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President’s Column

By now those of you who are going to apply for ARGC (now ARGS) grants for 1983 will have filled out and submitted your form, remembering, I hope, to have someone else read it critically (and perhaps sceptically) before it was finally typed. I hope that you all individually, and the Physics community generally, fare better than was the case for 1982.

While we await the outcome, you may be interested in the efforts being made behind the scenes by the Institute to try to secure a better deal for the Scheme as a whole and for Physics applicants in particular. The Victorian Branch has been particularly active in pressing the matter and in collecting supporting statistics and in this they have now been helped by a sub-committee of the Science Policy Committee. As a result a letter went to ARGC for that Committee’s annual policy meeting last November, and the Victorian Branch has met directly with the Chairman, Professor Brennan.

At Executive level, the Vice-President and I have met with the Minister for Science and Technology, David Thomson, and have discussed in some detail the scheme itself and the particular problems of the Physical Sciences. Letters on the same lines, urging an expansion of total funding for the Scheme, have been sent to the Prime Minister, the Treasurer and the Minister for Finance, with copies to ASTEC.

We have supported strongly the fundamental principle of adequate grants for truly excellent research projects, but have concentrated on the damage done to Australia’s research through withdrawal of support from other projects that are clearly of very high quality, because of the increasing pressure of applications in the areas of Humanities and the Social Sciences.

We have not urged a splitting of the Scheme into two components, one for the Natural Sciences and one for the Humanities and Social Sciences, for it seems that such a split might suggest a transfer of the Scheme to the Department of Education and then its adsorption into general TEC funding.

The institute as a body will keep up its pressure for additional funding, and in this we will be supported by the Chemists and others. What can we do as individual scientists? The Minister made several suggestions that seem to us to make good sense.

• give as much publicity as possible to achievements supported by ARGS and identify ARGS as the source of support
• do the same in open days and other displays
• contact your local member and give him the facts — or better still, show him.

If we all keep working at it then we will achieve something — for 1984 if not for 1983.

JIM GRAHAM

Editorial

Thank you for the response to our questionnaire. More than 10 per cent of our readers have replied and there have been some very helpful suggestions, but I am afraid changes may be slow. I was somewhat envious of those who obviously had their secretary mail the form.

It appears that we are not doing anything very wrong, even if there is plenty of room for improvement. Several people suggested more advertisements to provide cash for a better journal, but this is not as easy as it sounds. This issue contains the first “small advertisement”. May I remind you that the cost is S1 per line for members and $3 per line for commercial advertisements.

The questionnaire stimulated a few to think of articles they could write. May I appeal to these to submit their articles without further reminder, as follow-up is so time-consuming. Needless to say all offers will be followed up in time. A full analysis of the replies will be undertaken later, but there are sufficient objections to smaller print and softer covers that we will try other avenues first. For example, plastic bags instead of manilla envelopes are likely, to save several cents per copy.

Many people suggested that they would like to see profiles of physics departments and organisations in Australia, and I would encourage you to prepare and submit articles on the work that is going on in your institution. Please try to convey some of the underlying drive and excitement; but if your literary skills are not adequate for that, send an article anyway.

I would like to wish the assistant editor, John Barker, an enjoyable term of five months at the helm. Back in the Spring!

P.S. Professor Webb is Vice Chancellor of Macquarie University. His translation to Monash in the last issue was entirely my fault.

JIM GRAHAM

The Australian Physicist, Vol 19, May 1982 — Page 69
A VHF RADAR FOR ATMOSPHERIC STUDIES

R.A. Vincent, W.G. Elford, B.H. Briggs, Department of Physics, University of Adelaide

This paper is already rather long for our editorial policy. We hope there will be a later opportunity to consider the array in the context of other possible methods, perhaps discussing the background theory, the data reduction methods, and the ways in which results can be corroborated ("air truth"). Ed.

