1_4$, Benzene and Cyclohexane at 25 deg. C."
Trans. Faraday Soe., **65**, 1523 (1969).

"Thermal Diffusion of Diphenylin Benzene and of Urea in Water". Trans. Faraday Soe., **65,** 1810 (1969).

"Mutual Diffusion Coefficients from Thermal Diffusion Experiments".
Ind. Eng. Chem. Fundamentals, **8,** 777 (1969).

A very plain nurse was telling a voluptuous co-worker about the sailor who was a patient in Ward 10. "He's tattooed," she confided (and her voice dropped low), "in a very intimate place!"

"You mean . . ." gasped the beautiful nurse.

"Yes! Isn't that odd? There's actually a word tatooed there. The word 'swan'."

"This I've got to see," exclaimed the voluptuous one, and she hurried off to Ward 10. Half an hour later, she returned. "You were right," she said, "he is tattooed there. But you were wrong about the word. It's 'Saskatchewan'!"

ACTIVITIES IN THE CIVIL ENGINEERING DEPARTMENT

PROFESSOR F. B. BULL
(Head of Department)

It is surprising how jobs seem to come round in cycles, and I suppose 1969 would be categorised as the year of railways—that is so far as the Civil Engineering Department is concerned.

To start off, our interest in railway work was maintained by the fact that both Professor H. H. Davis and I were members of a Committee appointed by the South Australian Government to enquire into derailments. This turned out to be fascinating work getting right down to the fundamentals of what makes railways tick—or in this case fail to tick. The problem of a loaded bogey, sprung in various ways and moving over a track which includes errors of alignment in both vertical and horizontal planes is very complex. It may turn out to be uneconomical to provide a solution which will give 100 per cent. safety, particularly on lines used solely for minerals or grain and on which loss of life is unlikely to be a factor. The whole problem is typical of the broader aspects of engineering in which an economic solution is the right answer even if it falls short of perfect efficiency. The decision on where the break-even point comes is the difficult decision to make. Who can say what will be the cost of an accident that has not yet happened?

Railways have been with us for 150 years and we accept them almost without another thought. It is interesting to conjecture that if this form of transport had never been evolved and an engineer today proposed that loads of thousands of tons be transported at speeds of 100 m.p.h., or even more, by means of flanged wheels rolling on steel rails he would be dismissed as an impractical dreamer and if he went on to suggest that flanges only about an inch deep were all that were required, and that the support of the steel rails need not be too rigid so that movements of ½ inch could be tolerated, then he would be classed not only as a dreamer, but a dangerous one at that! Neverthless, that is what we have come to accept as a very practical means of transport.

Quite a number of examples can be thought of in which highly successful engineering practices might never have got started if the fully developed procedures had to be worked out from scratch. Who, for instance, would seriously put forward the idea of sliding 10,000 tons of metal down a couple of wooden runners sloped only at 1 in 40, and with no side guards to stop the load slipping sideways off the runners. Yet that is what we conventionally do every time we launch a ship.

Getting back to the railways, however, our next contact took us much further afield; this time to Darwin, where we had been asked by the Commonwealth Railways to carry out field tests on certain wrought iron bridges in the Northern Australia Line running south for 300 miles from Darwin.

This line, begun in the 1880's, has for most of its life carried only light traffic, but now iron ore has been discovered along the line and the traffic is greatly increased, not only in the loads, but also the frequency of trains. The old bridges, after nearly 90 years, are being called upon to take loads greater than ever before. Our job was to measure the strains set up by the passage of actual trains in order to assess the probable safety of the various structures. A team from the Department spent a week beside the track and succeeded in getting an excellent set of records. Subsequent analysis of the records back here in Adelaide has revealed many interesting, and in some cases unexpected, features. The main outcome is that there appears to be plenty of life in the old spans yet.

Our interest in the reaction of a moving truck on rails imperfectly in alignment led to our increased interest in instrumenting what was happening. The Instrumentation class had a field day on this subject, and since then we have continued to work on the problem. At the moment we are hoping to be able to record the imperfections of the track and also the movements of the bogey by means of a double integration of the output of an accelerometer. This would all be done within the "black box" and the recorded trace would be a measure of track (or vehicle) wander.

In addition to work on railways, the Department has been able to assist in problems with both Government Departments and private industry. One of the more unusual problems tackled was the failure of crossheads in the large diesel engines at one of the power stations at Broken Hill. There are five of these engines, each of 2,500 H.P., and they provide the entire power to one of the mines. For some curious reason they generate at 40 cycles and so in the event of a breakdown it is not possible to "borrow" from the N.S.W. State system.

These crossheads connect the top of the piston rod to the underside of the piston and also take out any horizontal components of force on to sliding surfaces. After 15 years of more or less trouble-free running one crosshead broke. This was rather dramatic as the bits fell into the sump and the lower part of the engine was rather mangled as the crankshaft tried to push the bits out through the walls.

After the accident, a close inspection of the other 48 cross heads revealed that a number of others were cracked. The Department was called in to see if any explanation could be offered and also to recommend measures to stop the rot. This turned out to be a very complex problem. We measured strains, both in the running engine and also in a simulated mock up on a full scale piston and crosshead in the Civil Engineering Laboratory. After following many false trails it does finally appear that there are some high stress concentrations in the crossheads which are overstressed during the starting up of the engine from the cold. Steps are being taken to reduce the stress concentration and to alter the starting procedure, which should result in eliminating the failures.

In the Testing Laboratory we have undertaken several major projects which are of interest to the State Government. The most spectacular to look at is the ¼ full-scale model of a highway bridge. This is of a type which will be very much a feature of the overpass routes to be used in the M.A.T.S. plan. This prestressed concrete box girder bridge 45 ft. long is at present being load tested within the elastic range, but finally a test to destruction will be undertaken.

Another interesting project has been the investigation of a model of a concrete valve box as used on the big pipe lines. The object of this box is to take the forces in the pipe line and transmit them across the gap where a valve is to be fitted, thus relieving the valve body itself from having to take the forces. Very large forces are induced by expansion and contraction in the pipeline and the economic design of these valve boxes is a matter of great importance.

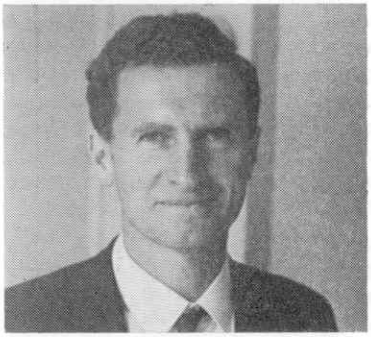
On the water side, the Department has continued its interest in Beach Erosion. Much activity in 1969 was directed to the accurate prediction of waves resulting from defined winds. For years we have been recording wind patterns and hope from this to deduce the typical wave pattern and in particular their littoral components which cause sand transport.

Also on sand transport, but this time intentional, we have been working on the problem of improving the efficiency of the sand cutters used in the recovery of beach sands for their rare mineral content. This work looks very promising and improvements which will have considerable economic importance have already been effected.

Housing problems have also received attention, and the work on building on Bay of Biscay soils has continued. Attempts have been made to improve the stress distribution around potential sources of cracking and some large scale model houses are now under test to see what success has been achieved. This work is going on at a field station set up for the purpose at West Beach Airport.

Another venture into the engineering of housing was some tests carried out on fibreglass house units, perhaps the shade of things to come.

DEPARTMENT OF ELECTRICAL ENGINEERING



PROFESSOR R. L. WOODWARD
(Head of Department)

1969 was a heavy year for the staff of the Department, with undergraduate student numbers in the two senior years of the course at record levels. Staff and equipment were strained to the limit to provide satisfactory laboratory project conditions for the 42 members of the final year class. This doubling of numbers over a two-year period is a result partly of the transition from a five-year to a four-year B.E. course, and partly of the large intakes to the Faculty in the two years before imposition of the existing entry quota. The increase in Faculty entry quota from 135 to 180 in 1970 will however mean that present numbers will be maintained, and it is hoped that adequate additional staff and equipment will be forthcoming to avoid any depression of teaching standards.

Dr. Griffin was overseas on Study Leave during the first half of 1969, in the course of a year spent at Cornell University and the nearby Rome Air Development Centre. During this time he was able to make a significant contribution to the work of the Cornell group on microwave solid state devices.

Professor Willoughby was on Study Leave during the latter half of 1969. After spending three months with the Brown Boveri Company in Switzerland on the design of high-power transmitter equipment, he returned to Adelaide via England and the United States.

Late in the year Mr. B. H. Smith submitted his resignation as a Senior Lecturer in order to take up appointment to the new Chair of Electrical Engineering at Wollongong University College. It is of interest to note that Mr. Smith spent eight years as a farmer at Meningie immediately after gaining his Bachelor's degree.

Mr. G. Karolyi has been promoted from Lecturer to Senior Lecturer.

During the year the Department was visited by two former members of staff. Professor H. A. Prime is now Head of the Postgraduate School in the Department of Electrical and Electronic Engineering at the University of Birmingham. Professor G. A. Rose, a graduate of this University, was recently appointed to the new Chair of Computer Science at the University of Queensland.

Continuing education is currently a very live issue amongst practising engineers, and staff members have been active in providing suitable courses. Under the auspices of the University Adult Education Department, three one-term courses were produced, entitled "Digital Techniques", "Networks and Noise" and "Dynamic Behaviour of Power Systems". All three were well attended and clearly supplied a real need.

Five Ph.D. degrees were awarded for work undertaken in the Department, the recipients being D. N. Cooper, B. R. Davis (staff member), R. J. Potter (staff member in Computing Science), B. M. Smith, and A. N. Vladcoff. A number of candidates also submitted Theses for the M.E. degree. However, a sufficient number of new candidates registered to maintain research student numbers at 15, and to allow our research programmes to proceed unimpeded.

Our research attracted substantial funds from outside granting bodies during 1969. A.R.G.C. grants were made in support of programmes for digital interface development, solid state microwave devices, and ferrimagnetic resonance investigations. The Electrical Research Board supported work on power systems and energy conversion while the Radio Research Board continued its support of antenna projects. A two-year contract was negotiated with the P.M.G. Department for comprehensive studies of possible applications of surface acoustic wave phenomena.

Digital research in the Department was placed in jeopardy by a major breakdown of the CIRRUS computer during the year. The action of the University Council in making available funds on an emergency basis to purchase a replacement for CIRRUS averted a crisis. We have recently taken delivery of a NOVA computer, a sixteen bit machine with 8,000 words of store and good peripheral facilities. Interface hardware has been redesigned and modified to suit NOVA, and experimental work can now proceed.

Research Students and Projects:

Aerials and Propagation:

M. L. Lees: "Atmospheric Refraction Phenomena at Microwave Frequencies." (Ph.D.)

T. V. Nguyen: "Endfire Slot Aerial with Reflector." (M.E.)

J. D. Robert: "Overwater Propagation Studies." (M.E.)

Communications:

G. Haack: "Active Network Synthesis." (Ph.D.)

C. J. Kikkert: "Some Aspects of Delta Modulation." (Ph.D.)

T. S. Khoo: "System Characteristics Determination with Pseudo-Random Signals." (M.E.)

D. J. Patterson: "Optimal Digital Data Transmission." (Ph.D.)

Materials:

A. S. Burgess: "Information Storage Using Electroacoustic Devices." (Ph.D.)

N.C.V. Charyulu: "Ferrimagnetic Resonance Studies." (Ph.D.)

P. V. H. Sabine: "Studies of Surface Acoustic Waves." (Ph.D.)

Digital Electronics and Control:

J. P. Bartlett: "Digital Control Studies." (Ph.D.)

P. Polson: "Implications of Adaptive Control in Brain Mechanisms." (Ph.D.)

A. Y. C. Quan: "Identification of a Multi-Variable System." (M.E.)

V. C. Sobolewski: "Computer-Aided Circuit Design." (Ph.D.)

Machines:

A. H. Baghurst: "Characteristics and Design of Doubly-Wound Induction Motors." (M.E.)

Following are brief accounts of certain of the research projects which have reached a significant stage of development.

"Atmospheric Refraction Phenomena at Microwave Frequencies"

Point to point microwave communications systems are subject to ray bending as atmospheric conditions such as turbulence and temperature inversions alter the vertical refractive index profile of the air from a defined standard. Rays bent downwards become trapped in the surface layer and form a duct of enhanced signal while rays bent upwards often miss the receiver causing loss of signal.