A new radar system for studying the troposphere and stratosphere is being constructed at the Buckland Park field station of the University of Adelaide. The chief objectives are the continuous measurement of winds and turbulence at heights up to about 30 km. This is the first such system in the Southern Hemisphere, and will be a major Australian contribution to the International Middle Atmosphere Program (MAP) which starts this year.

THE MIDDLE ATMOSPHERE AND MAP

The "middle atmosphere" is that region which lies between about 10 km and 100 km in height. The region below 10 km (the troposphere) is accessible to direct sensing techniques and is the seat of everyday weather phenomena. The region from 100 km upwards is studied by a variety of techniques, prominent among which is remote sensing by radio methods which depend on the fact that the air is appreciably ionized in this region. The intermediate region or "middle atmosphere" is difficult to study. It can be transversed by rockets, which have given much valuable information, but rockets are obviously unsuitable for providing continuous observations. Balloons can reach 30 km, but again do not provide the necessary continuity of observation and temporal resolution.

It is clear that further studies of the middle atmosphere are dependent on the development of remote sensing techniques. In recent years these developments have fortunately been forthcoming. Firstly, remote sensing from satellites has become possible. Infra-red radiometers carried by satellites can give information on the temperature and the density of several atmospheric constituents in the middle atmosphere. Secondly, a new ground-based technique, the VHF radar, has been developed capable of measuring winds and detecting the presence of turbulence in the middle atmosphere.

It was mainly the development of these new techniques which led the international scientific unions to recommend a period of intensive study of the middle atmosphere, starting in 1982. The region falls within the field of interest of many of these unions, and the Middle Atmosphere Program (MAP) has therefore been organized by the Inter-Union Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)*. In Australia the National Representative for SCOSTEP is Professor K.D. Cole of La Trobe University. The sub-committee for the Middle Atmosphere Program is convened by one of us (W.G.E.).

The first MAP Planning Document (June 1976) described the middle atmosphere as the "terra incognita" of the earth's environment. The document also stressed the importance of increasing our knowledge of this region. It forms the upper boundary of the troposphere, and may well have some influence on the weather. It has a major effect on the solar radiation reaching the earth's surface, mainly because it is the region where ozone exists. More generally, knowledge of the atmosphere at all heights is needed if the complicated dynamics and chemical processes in the atmosphere as a whole are to be understood. It is the study of the dynamics of the lower part of the middle atmosphere that is the particular application of the new VHF radars.

We will now explain the mode of operation of a VHF radar, and then give some details of the new facility being constructed near Adelaide.

PRINCIPLE OF THE VHF RADAR TECHNIQUE

If radio waves can be scattered or reflected back from any region of the atmosphere, air motions in that region can be studied by observing the Doppler shift imposed on the returning wave. As we will see later, the Doppler shift may be measured either directly, or by indirect methods, but the principle is the same. This technique has been extensively used to study the dynamics of the ionized regions of the upper atmosphere. The presence of free electrons in these regions causes the refractive index to be less than unity, and radio waves are totally reflected from a level where the refractive index becomes zero. Even if the electron density is not large enough to cause this to happen, significant scattering of radio waves may still occur because of local fluctuations in electron density, and hence of refractive index. The measured Doppler shift is related to the wind velocity because the scattering irregularities are carried along by the wind.

In the middle atmosphere the electron density is negligibly small, and the refractive index of air is very close to unity. However, it is very slightly greater than unity by an amount which depends upon the density and on the amount of water vapour present. For example, at a height of 10 km, near the top of the troposphere, a typical value of the refractive index would be 1.0001. At greater heights it will be even closer to unity because of the decreasing density and humidity. The presence of turbulence will cause the refractive index to fluctuate around its mean value, both in time and in space. These fluctuations will, in principle, produce scattering of radio waves, which
should be observable with a radar sensitive enough to detect the very weak echoes.

In the last few years it has been realised that it is technologically feasible to construct radars which can utilise this weak scatter. It is a question of combining sufficiently large antennas with high transmitter powers and sophisticated signal averaging techniques. The choice of operating frequency is also important. The need for high gain antennas and short pulses (to obtain the required height resolution) suggests the use of high radio frequency. However, it can be shown that if the atmospheric density fluctuations are Fourier analysed, then the strength of the radar echo is proportional to the magnitude of density fluctuations having a scale equal to half the radar wavelength. If the radar frequency is very high, the spatial scales which are relevant will be very small and may be highly damped, or not present at all, due to the effects of viscous dissipation. It is necessary to use a radar whose half-wavelength is in the so-called “inertial range” of the turbulence spectrum, where viscosity is not important. In choosing the radar frequency, the frequency variation of galactic and man-made noise must also be considered. Most existing radars which have been specifically designed for measurements of atmospheric wind and turbulence use frequencies near 50 MHz and therefore “see” spatial scales in the atmospheric structure of the order of 3 m. For a given frequency the effectiveness of a radar depends on the product of the mean power transmitted and the area of the antenna array.

Given a radar of sufficient sensitivity to produce observable scatter from the heights of interest, the way the strength of the echoes varies with height and time will itself provide much useful information on the occurrence of turbulence. If the angle of the radar beam can be varied the strength of the echoes can be studied as a function of off-vertical angle. It is sometimes found that the strength increases markedly when the beam is directed vertically upwards. This suggests that horizontal stratifications, as well as turbulent irregularities, are important sources of scatter. These stratifications, which may be sharp steps in air density, behave like weakly reflecting horizontal mirrors. Their presence is usually taken as an indication that the region is dynamically stable.

The prime purpose of a VHF radar, however, is usually to measure winds. Two ways of doing this will now be described.

(a) The Doppler Method

In this method the radar beam is directed in succession to several different off-vertical angles, and the Doppler shift is measured for each. Consider the beam set at an angle $\theta$ (Figure 1) and suppose that echoes returning from a range $r$ are selected. These echoes come from a certain scattering volume (shown shaded) which is determined by the beam width of the radar and the duration of the transmitted radar pulse. Let the average wind vector within the scattering volume be $\mathbf{V}$ (not necessarily horizontal). Then the measured Doppler shift will tell us the component of $\mathbf{V}$ in the direction of the radar beam.

Each direction used for the beam gives a measure of one component of $\mathbf{V}$ (assuming that $V$ is constant over a sufficiently large region). In general three non-coplanar directions of the beam are required to determine the vector $\mathbf{V}$. If the wind is assumed to be horizontal, two directions will suffice.

The range $r$ is easily converted to a height $h$, and by repeating the measurements for a series of different ranges a profile of wind velocity as a function of height is obtained. This can be repeated as often as desired to give the variability in time. As a complete wind profile can be obtained in less than a minute, the time resolution is excellent. The height resolution depends on the duration of the radar pulse and is typically of the order of 1 km.

In the Doppler method it is usual to use the same antenna for transmission and reception. A transmit-receive (TR) switch connects the antennas first to the transmitter for the emission of the pulse and then to the receiver for reception of the echo. It must, of course, be very rapid in operation, and have very good isolation to prevent the powerful transmitted pulse from damaging the receiver.

![Figure 1: Doppler technique for wind measurement. A single observation gives the radial component of the wind, Ve. The same antenna TR is used for transmission and reception.](image)

(b) The Spaced Antenna Method

The field strength due to scatter from a selected height will, at any instant, vary with position in the ground plane, due to the random nature of the scatterers. Thus we can imagine a random pattern of field strength being produced over the ground. If the scatterers are moving horizontally with velocity $v$ it can be shown by diffraction theory that this pattern will move over the ground with velocity $2v$ (Ratcliffe, 1956). If we set up three receiving antennas $R_1, R_2, R_3$ (see Fig 2), each with its own receiver, the received signal strengths will fluctuate as the pattern moves past. Well defined time shifts will be observed between the fluctuations recorded by the three receivers. These time shifts can be measured by cross-correlation techniques, and from them the velocity $v$ can be found. The vertical component can be found quite separately by computing the mean Doppler shift for any one receiver, as in the Doppler method.