An experiment has been established where two transmitting antennas transmit from Aldinga Beach across a 6-mile overwater path to Myponga Beach. The signals from each antenna are compared and manipulated in the receiver to give a direct output of angle of bending occurring over the path, with angles as small as 0.01 degrees being reliably detected. Received signals also provide information on the spectrum of turbulent eddies in the atmosphere.

Several effects have been noted to date ranging from standard propagation in the case of cool S.W. winds from the sea, through large variable angles of bending downwards during humid weather, to stable angles of upward refraction of 0.15 degrees when dry winds come off the land and blow over the sea.

—M. L. LEES.

"Digital Control Studies"

This project is designed to investigate and establish the transient stability of an alternator-prime mover set operating into the infinite bus, by using a digital computer in the feed back loop. At this stage the development of the necessary hardware has just been completed and the formulation of a control strategy and programming techniques are about to start.

The hardware consists of the machine set itself (a 3-phase alternator and a D.C. motor, with external armature resistance, as the prime mover), a digital to analogue interface, a current control for the field of the synchronous machine, and the necessary switching panel with power and speed controls.

The digital to analogue interface provides 6 A/D converters, which are programmed to perform a conversion by computer control, and four D/A converters, which act as zero order holds. The converters are bipolar with inputs (outputs) of

±1 volt and an accuracy of ±0.1% (10 bits + sign. The A/D conversion rate is 1 MHz i.e. 11 μsecs per conversion.

It is hoped to achieve the required stability by controlling the field of the alternator, which is varied by a system monitoring the output of one of the D/A converters. This system uses S.C.R.'s for power switching, and is similar in operation to a closed loop pulsed D.C. converter, which forces a fast response in the field current.

Thus as stated the hardware is now prepared and the development of a control strategy using modern optimal control techniques is to follow.

—J. P. BARTLETT.

"Studies of Surface Acoustic Waves"

The comparatively low velocity of acoustic waves (10^5 times smaller than electromagnetic), and the development of efficient transducers for the conversion of energy from electromagnetic to acoustic form, make the storage of energy in the acoustic mode most attractive. Further, the fact that surface-acoustic or Rayleigh waves may be generated, propagated and detected on a single substrate surface means that the surface wave is compatible with existing integrated circuit technology, and has potential application to communication engineering.

Research is currently centred upon methods for launching, guiding, and processing signals in the surface acoustic mode. Techniques for amplification, filtering and power division of surface wave energy are being investigated.

A new photolithographic facility nearing completion should simplify the fabrication of high frequency array transducers, and enable more precise studies of surface wave phenomena to be undertaken.

—HARVEY SABINE.

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Smith, B. H.—"Commutation in a Bilateral Variable-Ratio D.C. Pulse Converter", I.E.E.E. Trans. on Industrial Electronics and Control Instrumentation, Vol. IECI-15, No. 1, Nov. 1968, pp. 6-11.

DEPARTMENT OF MECHANICAL ENGINEERING

PROFESSOR H. H. DAVIS
(Head of Department)

General Development

Existing ground floor Mechanical Engineering laboratories have received a face-lift and a special grant has been received to replace about 10 obsolete machine tools to improve facilities in the Civil and Mechanical Engineering departments' workshop. Basic laboratory facilities developed over recent years should now be better able to cope with both teaching and project needs for the increasing numbers of undergraduates expected in the new triennium.

Extensions have been planned for the Mechanical Engineering building in 1970. A fourth floor will be added and will provide more Faculty space for drawing offices and lecture rooms to accommodate the increased entry quotas, and will provide some increased departmental accommodation for academic and research staff, postgraduate students and light laboratories.

Although improved accommodation and basic facilities should help to meet the needs of increased student numbers in the next triennium, the small academic and ancillary staff increases approved will barely maintain the present inadequate staff/student ratios.

Vacation Experience

Due to the recent omission of Workshop Practice from our first-year schedules, and because of its importance to mechanical engineers, a new development has been introduced for first-year Mechanical students. Systematic workshop courses, given by qualified apprentice school supervisors, are now being provided for all students requiring them in their first (or second) long vacation in some of S.A.'s larger industries. These courses for 1969/70 are to be held in the apprentice schools of B.H.P. Co., Whyalla, British Tube Mills, Kilburn, and Chrysler Engine Works at Port Lonsdale, and will provide about 6 to 8 weeks of organised experience with pay, and will count as part of the Faculty requirement for 16 weeks' vacation experience.

Academic Staff

Mr. P. R. Sanderson (B.E. Adelaide, 1952) is joining our staff in December, 1969. After a period of service with E.T.S.A., he has spent the last ten years in U.K., mainly engaged in research and development work with the Central Electricity Generating Board on advanced problems of thermal power production.

Mr. J. H. Fowler has been seconded to the Department of External Affairs for the two years, 1969-70, as a Colombo Plan technical consultant to set up and organise operation of a new computing centre at the University of Singapore.

Visitors to the Department

Professors A. Corbett, M. S. Shaw, P. Whitton and J. F. D. Wood, of Mechanical Engineering Departments of other Australian Universities.

Professor W. Smith, of Oregon State University, U.S.A., for discussions on the teaching of design.

Dr. P. O. A. L. Davies, Reader and deputy head of the Institute of Sound and Vibration Research, University of Southampton (a former member of our staff), for seminars on the study of random phenomena.

Research Activities

In addition to Commonwealth postgraduate scholarships and Department of Supply release for postgraduate research students, research contracts and grants have been received from the Australian Research Grants Commission, Australian Atomic Energy Commission, Australian Institute for Nuclear Science and Engineering, Australian Mineral Industries Research Association and from private industry. These scholarships, fellowships and grants provide finance for personnel and for some of the equipment needs in the research activity outlined below:

Gas Dynamics

(a) Boundary layer turbulence

Studies of boundary layer phenomena in fluid flow over immersed bodies or through ducts are of great importance in a wide range of engineering problems. In particular, turbulent boundary layers involve random fluid velocity and corresponding pressure fluctuations which give rise both to aerodynamic noise, and to vibration and noise generation at the solid boundaries in ducts and casings and at the surface or skins of high-speed aircraft, ships and submaries. Even fatigue failure of surface components may result from this form of excitation. Analytical studies over several years are now being checked and complemented by experimental studies in a sophisticated research wind-tunnel facility developed here to investigate the influence of variables such as mean streamwise static pressure gradients on various statistical properties of the fluctuating pressure field in turbulent boundary layers and to achieve a better understanding of the basic mechanisms operating in such flow regimes.

(b) Aerofoil noise generation

Somewhat related work on another specially designed "silent" wind tunnel is aimed at an understanding of the mechanisms of aerodynamic noise generation in the flow over aerofoils and other immersed bodies, including aerofoils in cascade. This project is the first fundamental stage in an attempt to reduce aerodynamic noise produced by fans, impellers, propellers and helicopter rotors.

(c) Aerofoil fan noise

Concurrently with the above, applied research is proceeding on noise generation by axial flow fans designed with many variable parameters and set up for study in the reverberation chambers of the acoustics laboratory. Variation in blade profile, twist and solidity ratio, tip-to-hub ratio, flow straightening stator blades, and other factors are being studied in relation to spectral distribution of total sound power radiation upstream and downstream under varied operating load conditions.

(d) Shock-wave attenuation

Supersonic flow and associated shock-waves provide a range of engineering problems. One aspect under study is concerned with methods of shock attenuation in ducts without the introduction of significant flow resistance, an aim being to improve silencing in two-stroke engine exhaust systems without power loss. Schlieren optical techniques are used to photograph the passage of shock-waves in two-dimensional models while shock pressure transducers record instantaneous intensities.

(e) Air lubricated bearing

A long programme of studies on the theoretical and experimental evaluation of the characteristics of tapered and stepped land aerostatic bearings developed in the department has been successfully undertaken. Further work is anticipated to meet special needs for this type of bearing in the nuclear power field.

(f) Cyclone particle separators

Flow studies in cyclone type particle separators is being continued, with transparent models, in order to reduce flow resistance for use in patented combined spark-arrester and silencer units for internal combustion engines.

Hydrodynamics

(a) Marine propulsion

A long programme on vibration control for ship propulsion using ducted impellers or submerged hydrojets has continued with the aim of producing a rational design approach for high propulsive efficiency and cavitation control. Theoretical and experimental studies, using the research circulating water tunnel, are making good progress.

In addition, water-to-air forms of hydrojet propulsion systems, which promise higher propulsion efficiency than propellers for fast marine surface craft of the planing, hydrofoil or hovercraft types, are being studied on the research water tunnel and on a manned 12 ft. test hull in order to optimise the critically important inlet duct design and cavitation control.

(b) Marine surface craft

Transparent model hull studies, using towing and measuring systems developed here for use with the S.A.I.T. towing tank, are continuing with a U.S. calibrated hull form and with a 4 ft. model of the 12 ft. manned hydrojet test hull in order to obtain scaling data and to determine relationships of speed, drag, trim and hull/water interaction.

Dynamics of Machines and Systems

(a) Vehicle suspension dynamics

Mechanical models and electrical analogue simulation of coupled mechanical systems are being used to optimise damping and other parameters for automobile ride quality and road-holding characteristics with statistical and deterministic forms of input disturbence.

(b) Control systems

The use of fluidic control elements is being investigated for speed control in a pneumatically driven and controlled rotor system.

(c) Vibration control

Further work is being done on the use of two-dimensional dynamic absorbers for control of wind-excited structures. In particular an aim is to design for minimal size a suitably sprung and damped ring mass at the top of unstayed tall chimney stacks to cope with supercritical flow vortex excitation at high wind speeds.

Thermodynamics

(a) Heat transfer

A continuing programme of correlation between theory and experiment for natural convection heat transfer in restricted vertical ducts is proving very successful.

(b) Biotrcn environment control

Simultaneous control of temperature, humidity and air flow in artificially lighted plant growth cabinets used in agricultural and other biological research has been achieved with a new patented system of environment control using far less power, and simpler control systems for a wider range of variable swing and finer control limits than heretofore obtainable.

Research on two-phase heat and mass transfer associated with this development is proceeding.

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AN ELECTRICAL ENGINEER

If you should see upon the street
A man who walks with micro feet
With a train of little pips behind
He's an Elec engineer with a micro mind
With micro seconds and micro waves
And micro volts he fills his days
And thus in the course of time we find
His brain has shrunk to a micro mind
His eyes give out a neon gleam
His ears fan out like a radar beam
As he chews his molars oscillate
His heart pumps blood at a video rate
This engineer obtains with passing years
Infinite impedance between his ears
And at last he succumbs to a heavy jolt
When he gets what he thought was a micro volt
The doc looks up from his microscope
And says to his nurse Behold this dope
No trace of a brain cell can I find
He's an Elec engineer with a micro mind.

J. Tabalotny.

SUPERVISION

Extracts from a paper by G. J. Milner, courtesy of the Highways Dept.

Introduction

Prior to the 1930's, industrial psychologists considered that output and earnings could be increased by changes in lighting, heating and ventilation together with improved factory layout and incentives.

The economic concept of the workers—each motivated to seek the maximum wage for minimum effort—lacked adequate recognition of the individual worker as an ordinary human being. Then came the discovery that "man is a social animal" with subsequent redirection of scientific interest towards social issues; the study of human relations in the work group. The development of understanding of human situations is still evolving and is leading to improved employee relations.

The Supervisor

Leadership can be considered as a dominance based on a special knowledge, a compelling personality or the acceptance of the group. Headship, on the other hand, relates to the type of power possessed by say a tribal chief or king.

In the primary work group there is a formal leader appointed by management, but there also arises an informal leader to whom the members of the group look for guidance. Ideally the informal leader should occupy the position of working supervisor. However, management will usually be asked to promote staff members with high seniority or technical skill, even though these men may not show leadership skill. Management must then look to means of supporting the position so that men with modest social abilities can function adequately.

Leadership characteristics

The list of traits of good leaders provided by psychologists does not prove helpful because of the difficulty in defining such terms as "a sense of humour" or "acceptance of responsibility".

It is self evident, on the other hand, that the leader of a healthy group must be reasonably intelligent and must have a flexible personality which will make him sensitive to the feeling of the group. An important point is that the good leader must not only give out orders but be capable of taking in messages from the environment. He will in fact try to act as a human thermostat to keep the climate at a healthy level. In other words, the leader is part of an environment and qualities of leadership aimed solely at individual traits fall short of the mark.

Types of leadership and group structure

Three forms of leader are the autocratic leader, the democratic leader and the laissez-faire leader. The last type has little effect on the group and we will concern ourselves only with the first two forms.