The method used to obtain the horizontal velocity seems at first sight to be quite different from that used in the Doppler method. However, it can be shown that they are closely related. It is the spread of Doppler shifts, due to scattering from slightly different off-vertical directions, which actually produces the pattern motion (Briggs, 1980). The difference is that in this method we do not attempt to
Figure 2: Spaced antenna technique for wind measurement. Transmission is from the array T, and reception on the arrays R₁, R₂, R₃.

isolate a particular value of Doppler shift by pointing a narrow beam in one direction. Instead, we accept a spread of values of Doppler shift related to the angular width of a single vertically directed beam.

The time and height resolution of the spaced antenna method are similar to those obtainable with the Doppler method.

Choice of Technique

For ionospheric studies in the frequency range 1-20 MHz (H.F.) it is difficult to produce the narrow beams which the Doppler technique requires, whereas the spaced antenna technique is simple and inexpensive. We have used it extensively at our Buckland Park field station, and it has been used by many other ionospheric physicists. On the other hand at higher frequencies (VHF) narrow beams can be produced fairly easily, and the Doppler technique has been favoured.

A few years ago one of us (RAV) was able to spend a period of study leave at Lindau in West Germany, where there is an operational VHF radar (the SOUSY radar). It was demonstrated that the spaced antenna technique could be used with the VHF radar and that it had some advantages over the Doppler method (Röttger and Vincent, 1978; Vincent and Röttger, 1980). Thus in designing the new VHF radar a decision had to be made as to which mode of operation would be used. Detailed design studies carried out in 1980 showed that a spaced antenna system could be build more cheaply than a comparable Doppler system, and so the spaced antenna method was chosen. The design is such that at a later stage it will be possible to use the Doppler technique as well, in the EW plane only.

Description of the new VHF radar

An artist's view of the radar is shown at the head of this paper, and a plan view in Figure 3. The new facility is adjacent to the large 1 km x 1 km HF array at the Buckland Park field station, about 40 km north of Adelaide.

The pulse transmitter is housed in a small building at the centre of the transmitting array. This array consists of 32 north-south rows of half-wave dipoles of the co-axial colinear type (Babley and Eckland, 1972). Each row contains 48 dipoles, making a total of 1536 dipoles. The array is being constructed on an area of accurately levelled ground 90m x 90m, and wires forming a ground plane will be laid beneath it. Each row of dipoles has its own co-axial feed-line to the transmitter building. There will be provision for connecting all rows directly in parallel to produce a vertical beam, or alternately, for phasing the rows to produce an off-vertical beam. However, beam swinging is possible only in the EW plane with this arrangement, so that if the Doppler method is used, only the EW component of the wind will be measured. For the spaced antenna technique, which is expected to be the routine method, the transmitting beam will be directed vertically.

The receiving antennas for the spaced antenna technique will consist of three spaced arrays each consisting of 16 5-element Yagis. The Yagis are of an inexpensive commercial type sold for television reception. The arrangement of the receiving antennas is shown in the upper part of Fig. 3. Signals from the three arrays are fed to a small hut containing preamplifiers and then by underground co-axial cables to the main radar building at the east end of the site. This building contains the receivers, and all the computing, recording and control equipment. Coherent averaging of several successive received pulses will be used to improve the signal to noise ratio.

The main parameters of the initial system are given below:

- Radio frequency: 54.1 MHz
- Pulse length: 6.7 μs
- Repetition frequency: 1024 Hz
- Peak power: 40 kW

Figure 3: Ground plan of the VHF radar system at Buckland Park, South Australia.
Mean power 329 W
Height Resolution 1 km
Beamwidth (half-power) 3 deg
Power-aperture product $2.4 \times 10^7$ Wm$^2$

The cost, including labour, is in the region of $10^7$. At the time of writing, construction is about half completed.

Further Development

The above parameters give a power-aperture product at the lower end of the range when compared with existing VHF radars overseas. The height range will be restricted initially to the troposphere and lower stratosphere. The measurement of vertical air velocities in the troposphere should be possible and is of considerable interest to meteorologists, since it cannot be obtained from balloon radiosondes.

To extend the height range upwards, it will be necessary to increase the transmitter power. To avoid the problems associated with very high peak powers and high voltages, it is proposed to use the present transmitter to drive several power amplifier modules, each coupled to several rows of dipoles in the transmitting array. For example, four modules might be used, each of mean power 1 kW, and each driving 8 rows of dipoles. The power-aperture product would then be increased to $3.1 \times 10^7$ Wm$^2$. An improvement in sensitivity is also possible by the use of pulse coding. This is a method of effectively increasing the pulse length, and therefore the mean power, without loss of height resolution.

It will be seen that the new radars under construction in Japan and South Australia are located at the same longitude but equal and opposite latitudes. A comparison of the results will be important because the dynamics of the atmosphere is different in the two hemispheres owing to the different distributions of land and sea. We have already been involved in co-operative studies of the upper atmosphere with workers at Kyoto University (Aso and Vincent, 1982). We expect this collaboration to continue, and it is being supported by the Australia-Japan Science and Technology Agreement.

The importance of the work to meteorology is obvious, and there is a particular application to aviation. The availability of continuous observations of winds in the troposphere and lower stratosphere will allow better flight planning for efficiency and economy. It has been estimated that such observations lead to annual fuel savings of up to $10^3$ in the United States.

ACKNOWLEDGEMENTS

The building of the radar is being financed by the Australian Research Grants Committee and the University of Adelaide. We are grateful to several colleagues for help with the design and construction and particularly to Mr. B. Fuller and Mr. J.W. Smith for electronic design and construction work and to

CONCLUSION

When completed the VHF radar will give continuous monitoring of winds and turbulence up to about 30 km. It is situated adjacent to the large 2 MHz radar which gives similar information for the ionized region between 55 and 100 km. Thus the combined facilities will be capable of monitoring atmospheric dynamics from the ground up to 100 km, with only a small "gap" near 40-50 km. They should provide valuable information on prevailing winds, planetary waves, tides, internal gravity waves and turbulence over this height range, and give some indication of the importance of coupling between different regions. The contribution to MAP will be particularly important because the VHF radar is the only one in the southern hemisphere.

The Table below lists all the existing or planned VHF radars which are specifically intended for atmospheric studies of the type described here. (Certain other large radars such as those at Arecibo and Jicamarca have done some work of this type on a time-sharing basis, but are not available for continuous observations because of other commitments).

Mr. L. Heitner for mechanical construction. Helpful advice has been received from Dr. B.B. Balsley, Dr W.L. Echlund and Dr. J. Röttger. We would also like to thank Mrs. A.H. Vincent for the artist's impression of the completed radar system.

REFERENCES


*Under construction.

<table>
<thead>
<tr>
<th>Location</th>
<th>Co-ordinates</th>
<th>Frequency (MHz)</th>
<th>Beamwidth (deg.)</th>
<th>Power Aperture (Wm$^2$)</th>
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<tr>
<td>Poker Flat (Alaska, USA)</td>
<td>65°N 147°W</td>
<td>49.9</td>
<td>1.5</td>
<td>5.1 x 10$^7$</td>
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<td>Lindau (W. Germany) (SOUSSY)</td>
<td>51°N 10°E</td>
<td>53.5</td>
<td>5</td>
<td>7.6 x 10$^7$</td>
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<td>Platteville (Colorado USA)</td>
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<td>49.9</td>
<td>3 x 3</td>
<td>4.5 x 10$^7$</td>
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<td>Sunset (Colorado USA)</td>
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<td>5 x 9</td>
<td>9.4 x 10$^7$</td>
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<td>Urbana (Illinois USA)</td>
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<td>4.4 x 10$^7$</td>
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<td>Kyoto* (Japan) (MU)</td>
<td>35°N 136°E</td>
<td>48</td>
<td>3 x 3</td>
<td>5 x 10$^8$</td>
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<tr>
<td>Buckland Park* (South Australia)</td>
<td>35°S 138°E</td>
<td>54.1</td>
<td>3 x 3</td>
<td>3 x 10$^7$</td>
</tr>
</tbody>
</table>
THE RESEARCH FUNDING CRISIS