The autocratic leader gives orders without consulting the members of the group or giving detailed information about future plans. He gives personal praise or criticism on his own initiative and is insensitive to the emotional climate which surrounds him.

By contrast, the democratic leader consults the group before giving orders and ensures that all members who are affected are aware of the long term plans on which they are working. He makes it clear that blame or praise is a matter for the group and is a participating member of the group.

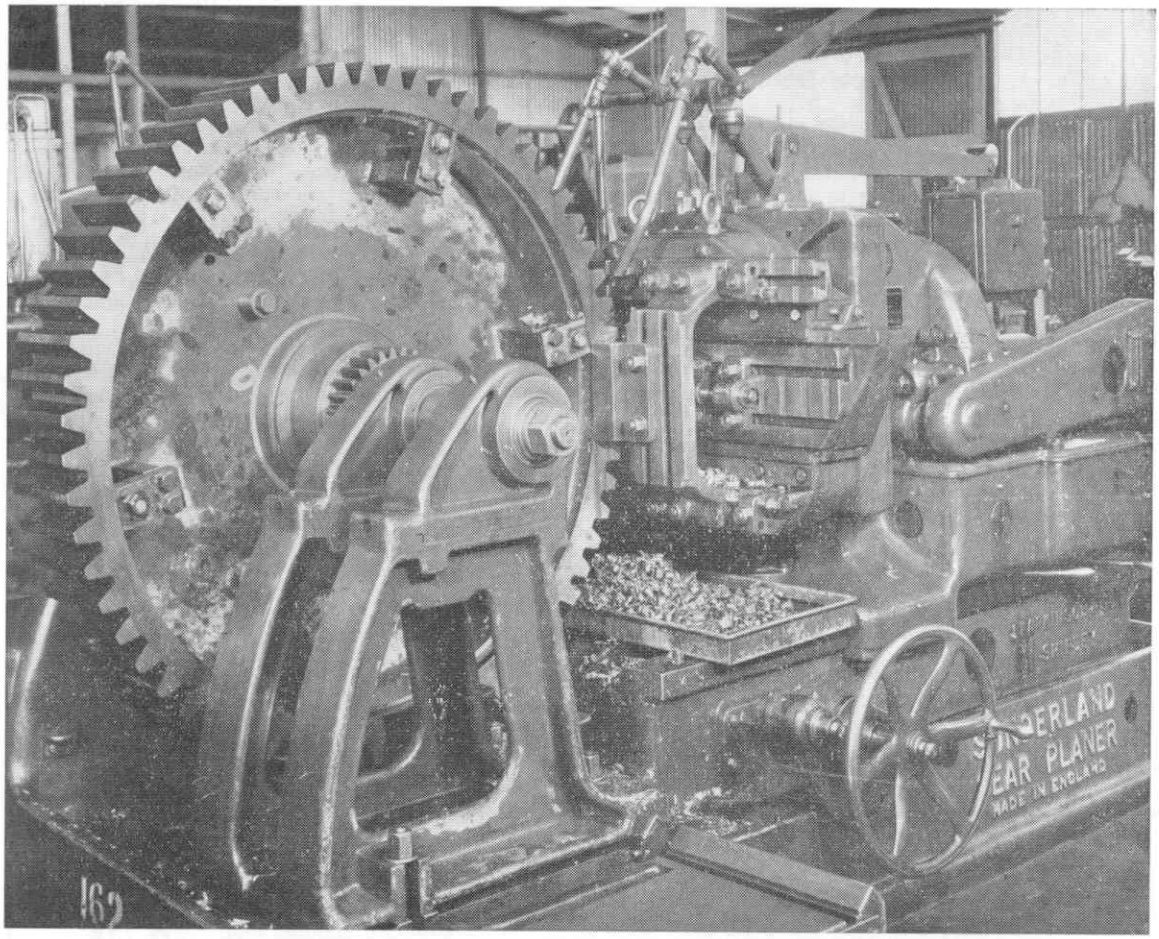
Observations on these different types of structure suggest that:

(1) Democratic control is superior.
(2) The self imposed discipline of the "we" group is vastly different to the externally imposed discipline of the autocratic group.
(3) The behaviour of the members of the experimental autocratic group was close to that complained of by managements.
(4) Any well balanced intelligent individual can be taught democratic methods of control.

Morale and physical conditions of work

Good morale or bad morale is a quality that trickles down from above. It does not well up from below. Complaints are not necessarily objective statements of fact but may be merely a scapegoat manifesting a deeper problem and this should be carefully watched for. In addition, opportunity to air grievances must always be available.

On numerous occasions it has been proved that physical conditions of employ-



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ment have no effect on morale. Experiments have varied lighting, heating and ventilation and measured changes in productvity. They found absolutely no correlation. The need for recognition, security and a sense of belonging is of more importance in determining workers' morale and productivity than physical conditions of work.

Status

The worker's satisfaction is in terms of how he regards his social status in the organisation and what he therefore feels should be his reward.

Although the supervisor should not emphasize status symbols setting him apart from his subordinates, some status distinctions are necessary between subordinates and supervisors. In large organisations they are important in building the organisation relations, serving to place members in the structure. If men do not behave in the way their position dictates, they are subject to criticism both from their subordinates and their superiors.

Close v. general supervision

Close supervision is understood to mean the issue of detailed instructions with frequent checking on progress. General supervision involves issuing general instructions and detailed and frequent checks on progress are avoided.

Studies seem to point to the fact that supervisors who practised general supervision obtained best production results. However, one should treat this with caution as it is evident that the personality of the supervisor is an important variable in the determination of organization structure.

Supervisor intervention

Factors which allow flattening of the hierarchy are:

(1) Independence of units.
Where units of production are fairly independent, supervision can be broader. A mistake made in any one section will not greatly affect any other section.

(2) Simplicity of technology.
Complex technology may require more detailed supervision than for simple tasks.

(3) Measurability of results.
Philosophers of decentralization argue that supervisors should give general supervision and only intervene if it is judged necessary from the results achieved by their subordinates. Where a measure of results is not obtainable readily, the supervisor will tend to involve himself more heavily in the operation of the work group.

Criticising subordinates

Criticism of subordinates is one of the hardest tasks of a supervisor. Too much criticism is demoralizing and can disrupt the superior-subordinate relationship unless skilfully made. On the other hand if criticism is withheld, the subordinate will not necessarily be aware of his shortcomings and no improvement could be expected. The most effective supervisors make a frontal approach to criticism but at the same time ensuring that the maximum initiative is left in the hands of the person undergoing criticism.

Engineers as supervisors

Engineering graduates are recruited into supervision and find themselves supervising experienced workers who are older than they. There is frequently a conflict arising from the problem of recognition of knowledge. Good morale and efficient work depends on the engineer recognising the special knowledge and skills of these workers.

Initiating activity and giving orders

However understanding a superior may be, he is not effective unless he has some skill in initiating activity for subordinates.

It is not pleasant to work for someone for whom you have no respect, hence, for effective action orders must be clear and definite. They should outline what is to be done, by whom, and when. If it is away from regular routine, the why of it should be given.

This is not to say that the worker should be an automation, giving no thought to his work. There is a time for discussion and consultation, but there is also a time when responses to direct orders should be automatic. In a democratic society with its emphasis on equality, the supervisor may find it helpful to phrase his orders as if they were requests.

The supervisors who seem to have the support of their subordinates do not just wait for complaints and suggestions to come to them. They go out calling for consultation. Where discussions are encouraged between management and staff, workers will be found to show more positive sentiments towards one another and towards management.

THE MALE NUMBER M

One of the most critical, most difficult and generally most revolting decisions an engineer must make is that involved in the determination of the Male Number, M, which governs the maximum permissible consumption before social failure occurs.

The first step is to design against *Failure by Chucking.* For this mode of failure, the design is:

Consumption at failure $q = Qb^M - \Sigma Wi$

where $Q =$ largest quantity of Southwark which student can consume in one hour. / Weekly production of S.A. Brewing Co.

$b =$ Spew No. of Beer

e.g. Coopers	1.09
Southwark	1.02
Vic. Bitter	0.71
Tas. Bitter	0.011

$\Sigma Wi =$ total quantity of wine and spirits expected to be brought to show by other members of party.

Next the engineer must design against *Failure by Poverty,* for which:

$$q = qo - \frac{Mc}{I}$$

where $C =$ cost per bottle in cents

$qo =$ quantity of beer supplied at show

$I =$ yearly income of student in cents, e.g. 213.

The next consideration is *Failure by Drought,* where:

$$q = (I + t)\, V^n M^x + Z$$

where $V =$ Volume of beer in cubic feet which engineer is accustomed to drinking per evening.

$n =$ No. of engineers (excluding Elecs.) at show.

$x =$ the show rating No., an arbitary constant decided intuitively by the engineer, e.g. Law Ball 10^{-5} Engees Ball 10^{13}

$Z =$ that volume of beer, below which *any* engineer would be high and dry, generally taken as seven cubic feet.

$t =$ the tart coefficient. This is a most important factor in the design criteria and is calculated thus:

$$t = S^r.p + \Sigma Si\ (J)$$

where $S =$ the frigidity factor, readily available from standard tables provided by the A.U.E.S.

$r =$ the *likelihood coefficient,* dependent upon the engineer's past social successes (or lack of).

$p =$ the hour the tart is expected home.

$\Sigma Si =$ sum of the frigidity factors for tarts brought by other engineers.

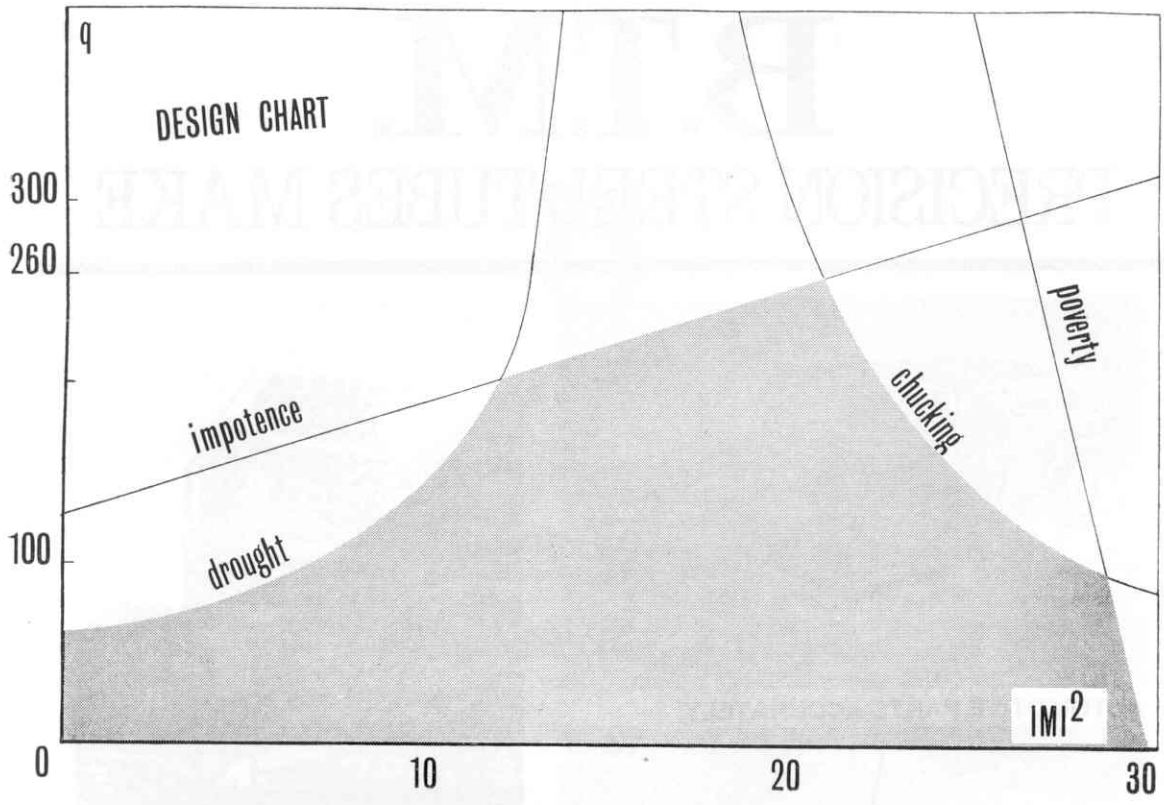
$J =$ the infidelity factor (little information is obtainable for this No. which is usually taken as unity).

Finally, the engineer must design against *Failure by Impotence* (known as Catastrophic Failure by some).

Here $q = M(Q - V)^{-t} + Y$

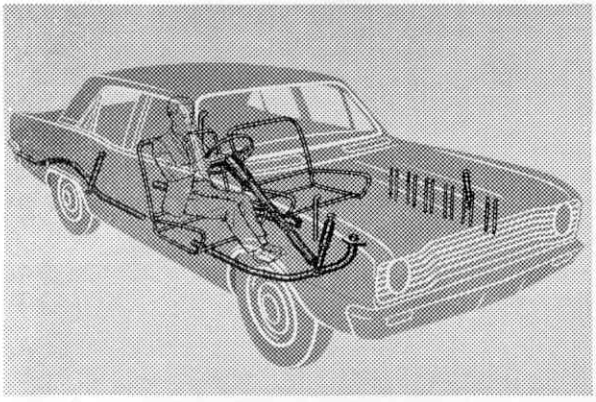
where Y is the safety margin.

The following graph is that for a typical Engineering Ball. $|M|^2$ can be taken (vaguely) as the No. of (9 oz.) glasses consumed per minute by the engineer. As can be seen from the graph, a consumption rate of 21 glasses per minute would produce failure by either chucking or impotence after approx. 260 gallons had been consumed. This point is known as the quaffing point.

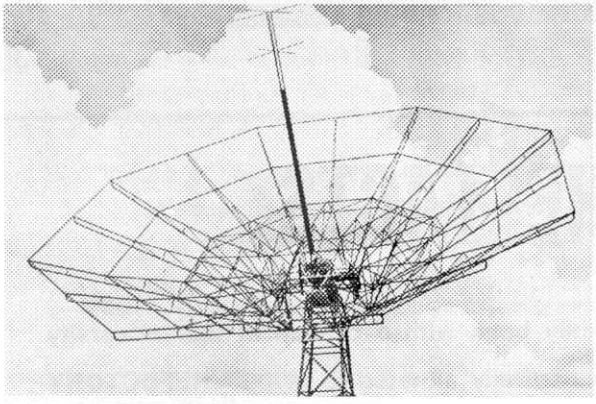


B.T.M.

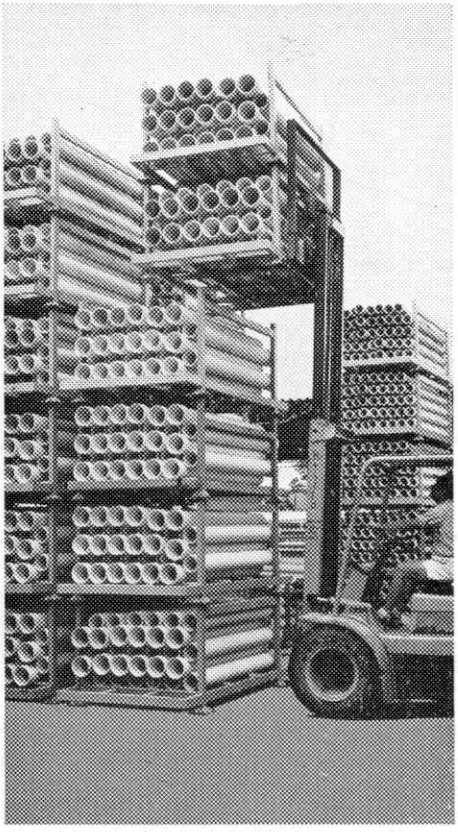
PRECISION STEEL TUBES MAKE



AUTOMOTIVE PARTS ACCURATELY



RADIO TELESCOPES RIGIDLY



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ADELAIDE UNIVERSITY

ENGINEERING SOCIETY

1969

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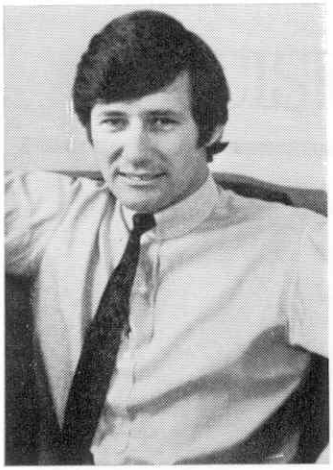
THE PRESIDENT'S REPORT

1969 A.U.E.S. PRESIDENT, IAN CLUTTERHAM



1969 wasn't a good year for the A.U.E.S. From the prevailing attitude of the majority of the students, one couldn't be blamed concluding that there was no longer any need for such a body in the Engineering faculty. The greater proportion of the people attending the ball this year didn't come from the ranks of Engineers, but more about the social aspect later. The attitude of the students was further evident from sundry attempts by the committee to hold student meetings in the Chapman Theatre. Even a general meeting to discuss the Dean's Committee, an issue one would have thought important to students, failed to arouse any interest. Finally, the A.G.M. of the A.U.E.S. had to be postponed and devious means resorted to in order to provide the required quorum of 30 members. Admittedly this meeting was held in third term when, ostensibly, everyone was beginning to cram for exams, but, as stated previously, meetings held earlier in the year were no better attended.

The Committee this year was an active one, having on it several members experienced from serving on previous A.U.E.S. committees. It began its year well before the commencement of the academic one as a result of which, arrangements for the Freshers' Welcome, Ball, Car Trial, etc., were in hand very early.

This year's Freshers' Welcome set a precedent. Thanks to Bryan Jenkins and the Institution of Engineers, we were able to introduce the new engineering students to the staff at the Institution's premises, Bagot Street, North Adelaide. The evening was a success with almost full attendance by the freshers. The Society gained some year representatives and many new members from the welcome meeting.

The Engineering Ball was held in the refectories this year and was the first licensed faculty ball to be so held. Ball organisers were Messrs. Menadue and Le Messurier and credit goes to these two gentlemen for the success of the venture. The only black mark against the ball is due to the loss of approximately $110 by theft.

This year's Car Trial was organised by Graham Burton and Mike Williams and provided the 100 odd entries with quite a deal of fun and confusion. The weather wasn't good, being overcast, but the thought of barbecue and keg at the end was sufficiently enticing to spur people on. It is perhaps worth noting that the single all-female entry **wasn't** the last home.

Due to the increasing interest shown by officers of the Law in the activities of the A.U.E.S. in previous years, it was deemed wise to forego our barbecue and their attentions.

To the ministrations of Rick Guenther we owe the fact that our dinner this year was held at the Morphett Arms Hotel. About 100 attended the dinner, including several members of staff. The guest speaker, Mr. Malcolm Kinnaird, indulged in some amusing reminiscences in a speech well tailored to the occasion and, though the numbers could have been higher, those who took the trouble to attend found the effort to be worthwhile. Our thanks to Rick for organising this year's dinner.

The Golf Day, held at Ashbourne, was also arranged by Mr. Guenther and proved an enjoyable one. Staff members were down on last year.

The Annual Med.-Engineers Tug-of-war, organised by Messrs. Fletcher, Sandland and Rinder, resulted in victory for the Engineers. The coveted Pam Western trophy resided for a further year in the Civil Engineering Secretary's office.

Hahndorf Oval was the venue for the 1969 Inter-Departmental Football Carnival,

organised by John Sandland. Each department entered a team in the "competitions", the Elec. team being victorious in the Elec./Chem. match and the Civils coming out well in front in the Civil/Mech. fracas. Luncheon was "en pleiu air" and refreshments were taken continuously throughout the day. Needless to say, everyone enjoyed himself.

Sad to relate, our annual tour of one of the local breweries was taken over by an entrepreneur from another Society this year and run as a profit-making venture. Perhaps the 1970 A.U.E.S. committee might run it under similar conditions next year.

1969 also saw the passing of the film shows held in previous years in the Chapman Theatre on Tuesdays between 1 p.m. and 2 p.m.

On the credit side the previously mentioned Dean's Committee was formed late this year, it's purpose being to provide a stronger line of communication between students and staff. The committee consists of six students elected (by vote) annually, an equal number of staff members, and the Dean. Thanks to the present Dean, Mr. Sved, for his untiring interest in the committee.

On behalf of the members of the A.U.E.S. Committee, I would like to thank Mr. Robinson for auditing the Society accounts. Also, for coming through with the goods whenever a quick typing or duplicating job was needed, thanks to Vera Walls and Kay Sharpe.

Further, I would like to thank Professor Woodward for his interest in the A.U.E.S. and also in the Dean's Committee. Lastly, to the Committee of the A.U.E.S. and to all co-opted members, year reps. and volunteers, thanks for making my year as President a pleasurable and fruitful one.

While vacationing last summer in the North Woods, a young fellow thought it might be a good idea to write to his girl. He had brought no stationery with him, however, so he had to walk into town for some. Entering the one and only general store, he discovered that the clerk was a young, full-blown farm girl with languorous eyes. "Do you keep stationery?" he asked.

"Well," she giggled, "I do until the last few seconds, and then I just go wild."

ADELAIDE UNIVERSITY ENGINEERING SOCIETY'S TREASURER'S REPORT, 1969

The Treasurer is pleased to say that the Engineering Society on the 16-9-69 was liability free (we owed nobody nothing!). This is a fairly rare situation for A.U.E.S.

Although expenditure exceeded receipts in 1969, most of the expense was due to substantial losses of previous years; two significant amounts were Repayment Tie Loan $267 and Hysteresis '68 $201. However, Coca Cola and the S.R.C. came to the rescue.

One cannot be pleased with the financial trends of the Society. Over the last two years the Society has been recording losses and not profits; and the turnover has decreased, indicating a slackening in the Society's activities. Although the Society is a non-profit organisation it is handy to have substantial reserve, especialy for symposium years like 1970. Also the Society could easily be sent bankrupt with a substantial loss on any function.

So in 1970 keep drinking Coke, buy Hysteresis, become an A.U.E.S. member and attend the shows to keep your society out of the red.

A.U.E.S. FINANCIAL STATEMENT

14th February, 1969 to 16th September, 1969

Starting Balance	$186.38
Plus Receipts	$2,797.50
Less Expenditure	$2,811.26
Closing Balance	$172.62

RECEIPTS	$	EXPENDITURE	$
Membership	133.81	Administration	10.45
Badge Sales	23.00	Petty Cash	10.00
Tie Sales	125.00	Repayment Tie Loan	267.00
Ball	899.50	Ball	969.27
Dinner	217.70	Dinner	234.95
Car Trial	58.60	Car Trial	58.74
Hysteresis '68	658.60	Hysteresis '68	859.68
S.R.C. Grant, Hysteresis	100.00	Hysteresis '69	8.00
Inter Dept. Football	15.68	Inter Dept. Football	14.00
Winery Tour	24.50	Winery Tour Bus	35.00
S.R.C. Grant	35.00	Tug-of-War	4.56
Coca-Cola	493.44	Inter Faculty Basketball	2.00
Sundries	2.40	Golf Day	0.26
Interest	10.27	Coca-Cola	337.35
	$2,797.50		$2,811.26

BRYAN JENKINS, Hon. Treasurer.

Sue Darwent
Miss Engineering — Miss Fresher

The Engineering faculty has always suffered from one grave disadvantage—NO BIRDS—and hence has never been able to compete for one of the most coveted trophies on campus—Miss Fresher.

This year, however, your far-sighted A.U.E.S. Committee conquered this disastrous situation. They decided to look outside the Faculty for the fairest of fair maidens to represent the mighty Engees.

After many days of exhaustive searching around the campus, they found her—the charming Miss Sue Darwent. Sue's great personality and good looks left no doubt in the committee members' minds that victory for the Engees was inevitable.

Armed with a hard hat and spanner, Sue walked away with the 1969 Miss Fresher Crown.

Thanks to Sue for her great effort and never ending tolerance.

ENGINEERING DINNER

In accordance with tradition, this year's Engineering dinner proved to be a major highlight of Prosh Week activities. Following the successful precedent set last year, the winery tour once again adequately prepared the participants for the coming debauch at the new venue of the Morphett Arms.

The dinner got off to a fine start with the annual ritual of re-arrangement of seating, the final set-up resembling something like a rectangular circloid. Nevertheless, everyone set themselves firmly for the heavy night ahead. Under the guidance of President Clutterham the formal toasts and responses were conducted smoothly, with everyone in an extremely complimentary mood. The monarchists revealed themselves after the toast to the Queen, with a spontaneous rendition of our great national anthem.