Report of a meeting of the Victorian Branch

Following discussion at a meeting of the Branch Committee last year on the reducing percentage of Australian Research Grant Scheme (ARGS) funds awarded to the Physical Sciences (see The Australian Physicist, 18 (11), 1981, 227; also Chemistry in Australia, 48 (10), 1981, 400-404), the Victorian Branch has been pursuing the topic energetically. The Department of Science and Technology has provided valuable factual material and there has been correspondence with the Chairman of the Australian Research Grants Committee (ARGC).

A forum discussion on ARGS funding for the Physical Sciences, the first Victorian monthly meeting for the year, was held on 25th February, the early date being chosen to allow the topic to be aired before the closing date for 1983 ARGS applications. Professor Fred Smith of Monash University Physics Department put the case for the Physical Sciences, Professor Max Brennan, Chairman of both the ARGC Physical Sciences Sub-Committee and the ARGC itself, responded, and a lively question, answer and comment session followed.

Fred made the following points:

(1) With the exception of a pronounced fluctuation due to the introduction of funding for Marine and Upper Atmosphere research, and then a reduction in funding for the scheme as a whole in the mid-1970s the total grant funds made available by the Federal Government through ARGS ($17.98M) have remained essentially constant over the past decade, when expressed in 1982 outturn dollars (including supplementation and cost-of-living adjustments).

(2) During the same period there has been a steady growth in the total number of grant applications (from 1,092 in 1972 to 2,102 in 1982), and an increase in the number of grants approved (from 767 to 1,347). The average grant has therefore fallen from $21,270 to $13,350 (all figures expressed in 1982 dollars); the corresponding physics averages are $33,900 (1972) and $15,000 (1982). Such a fall is clearly devastating during a period when the costs of scientific equipment are rising faster than the cost-of-living and when research-staff salaries are escalating at least at the cost-of-living rate.

(3) The ARGC is now able to provide less than 50% of the total funds requested by all disciplines, and while in terms of the number of applications that are at least partially funded the Physical Sciences does moderately well, ARGS figures reveal that the size of the grants received by physical scientists has fallen to 60% of the amount requested, by far the lowest of all disciplines, the others being in the range 73% to 76%. In absolute terms the average physics grant in 1972 was 62% above the overall average, while in 1982 it was only 11% above.

(4) The significant change in the distribution of ARGS funds between disciplines was the subject of our previous note in this journal. This situation is likely to continue to deteriorate, Fred pointed out, when it is noticed that, over the past five years, the number of applications in the Physical Sciences has remained constant at about 200, or approximately 60% of potential applicants, whereas the number of Humanities and Economics and Social Sciences applicants has risen from 348 to 637 in the same period, the last figure representing only 12% of potential applicants.

(5) The support for physics research by the British Science and Engineering Research Council (SERC) provides the most direct comparison between the levels of funding in Australia and overseas. Thus, the average level of ARGS grants for physics in Australia is between one-half and one-third of that provided by SERC, even though the latter excludes expensive and special physics facilities. Similarly, a table of physics funding for the top ten Australian and British Universities reveals that the funding of the tenth British department (Hull) is more than one-and-half times that for the top Australian money-winner (Sydney) and five times that for Australian physics departments of comparable size.

(6) It has been noted by the ARGC that the average level of support requested by physical scientists has fallen from approximately $48,000 in 1972 to $25,000 in 1982. The Minister for Science and Technology has concluded from this that the drop in funding for physics is due to a reluctance by the top scientists to propose ambitious and expensive projects. The truth, as Fred pointed out, is that applicants, on the basis of the harsh reality of past experience, have simply cut the scope of their proposals to a level of activity that can realistically be mounted with the likely resources. It might be added that, if you are living on skid row, it is not easy, or even sensible, to imagine that tomorrow you will be living in a palace!