This year's guest speaker was Mr. M. A. Kinnaird, graduate of Adelaide University, and now successful consulting engineer. His humerous recollections of his student days, and in particular, of the engineering dinners he attended, were well received by everyone. In addition his thought-provoking comments concerning the responsibility and value of the engineer to the community were presented in a refreshingly original manner. Later in the evening, however, he was forced to revise an initial statement that the student of today was more academically orientated than his counterpart of a decade ago. Thanks to the Civil III table the Bacchanalian image of the engineering student was upheld.

The eating over, the establishment was converted into a fun filled fairyland of fantasy with humorous ditties being tossed from table to table. True to his usual form, Mike W. took the prize for the longest and most boring joke of the evening. For this effort he came very close to a dip in the hotel pool.

After the dinner, difficulty was encountered in vacating the premises due to the prostrate body of one final year student elegantly sprawled across the exit.

Next morning, lectures were attended by many bleary-eyed students who had kicked on at various post-dinner shows around Adelaide. One of the Civil III crew is believed to have spent an educational night recuperating from the dinner in the city watchhouse.

FRESHERS' WELCOME

The Engineering Society's Fresher's Welcome for 1969 was held on Tuesday, 11th March, at the Institution of Engineers' Building, North Adelaide, and was well attended by about 80 aspiring engineering students.

The President of the Society, Ian Clutterham, opened the meeting with an introductory speech outlining the function of the Society and the type of activities organized throughout the year. He also attempted to pass on a few pointers to freshers on study methods and University life in general, based on his own long interest-packed experiences.

The Dean of the Faculty, Mr. George Sved, then introduced himself to the freshers by speaking generally on the rewards of Engineering as a profession.

A brief resume of the past and planned activities of each of the departments was then presented by their respective representatives, namely, Prof. Bull, Head of Civil Department, Prof. Woodward, Head of Electrical Department, Prof. Tait, Head of Chemical Department, and Dr. Bull, of the Mechanical Department.

The formalities over, Secretary LeMessurier revealed his lack of experience in projector operation whilst presenting past activities of the Society on film. Nevertheless, the film of previous "tug-of-wars" etc., played backwards, proved most entertaining.

The evening ended with an informal supper and the selling of memberships, ties and badges, much to the Treasurer's relief.

The interest in the Society which was shown by the Freshers was most gratifying and it is hoped that their enthusiasm will continue for the rest of their University life.

SYDNEY SYMPOSIUM REPORT by Hamish Robson

The 1969 A.N.E.S.A. Symposium was held in Sydney between the 18th and 23rd of May. However, the casual observer would scarcely suspect that in this small sentence lies a story of unbridled passion and incredible adventure so spine-chilling and horrific that the writer has had to exercise considerable discretion and restraint in many instances. (Messrs. Mudge and Phillips, your payments are overdue.)

About twenty students from Adelaide University left town on the last day of first term bound for Botany Bay. Most preferred to travel by train at a substantially reduced rate (thanks to a generous sponsor) while several groups of civil and mechanical students travelled by car. One affluent gentleman who shall remain nameless flew over on the Sunday morning.

The Hotel Diplomat in Kings Cross had been booked in advance and the arriving symposium participants were presented with a comprehensive folder outlining the week's events. Most of the Sunday afternoon was usefully employed wandering around the 'Cross observing ladies of shady character, a new and novel pastime for those from the Festival city.

The programme stated that an informal welcome was to be held that evening in the Argyle cellars and I think even the most optimistic members of the contingent failed to anticipate the lively entertainment that was to follow. About 10 p.m. the tables in the cellar were arranged to form a parade platform and a young lady was seen to enter by the back door. Immediately there was a dignified rush for a better view of the proceedings and, with commendable initiative, Bruce Muggleton and Trev. Johnsson commandeered an 18-gallon beer keg. The keg, later to become known as Adelaide Hill, provided an excellent view for eight of us and was successfully defended against a number of attacks. At the end of her performance the young lady was treated to a very warm round of applause. Amongst those unable to clap were Barry Griggs and Dave Mayo who were seen hanging from the rafters.

The Symposium proper commenced on Monday morning with the inaugural address from the local minister of conservation, the Hon. J. G. Beale. This address was remarkably interesting and the number of slumped figures in the audience was kept to a minimum. Regrettably this was not to be the case at talks held towards the end of the week. In the afternoon there was a short lecture, "Modern concepts of a Manufacturing and Distributing Business" followed by a tour of the Sydney University Engineering school. The latter was a source of some consternation and embarrassment to the South Australians since the equipment displayed far surpassed in quantity and quality anything to be seen at home. The tour was well arranged and most informative. In the evening a cabaret was held at the Oceanic Hotel, Coogee. Excellent entertainment was provided until well after midnight.

The following morning everyone was up before dawn for a brisk trot through the Sydney streets; eager faces thrust into the cool, crisp air that buffeted rosy cheeks. Like hell! The following morning some of us got up. Those in a fit condition then straggled off to the Sydney Uni. for what was to be a most entertaining talk by a Mr. J. Baxter, Qantas assistant development manager, on the relative merits of Jumbo jets and Concorde airliners. After the talk it was decided that, a football having been thoughtfully included in our travelling gear, the local natives should be treated to a demonstration game of real football. Regrettably the authorities did not share our enthusiasm and a ragged band of footballers was removed from three ovals in a matter of half an hour. After this discouraging course of events the match was temporarily postponed and the venue changed to Anzac Parade where D. H. Mayo subsequently sprained an ankle at 3 a.m. on Thursday morning.

There was a tour on Tuesday afternoon. I can't remember where we went but it was probably to the Opera House or one of the breweries. In any case rest assured that a good time was had by all. One particular incident comes to mind. While proceeding in a bus along Paramatta Road a fair damsel in a rather short skirt was observed flitting along the footpath. In reply to some light-hearted heckling from the engineering students the said young lady burst forth with a stream of abuse so colourful and imaginative that the next few minutes were spent memorizing catch phrases for further use. Everyone was most impressed.

Rodd Island is a nice, grass-sloped hill stuck in the middle of one of Sydney's many bays and coves. On the top of the hill is a shed in which one can hold a small dance or store a low loader. At 7 p.m. on the evening of Tuesday, the 20th May, the Symposium committee covered the island with chops, steaks, beer kegs and nurses, retired to a safe distance and then called in the engineers. With devastating efficiency this hand-picked body of men invaded the island and soon had the beer and steaks under control. Those nurses offering some resistance were hounded into submission after a brisk battle in the shed. Amongst those to figure prominently were Fred LeMessurier, Phil Rinder and Ron Sainsbury. For those in a playful mood a complete set of swings and slippery dips was provided, while Bruce Muggleton and Bill Phillips were seen at various times during the evening climbing trees. Operation barbecue concluded with a harbour cruise during which it appears the writer had to be restrained from jumping off the stern of the ferry.

Wednesday came and went. Somewhere in the middle Prof. Campbell-Allan, Civil Engineering Prof. at Sydney Uni., gave a short talk on "Engineering—Is it really a Profession?" Unfortunately a small part of the audience didn't seem to care one way or another. The rest of Wednesday was thoughtfully left free, which was just as well, and many students retired to their respective beds. However, a merry band of hardy characters, hell bent on self destruction, were seen furtively entering the Pink Possum (Pussycat? or was it Panther?) after the evening meal.

The lecture for Thursday concerned "Economics and the Engineer" and was given by Pro. B. R. Williams, Vice-Chancellor of Sydney Uni. This talk was of such excellence that question time discussions lasted longer than the actual lecture. After a counter lunch at one of the more colourful hotels the students were off on another tour, this time to H.M.A.S. Perth docked in Garden Island. It was during this tour that we were given an excellent insight into the security arrangements which protect our vast and beautiful country. During an inspection of the forward gun turret the officer-in-charge was asked the range of the main armament. Assuming a grave countenance, the officer replied that of course this sort of information was classified and he was not at liberty to divulge such data. This remark caused some amusement amongst the visitors since a small plaque mounted on the turret bulkhead directly behind the officer's head openly specified the required information. (I was tempted to actually state the figures involved, but then thought better of it—please note, A.S.I.O.) At the end of the tour we were returned our cameras, microphones, cigarette lighters and what have you and then an impromptu panel van cramming demonstration was staged when it was discovered that no return transport had been provided.

Dark suits and bow ties were the order of the day for the Champagne Ball held on Thursday evening. Despite a threatened barman's strike which had cast a shadow over proceedings and thrown the Symposium committee into near panic, all went well. By about 1 a.m. most of the guests had departed, bound for parties and miscellaneous celebrations being held all over Sydney. As a matter of fact the organisers seemed to have arranged a sort of "musical parties" in which participants moved from party to party every hour. The staff at our hotel seemed mildly amused when large numbers of gentlemen crawled in for breakfast clad in creased, beer impregnated dark suits. You'd think they'd be used to that sort of thing.

Regrettably the writer, overcome with exhaustion, was not able to fulfil the Friday itinerary commitments. Neither were a number of other engineering students who were suffering from such complaints as stomach disorders, cramp, a sprained ankle and headaches. However, I have it from reliable sources that the tour of the Engineering School of the Uni. of N.S.W. was even more impressive than the Sydney Uni. tour. Everybody was quite humiliated. The Engineering dinner held that evening was a fitting climax to a hectic week. Held in the indestructable auditorium of Grace Bros., Bay Street, the dinner was an unprecedented success. The catering was excellent and after dinner a relaxing time was had by all relating humorous ditties through a public address system. Towards the end of the evening a tie-exchanging ceremony was held, after which several gentlemen appeared to suffer dizzy fits and had to be escorted back to the hotel. Food poisoning, no doubt.

And that was it. Everyone had aged about ten years and yet no one seemed to mind.

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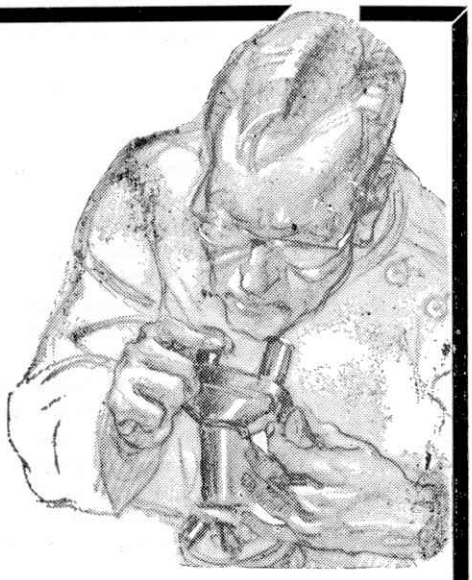

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TUG-OF-WAR

by Trevor Lands

On the third Wednesday of second term, the engineers sent forth a powerful tug-of-war team to regain the Pam Western trophy from the over-confident Meds. The crowds gathered on and around the Uni. footbridge to watch the interfaculty competition of the year. Having skilfully conned the Meds into taking the south bank, the Engees dug in on the north side of the mighty Torrens.

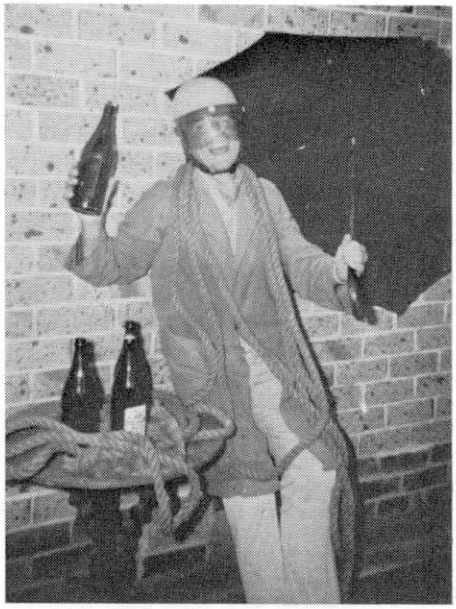
On the starter's command, Coach Mudge set the mighty Engee team into action, and with apparent effortless ease, they pulled the Med team, one by one, into the raging Torrens. This gave the first heat to the Engees. Preceding the second heat, a change of sides put the Engees on the south bank. In the past history of this test of strength, no side has ever won a heat on the southern bank. The Engees were faced with the impossible.

The heat began with the Engees only playing with the Meds youngsters, and at first no ground was given by either side. But then disaster! Ferry, the Engees anchor-man, lost his footing, and the Meds began to pull the Engees slowly towards the muddy waters. Then at a time when defeat seemed inevitable, with front man Fletcher hanging out over the river, delicately balanced on a pylon, Coach Mudge unleashed from his team the most amazing display of power ever seen. The Med team packed up under this crushing pressure and the Engees pulled their way to victory, winning both the heat and the Pam Western Trophy.

Thanks to our team—Mitchell, Steele, Ferry, Rinder, Sandland, Fletcher, and to Coach—Mudge.

Circles

Mohr Circles



THE ADVENTURES OF DOCTOR GAUSS

by H. T. G. Robson
(Mech. 3rd Year)

It was a blustery cold night when suddenly there came a knock at the door. There stood a ragged, shivering echelon. "Come quickly", he cried, "Dad's gone off his identity." I grabbed my bag of real numbers and leapt onto my three wheeler transposition. Because of the terrible weather there were many standard deviations around monotone increasing functions. At last I got to the lad's home. His mother was hiding under the kitchen matrix. "Old Tom's off his eigen value," she cried.

Entering the bedroom I perceived a slumped canonical form on the bed. As I approached, old Tom struggled to his feet coughing up several ionic sections. Through bleary eyes he glared at me and hissed, "Aint I got any linear independence around 'ere?" Then he went into a convolution. I tried emergency treatment and gave him a big dose of concentrated permutations but his linear transformation was empty and he died in my arms.

It was a most distressing case—we had to bury him in a six foot bounded sequence with all the recurrence relations looking on.

FOOTBALL CARNIVAL

Undoubtedly one of the greatest events on the sporting calendar of the Engineering student is the Football Day. This year people gathered at Hahndorf oval from hundreds of miles around to witness the annual spectacle of the finest young men in the community pitting their beer-bloated bodies against each other and the ball.

This year it was the Mechanicals' turn to have a crack at the champion Civil combination (unbeaten since the inception of the carnival in 1967), in the main game of the day. The winner of the dreaded Wooden Spoon award was to be decided in the cut-throat curtain raiser between the Chems and Elecs.

As the time for the first bounce drew near, the crowd, in anticipation of the exciting football to follow, broke up in small rival groups, each discussing their team's prospects for the day over a beer and a chop.

At approximately mid-day the curtain-raiser began. The catastrophic Chems, who had performed remarkably well against the Civils in the previous year, started hot favourites, and the general feeling was that the elementary Elecs would have a hard job ahead of them to avoid winning the well-known award of the outright loser. However, from the first bounce the Elecs hit the Chems with everything they had, and the game developed into a fierce battle of bumping and thumping with possession of the ball seeming to be the last thing in players' minds. As the tense tussle continued, the odd score was pushed between the big sticks with neither side being able to break away. Minutes from the final bell, the scores were locked. Urged on by the excited crowd, the Elecs smoothly brought the ball down and pushed it through seconds before the final whistle, leaving the Chems the stunned winners of the Wooden Spoon.

The combination of the thrill of this tight struggle and the high level of beer consumption which had been reached, put the crowd in the right frame of mind to appreciate the Civil mastery which was to follow.

It is well to note that up to this point in time, the players in the big game had also been freely indulging in the amber fluid and the charcoal chop. Even before taking the field, several had been seen to perform rather unusual antics, such as taking screamers over car bonnets, barbecues, cliffs, etc., and there was every indication that these antics would become even more spectacular once the big game actually began.

The preliminary pep talks over, the respective Civil and Mech captains led their teams onto the field amid a deafening roar from the crowd. The crucial toss was then carried out under the close scrutiny of umpire Drewer. On winning the toss the Civils elected to kick up-hill. Sensing the atmosphere of intense rivalry, the umpire warned players that no rough stuff would be tolerated. He was immediately thrown in the nearest mudpatch.

The formalities over, the ball was bounced. Immediately the scintillating Civil's centreman Sandland took possession of the ball, handballed over to their speedy wingman Flash Fletcher who brilliantly foot passed to full forward Lightning Hopkins on a long lead. The Civil's first goal was on the board. The crowd was stunned. Never before at Hahndorf Oval had such play been witnessed.

The ball was returned to umpire Drewer still in the centre of the ring and was bounced again. This was the signal for follower (Leaping Lands) to smash his way through the pack, grab the ball and boot a 60 yarder deep into the Civil's forward territory, straight into the safe arms of the Civil's mercurial forward pocket Basher Beauchamp who calmly posted another major.

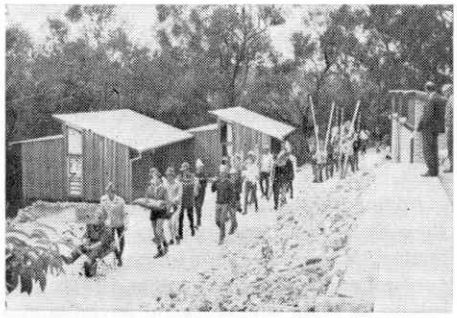
At quarter time a rumour passed around the boundary that the muddling Mechs had imported some cock from league football, and this had given them new inspiration. Indeed, when the second quarter began, the Mechs made a spirited attempt to attack their goals with Robson the Rodent proving dangerous. However, courageous play in the Civil backline by Weaving West and Iron-Man Ide ensured that this new lease of life did not last for long.

The Civils continued to pepper their goals with Christ performing miracles with the ball in the forward line.

The last quarter being merely a formality, many of the Civil stars retired to the waiting keg at the northern goals to see the game out in a more relaxed manner.

SECOND YEAR SURVEY CAMP, 1968

regurgitated by Flett Steele



After one day to recover from a gruelling set of exams, the 2nd year Civil class was thrust into the wilderness of the Adelaide Hills for a fortnight's indoctrination into the cult of Surveying and associated sins. Mylor National Fitness camp was the scene of this fun-filled fortnight of rain—much to the dismay of the National Fitness Council, the cook (it's amazing how good a 50-year-old cook looks after a fortnight of isolation), the caretaker, his dog, and his sheep.

The surveying side of the camp was a bit dull, but as they say, Survey Camp is what you make it. It was interesting to note that a pet theory of mine was verified, in that the degree of enthusiasm displayed on survey camp decreases proportionately to the time spent on said camp. On the first day, students applied themselves diligently to the job at hand, but as time dragged on, any opportunity for total relaxation was taken up.

Nights in the wilderness were spent by a few reducing data (for those less technically minded, this is a process of taking a traverse which miscloses by anything up to ten feet, and then by gentle manipulation of the available data and using a series of educated guesses, or someone else's work, the traverse is found to close). The more common element of the group spent nights in the Aldgate Pub, and these were the types that inevitably missed breakfast the next morning. Sandland was the only one who stooped low enough to attend breakfast in his pyjamas, but he did wear quite a lovely silk robe, the colour of which vividly complemented his freckles.

Several sporting events were held during the day, the most popular of which was the tree chopping contest. Although the camp area is (or was) a flora sanctuary (sanctuary much), from experience it was found easier to chop down trees, rather than survey around them. Thus it was that Lands and his group took the prize for the largest tree, when they felled a 40 foot monster.

Another popular sport was the javelin and discus throwing contests, which, although they were well patronized, were frowned upon by the staff. While they disliked the use of ranging rods as javelins, they violently objected to the use of 100 foot linen tapes as disci.

The final day of camp saw the ceremonial march past, with the salute being taken by Professor Bull. This precision marching display was supervised by the military influences present, namely Rear Admiral Male, and Mr. J. Ferry, late of Duntroon Girls' School. (It is hoped that Messrs. Sandland and Summers gained experience for the future in the art of marching.) After presenting arms (theodolites rather), the DAC award, given for "Diligence and Courage" in the field of surveying, was presented by the Prof. to the narrowly elected winner, Graham Copley. Our thanks must go to a certain Adelaide drinking house for the kind donation of the magnificent trophy.

On the final night, several were forced to spend the night in the washroom, due to the disappearance of their beds, and various articles of their attire.

However, Survey Camp was not a complete waste of time, because it taught tomorrow's engineers the art of having a good bludge, whilst conveying the impression to one's superiors, that you are really applying yourself diligently to the job at hand.

"INNOCENCE LOST" THE BALL

or

"I WAS THE ONLY BIRD ON THE WINERY TOUR"

by Virginia B.

'Twas a cool and rainy afternoon when eight and thirty stalwart, thirsty, would-be engineers and I embarked upon the momentous trip. 'Twas indeed so cold and wet, but the comfort we sought would allay all this. But stay—what ray of sunshine this, that warms our hungry hearts? Nay, 'tis no ray—'tis bounteous vineyards which by the muddy roadside stand so bold. And the rainbow in our sky, at its end, our golden fleece—the noble Chateau de La Grog.

Gnashing at the bit, we cooled our heels in the dear sweet air wafting gently from the mighty wine castle. And then—lo, a noble damsel appeared upon the scene. Fair lady, 'twas she who led us along the tortuous way, 'tween vast vats of maturing wines. Ah, utter bliss!! The sight was as manna to our thirsting souls. Bottling, capping, storing, shipment—we saw them all. And then, lo, the highlight of our sortie —the tasting inn! Many a happy hour there we spent, sampling the wares, to each his own delight. Verily, into our hearts the spirit of Bacchus did enter, and each succumbed to the grape's sweet nectar.

As night fell, alas, the tasting room appeared a battlefield—many brave warriors, staggering, falling, and lying peacefully; each his face covered with the smile of sweet victory.

At last that dreaded time arose, when, clutching supplies freshly purchased (or otherwise obtained) we clambered aboard our worthy chariot. Many ugly battle wounds revealed themselves as homeward we sped. And with what joy we greeted our alma mater when finally we arrived.

What a show! The 1969 "Engees Ball" turned out to be not only the best faculty ball for many years, but also the greatest turn the campus experienced for the year. Six hundred people, mellowed by the grape and the hop, swang to the sounds of a variety of top bands—jazz and rough red for the mood movers, ale, vino and wild song for the swingers.

Adding to the spectacle of the evening were two "machines" built by some enterprising Mech. students. These magnificent concoctions managed to rotate, vibrate and irritate all night without doing anything significant, except spewing computer punchings everywhere.

Notable incidents were:

The Dean clearing glasses from a table to allow more dancing room for a certain Engee and his bird; one rotund lecturer with an unusually broad alcoholic grin; one civil student sound asleep in his car at 5 o'clock next morning, whilst a certain secretary was joy riding in the "Champs" vehicle; several Fletchuter matched partners wandering around minus their other halves. Certain other notable occurrences are best left unmentioned (on the lawn)—aren't they Taffy.

After much rigging, this extremely successful show was close to breaking even financially. Unfortunately, a light fingered gentleman helped himself to $111 of the society's hard-earned cash while cleaning up was in progress, thus causing a substantial deficit.

Thanks must go to Fred and his ball crew for a fantastic job.

To sum up, the mumbled words of one seedy looking Engee crawling home in the wee small hours—

NEVER AGAIN—TILL NEXT YEAR!

She was a gorgeous girl,
And he was a loving male.
He praised her shape in English,
French, Italian, and Braille.

CAR TRIAL

In the past the biggest factor jeopardising the success of the car trial has been the weather. In order to surmount this problem, the organisers decided that this year the event would be held earlier, on a pleasant summer's day.

However, escape was not this easy. The rain began soon after midnight on the appointed day and continued until about fifteen minutes before the arranged starting time. Cancellation was a distinct possibility, but the sight of 38 cars complete with enthusiastic crews was sufficient to convince the organisers that the show should go on. A number of competitors found it a little hard to forgive this brave decision when contemplating their mud spattered cars after the event.

Despite the weather, the organisers were quite confident that the 90-mile course would be a relatively easy test of man, woman and machine. Nevertheless, a reconnaissance car was arranged to follow the competitors in case of any course mishaps (inter or otherwise).

Some hours later, when the cars assembled in staggered fashion at the Cherry Gardens reclaimed cow paddock (read "oval"), reported a complete lack of incidents and in fact a complete lack of cars on the course proper. Upon investigation, it was revealed that without exception, the instructions had proved too much for the navigators and no one had conquered the whole course.

After some discussion, Geoff Pitts and wife were announced the winners on the grounds that they had covered a greater proportion of the course than any other competitor. In fact they covered half of the 90-mile course, grinding over 160 miles in the process.

With the more harrowing part of the day behind, the entrants settled down to a barbecue and a keg. However, as teapots were the only pouring utensils, the beer was presented in a warm, frothy form to complement the chops.

Although on the journey home the navigators were relieved of the handicap of route instructions, the majority would undoubtedly have had to contend with a handicap of another kind.

STAFF-STUDENT GOLF DAY

as remembered by Dave Mudge

This year's Staff-Student Golf Day started at 9.30 a.m. at the Aldgate Surveyor's Hotel. After waiting until 10 a.m. the field drove off to Harry Meyer's nine hole golf course at Ashbourne. In contrast to the previous year, the students were represented by more than 20 long hitters and, despite a rumour of professional substitutes, only one member of the Staff (Bruce Davis of the Electrical Engineering Department) turned up.

After a brief warm up session the first trio took to the tee. The gallery tensed with excitement as Dynamo Davis sent off a sizzler down the fateful fairway. Shortly afterwards he played his second shot from the front of the tee. Although he carded a 13 for the first hole, he was unable to break the 14 stroke record created by Dashing Doble and Tiger Tyler in the 1968 Ashbourne Masters' Tournament.

During the first nine holes many new golf terms were learnt. Even the most seasoned golfers learnt some new ones.

One casualty nearly occurred on the 6th green when what appeared to be a gardener repairing the green was deafened by the roar of "fore" from the nearby bushes. The "gardener" turned out to be none other than Harry Meyer who knew nothing about the Ashbourne Masters' Tournament, but was pleased to see us anyway.

Grilled steak, chops, beer and onions followed the first nine holes and the field was met at the ninth green by Fred LeMessurier who had substituted aluminium cans for aluminium shafts.

After restocking the golf bags the field set off again after lunch for what turned out to be a most enjoyable, successful and intoxicating round. Colin Best claimed an advantage over the rest of us since he assured us he had the choice of two balls every time he stood up for a shot.

Star of the day was Bruce Davis, who, although starting the day with a 13, finished the round with a birdie 3 on the ninth hole after narrowly missing his wife. Although there was a lack of staff, those who attended agreed it had been a good day.

P.S. I would like to stress here that all you need is a stick and a couple of balls and **you** can enter next year's champion of champions—The Ashbourne Masters' Tournament.

COMMEMORATION, 1969

The Dean of the Faculty of Engineering (Mr. G. Sved) presented to the Chancellor:—

For the Degree of Doctor of Philosophy:

Davis, Bruce Raymond, B.E., B.Sc.	Electrical Eng.
Morgan, Garth Alan, B.E.	Mechanical Eng.
Potter, Robert James, B.E.	Electrical Eng.
Smith, Bernard Maurice, B.E.	Electrical Eng.
Vladcoff, Adrian Nicholay, B.E., B.Sc.	Electrical Eng.
Cooper, Dennis Neil, B.E.	Electrical Eng.

For the Degree of Master of Engineering:

Keith, Ronald James, B.E. (New South Wales)	Electrical Eng.
Ryan, William James, B.E.	Chemical Eng.
Woodburn, John Arnold, B.E.	Civil Eng.
Hashim bin Mohd. Salleh, B.E.	Electrical Eng.

For the Honours Degree of Bachelor of Engineering:

1	Battye, Peter Leonard	Civil Eng.
2B	Blake, Adrian John	Mechanical Eng.
1	Bryans, Neil Lyall	Electrical Eng.
2B	Chee Yan Pong	Mechanical Eng.
1	Downing, Andrew Richard, B.Sc.	Electrical Eng.
2B	Fisher, Jeffrey Ross	Chemical Eng.
2A	Fraser, Robert Alexander	Civil Eng.
2A	Fuller, Trevor Grantley	Civil Eng.
1	Gillett, John Arthur	Civil Eng.
2A	Hardy, Michael Peter	Civil Eng.
1	Hia Chek Phang	Chemical Eng.
2A	Horgan, Ian Raymond	Civil Eng.
2B	Keane, Philip Stephen	Electrical Eng.
1	Khoo Teng Seng	Electrical Eng.
1	Laing, Ian Edward	Civil Eng.
1	Lee Cheong Seng	Chemical Eng.
1	Lim Siong Guan	Mechanical Eng.
1	McPharlin, Terry Wayne, B.Sc.	Electrical Eng.
2B	Padarin, Werner Edward	Civil Eng.
2B	Presnail, Richard James	Mechanical Eng.
2B	Purdey, Brian John	Electrical Eng.
2A	Quan Yew-Choy	Electrical Eng.
1	Rehn, Mark	Civil Eng.
2B	Sandery, Dennis Noel	Civil Eng.
2B	See Leong Chye	Mechanical Eng.
1	Smith, Neil Innes, B.Sc.	Electrical Eng.
2B	Szto Cheng Kooi, Melville	Chemical Eng.
2A	Tan Cheng Yam	Chemical Eng.
2A	Bart Van Der Wel	Civil Eng.
2B	Wang, Kenneth Kun, B.Sc.	Electrical Eng.

For the Ordinary Degree of Bachelor of Engineering:

Baghurst, Andrew Harold	Electrical Eng.
Budarick, Roger Donald	Civil Eng.
Chitnuyanondh, Larp	Civil Eng.
Clark, Richard Hamilton	Chemical Eng.
Clarke, Darrell Owen, B.Sc.	Electrical Eng.
Cleland, David Fullerton	Electrical Eng.
Connolly, John Clifford	Mechanical Eng.
Cowan, David Murray	Civil Eng.
Cuffley, John Alexander	Electrical Eng.
Davis, Barrie William	Electrical Eng.
Dick, Gordon	Electrical Eng.
Falkenberg, Ronald Wesley	Electrical Eng.
Forrest, John Alexander	Civil Eng.
Foulis, John Ridgway	Chemical Eng.
Freeman, Robert Stanley	Mechanical Eng.
Grigg, Donald George	Electrical Eng.
Hall, Ian Sydney	Mechanical Eng.
Harrod, William Boswell	Electrical Eng.
Hollams, Robert Richard Frank	Electrical Eng.
Horn, Richard Anthony	Civil Eng.
Jenner, Alan John	Electrical Eng.
Krievs, Gunars	Electrical Eng.
Lai Kam	Civil Eng.
Lin Siong Kong, John, B.Sc.	Electrical Eng.
Luckhurst-Smith, Hugh	Civil Eng.
Maley, John Sydney	Chemical Eng.
Mitchell, Graeme Alan	Chemical Eng.
Moorfield, Peter Edward	Civil Eng.
Polson, Ian Sydney	Mechanical Eng.
Ports, Ziedonis	Civil Eng.
Rawnsley, Graham John	Electrical Eng.
Redden, Adrian Brian	Civil Eng.
Rudd, Brenton Dean	Chemical Eng.
Templer, Graeme Jeffrey	Civil Eng.
Tokmakoff, Victor Alexander	Civil Eng.
Tuncks, Robert Bruce	Civil Eng.
Tyler, Christopher Alan	Mechanical Eng.
Vassos, Jim	Electrical Eng.
Wang Khang Neng	Civil Eng.
Williams, Mark Rodney	Civil Eng.
Wilson, Richard Brian	Civil Eng.
In absentia:	
Kong Ai Tiing, B.Sc.	Electrical Eng.
Lam Chin Yeh, Denis	Mechanical Eng.
Williams, Brian John	Civil Eng.
Lwin, U. Khin Mg.	Civil Eng.

For the Degree of Bachelor of Engineering, ad eundem gradum:

Pucknell, Douglas Albert, B.Sc. (Heriot-Watt, Edinburgh)

For the Honours Degree of Bachelor of Applied Science:

Coats, John Allen	Applied Chemistry

Degree of Doctor of Philosophy:

Brooks, David Stirling, M.E. (July, 1968)	Civil Eng.
Phillips, Colin Rex, B.E. (December, 1968)	Chemical Eng.

Degree of Bachelor Engineering, ad eundem gradum:

Sved, George, Dip.Mech.Eng. (Budapest) (December, 1968)

SCHOLARS AND PRIZE MEN FOR 1968

ANDREW HAROLD BAGHURST: The Electricity Trust of South Australia prize (shared).

PETER LEONARD BATTYE: The Australian Institute of Steel Construction, Senior Prize; a Commonwealth Postgraduate Award in Civil Engineering.

ROGER DONALD BUDARICK: The Australian Welding Institute Prize.

GEOFFREY HAMILTON CLARK: The Shell Prize in Chemical Engineering.

DARRELL OWEN CLARKE, B.Sc.: The Cable Makers' Association Prize.

BARRIE WILLIAM DAVIS: The Electricity Trust of South Australia Prize (shared).

ANDREW RICHARD DOWNING, B.Sc.: The Philips Electrical Industries Prize in Electronics (shared); the Electricity Trust Prize in Electrical Power Engineering.

HIA CHEK PHANG: The Rutter Jewell Thomas Medal and Prize.

IAN RAYMOND HORGAN: A Commonwealth Postgraduate Award in Civil Engineering.

LUCIO PETER KRBAVAC: The Gerard Prize; the S.A. Chamber of Manufactures Prize in Electronic Control (shared); the I.R.E.E. Fisk Prize; the Sir William Goodman Scholarship.

IAN EDWARD LAING: The Humes Prize in Civil Engineering.

LEE CHEONG SENG: The Lokan Prize; the Union Carbide Prize.

LIM CHENG HOCK: The Shell Prize in Mechanical Engineering.

LIM SIONG GUAN: The Johns-Perry Prize in Mechanical Engineering; the British Tube Mills Prize in Engineering Management; the John Story Prize in Engineering Management.

TERRY WAYNE McPHARLIN, B.Sc.: The Philips Electrical Industries Prize in Electronics (shared).

STEPHEN JAMES NUTT: The Australian Institute of Steel Construction, Junior Prize; the James Hardie Prize in Civil Engineering.

PETER OCHOTA: A Commonwealth Postgraduate Award in Civil Engineering.

LEWIS WILLIAM OWENS: Petroleum Refineries (Australia) Pty. Ltd. Prize in Chemical Engineering.

JOHN WILLIAM PAPPIN: The Sir Robert Chapman Prize for Engineering I.

MARK REHN: A Commonwealth Postgraduate Award in Civil Engineering.

SZTO CHENG KOOI: The Albright and Wilson Prize in Chemical Engineering Design (shared).

KENNETH BERTRAM TAARNBY: The Philips Electrical Industries Prize in Elements of Electronics.

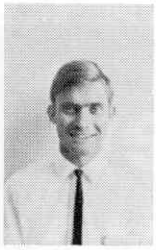
TAN CHENG YAM: The Albright and Wilson Prize in Chemical Engineering Design (shared).

THAM CHOON TAT: The E. V. Clark Prize for Electrical Engineering.

STEPHEN PAUL TUCKER: The S.A. Chamber of Manufactures Prize in Electronic Control (shared).

ELECTRICAL ENGINEERING

C. J. SICILIANO

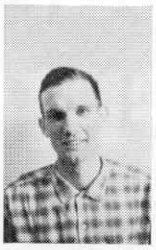


D. H. INKSTER

R. P. ROBERT

D. C. MALLEN

C. WINKLER



R. M. DALY

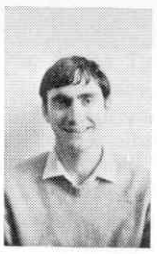
G. M. SHEPHERD

W. MARWOOD

B. W. RICE

D. J. EVANS

U. K. R. WONG



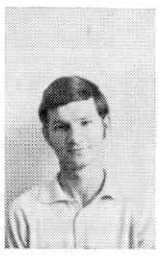
B. CRAVEN

A. J. HURST

I. B. FURLER

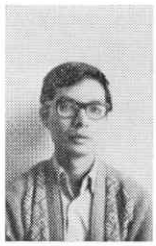
T. J. RADFORD

P. B. CHEESMAN

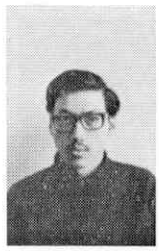


A. SQUASH

I. R. DICK



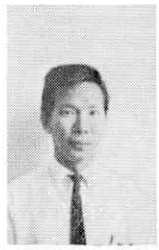
C. YAM



P. S. KUAN

J. C. JAVATILAKA

K. K. YEUNG

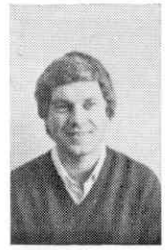


J. P. V. FOK

W. HENSCHKE

L. ZIHALIKISS

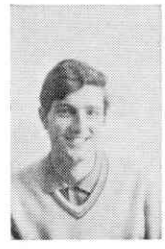
M. L. PALTRIDGE



N. DEMYTKO

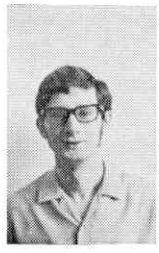
P. BALAN

J. V. MOLE

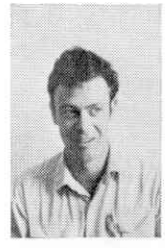


A. P. WILLIAMSON

B. GORDON



M. D. OSBORNE



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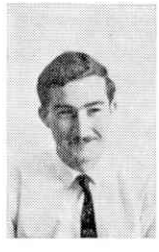
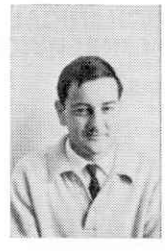
A. P. CRABB



D. L. JUST



C. D. BARLOW

N. H. HUNG

R. HARDING

I. MENADUE

S. S. NAMBIAR

G. P. LOW

J. SHEARER

R. L. PAYNE

R. JAMES

M. MICKLEM

D. S. PASCOE

F. LIM

R. PATTERSON

M. KOLDITZ

L. GOH

C. S. GOH

MECHANICAL ENGINEERING

T. ONG

P. SWIFT

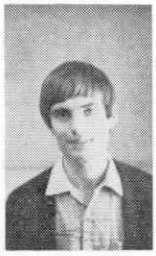
AGAIN???

CHEMICAL ENGINEERING

C. J. BAXENDALE

S. C. MOK

G. R. ILLMAN



R. J. HUUWICK

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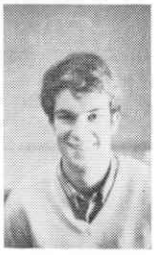

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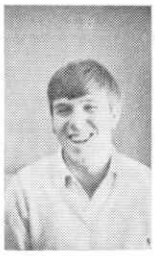
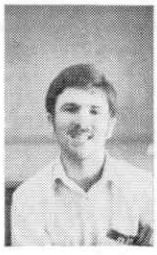
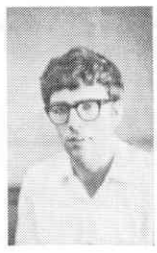
L. W. OWENS



D. R. LOVE

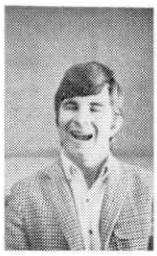


G. C. MATHEWS



J. H. PROWSE

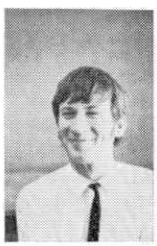
T. K. LEE



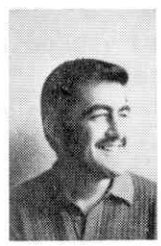
P. W. DAVEY

R. SULLIVAN

B. L. KHOO



W. A. MOBIUS



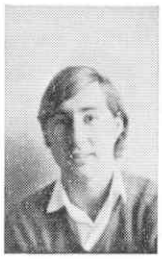
CIVIL ENGINEERING

P. N. LIMBERIS

I. D. IDE

T. A. ZAFIRIS

I. CLUTTERHAM



R. TUCKER

A. P. SHANKS

C. KAUFMANN

S. H. CHUNG

R. THOMAS

A. R. B. DUTTON

R. J. GAYLER

C. P. MICHELMORE

M. L. WILLIAMS

V. KRASNIKOW

M. ROSITANO

S. J. NUTT

P. SHEPHERD

B. JENKINS

J. D. BEARE

K. S. TAM

P. C. K. LIM

J. N. SPENCER

R. I. GUENTHER

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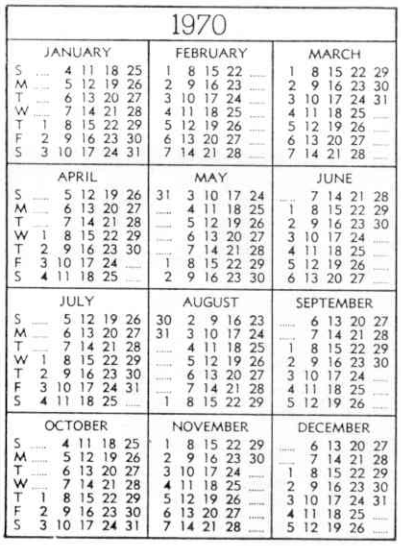

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1st Term: 9th MARCH — 16th MAY

2nd Term: 8th JUNE — 8th AUGUST

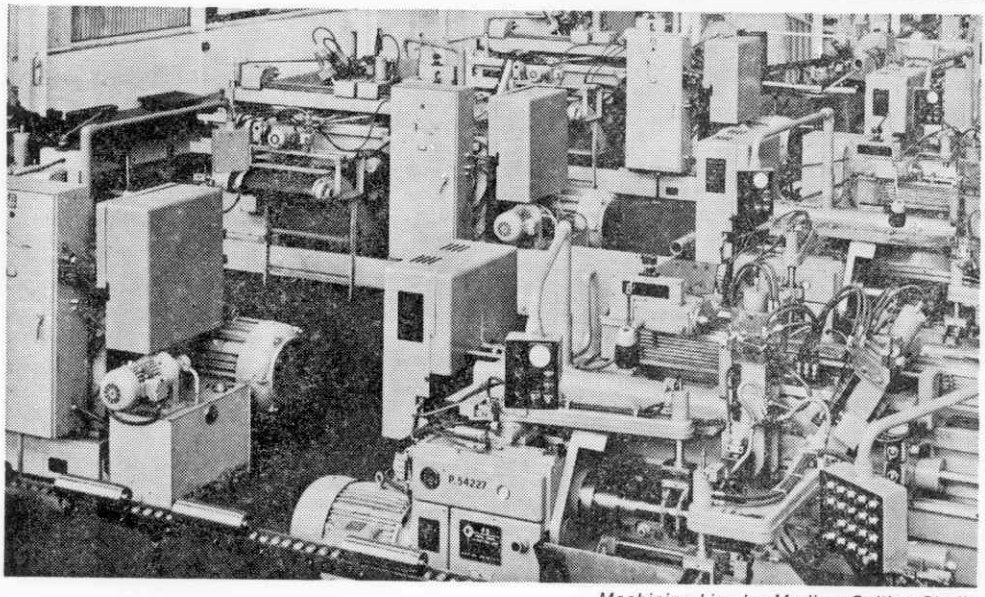
3rd Term: 31st AUGUST — 12th DECEMBER

EXAMINATIONS BEGIN 9th NOVEMBER

ENGINEERS

- **WE PRODUCE**
  - Explosives
  - Ammunition
  - Small Arms
  - Aircraft
  - Guided Missiles
- **WE OPERATE**
  - Over 20 Factories, Laboratories and Research Establishments in Victoria, South Australia and New South Wales
- **WE RESEARCH INTO**
  - Explosives
  - Ammunition
  - Structural Design
  - Aerodynamics
  - Weapons Systems

DEPARTMENT OF SUPPLY

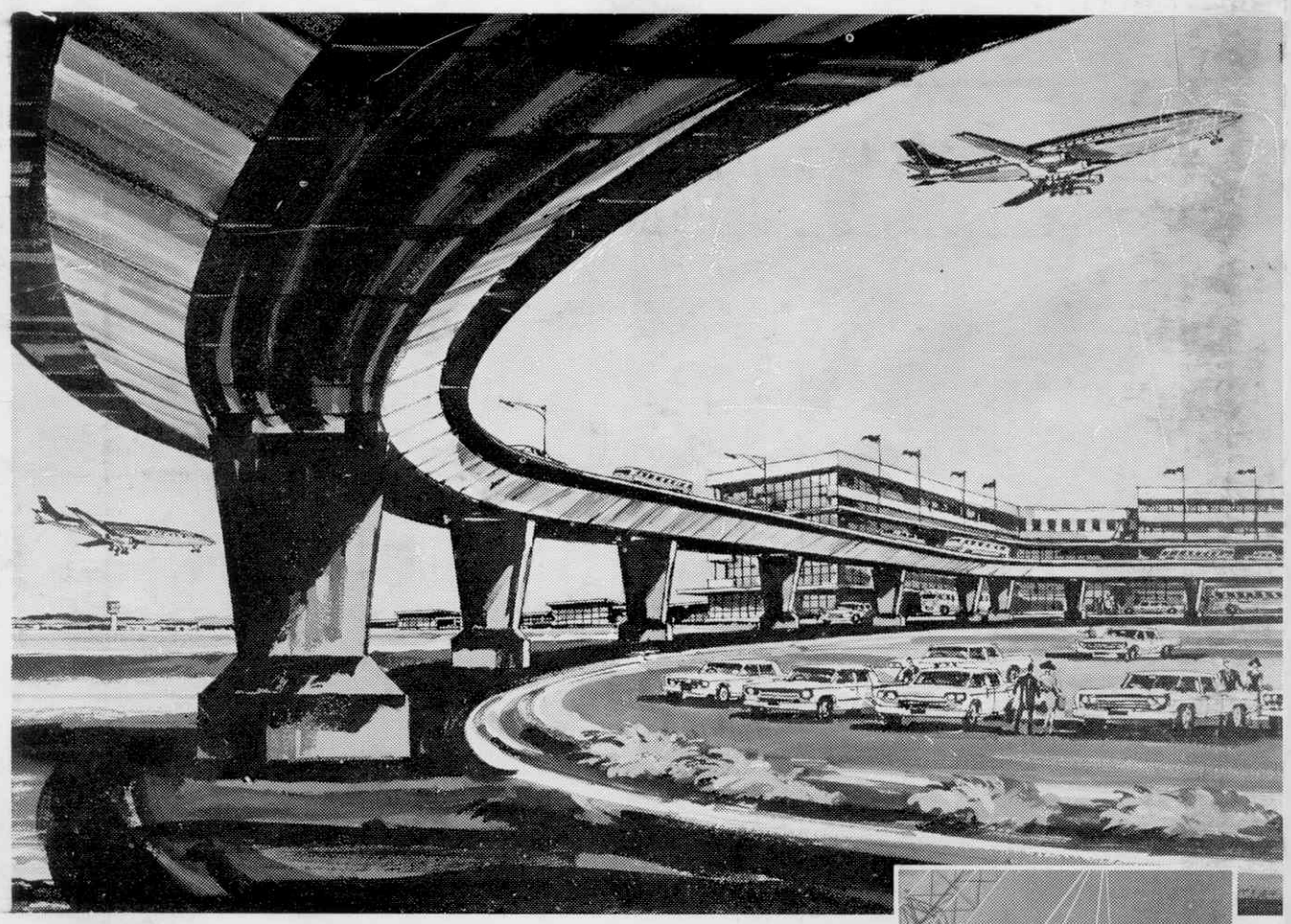


Machining Line for Medium Calibre Shells

Supply employs 20,000 people including more than 600 Engineers. Scope for promotion is excellent and depends on ability alone. The work is demanding but guidance is given by senior staff. Our Engineers are expected to develop their technical skills, to produce ideas and to develop management ability as they progress in the organization.

If you are interested in a professional position with us and want further information why not call in and see us, the Department of Supply, 68 Grenfell Street, Adelaide, S.A., 5000 (Telephone 23 9911)

We will be pleased to advise you.

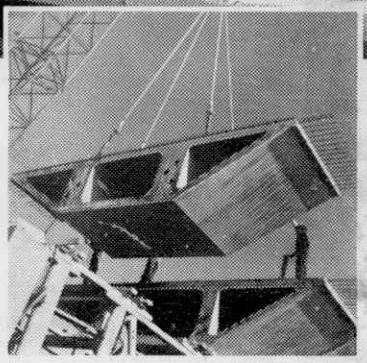


FUNCTIONAL ELEGANCE AT DOWN-TO-EARTH COST

The Tullamarine elevated roadway to Melbourne's modern new air terminal featuring Humes precast box girder segments

This is a fine example of the numerous projects where precast concrete is ideally suited to meet the design engineer's demand for accuracy and functional elegance . . . and also to satisfy the contractor's need to keep costs down. All units were manufactured to a tolerance of $\pm \frac{1}{4}''$ on overall dimensions; factory controlled casting and curing conditions made this accuracy possible. Further advantages —

● The units are delivered to exactly meet your construction programme's timing ● No delays once the units are in position ● No expensive formwork.



This unique roadway is formed by 192 concrete segments post-tensioned together. Each segment measures approximately 27-6″ wide by 9-0″ long by 5-0″ deep, weighs up to 35 tons. Precast in one of our concrete factories to a design by **Maunsell & Partners** for the **Department of Works**, built by **Lewis Constructions.**

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