(7) In view of the importance of the Physical Sciences in the context of a rapidly changing and developing technological society, the decline in research support is a matter of great concern. Through a lack of recognition of the level of support required to maintain a research program at an international level, the whole fabric of physics research in Australia has been eroded to the point where many such projects may no longer be viable.

In his reply Professor Brennan made the following general and specific points:

(8) The ARGC is now under intense pressure; it was something of a miracle that, thanks to the hard work of many people, the total level of ARGS funds has remained at least constant.

(9) The close and special relationship between the ARGS and the universities, from which it had sprung, must be preserved. Thus, Professor Brennan applauded the ARGC's terms of reference that required that regard be given to
the merits of proposals and not to their distribution between universities, states or disciplines; and he also expressed his concern at a proposal to separate funding for the Arts and the Sciences. (10) The availability of research funding from the newer mission-oriented grant bodies was emphasised, as was the fact that in 1981 Australian universities expended $77M on research, whereas total ARGS funds were only $18M.

(11) In connection with this last comparison and the audible sigh that went up from an audience that was only too aware of the widely differing university policies on the use of these internal research funds and their own personal difficulties in obtaining any share of them, Professor Brennan pointed out that the Prime Minister himself, twelve months ago or more, had urged the CTEC to devise a mechanism whereby all universities would be required to allocate their research funds on a merit basis. It was regretted that the CTEC had not yet taken steps to implement this directive. The ARGC Chairman also warned that, in drawing comparisons with overseas experience, attention must be paid to the proportions of research funds provided to universities by all routes, not only those of similar nature to the ARGS.

(12) The number of projects externally refereed, determined to be of 'good quality' and which the ARGC has found itself unable to support was rising alarmingly: from zero in 1978 to 112 in 1980 and 372 in 1982. This trend was likely to continue, since in 1980 the ARGC had adopted a policy, now supported by the Minister, of decreasing the number of grants so that those supported could be awarded larger sums.

(13) Finally Professor Brennan urged the AIP to assist the ARGC and the Minister and the Department of Science and Technology in seeking more funds for the ARGS from the Federal Government. He urged the AIP to prepare a thoughtful, well-argued and full document for presentation to the Government. He also urged physicists to submit larger and more ambitious proposals to the ARGC.

Question time explored several of the above general matters and one or two particular project cases. The following additional points emerged:

(14) The size of the Arts grant was linked to the cost of employing Research Assistants, but it was pointed out that there is also a large proportion of personnel money in the total Science vote. It was admitted that the equipment grant may have been especially hard hit in recent years; this was an area that the ARGC intended to examine.

(15) The Chairman of the meeting (Dr. Leckey) asked if, in fact, the cost of some physics research was now beyond the ARGS's funding capabilities. Professor Brennan explained the procedure whereby the ARGC could refer large proposals direct to the Minister, and expressed his hope that the Committee would be able to 'lift its sights' in the future. For the audience however, the answer to the question seemed to be largely 'yes'.

Three impressions remained uppermost in this correspondent's mind after the meeting:

(a) the problem of research funding in general, and for physics in particular, in the universities has reached crisis proportions;

(b) the AIP must take a far stronger position and lead in this matter than it has done in the past, not least by preparing as powerful and persuasive a document as possible for submission to government and by adopting a far more visible public stance; and

(c) the Australian physics community seems to have accepted almost totally the present situation; a very few university physicists attended this meeting (about 18) and almost no-one came from other institutions in Melbourne. As Professor Brennan pointed out, the ARGC itself is not immune from the 'what can we cut out' mentality. And the staff of CSIRO and other laboratories seem unaware that, unless the health of university science is attended to urgently, they will have no graduates to fill their research vacancies in the late years of this century. Some antidote must be found for the drug-like lethargy that presently characterises the bulk of the Australian physics community in this matter.

JOHN JENKIN

Australian Journal of Physics

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The Australian Physicist, Vol 19, May 1982 — Page 75
JOBS FOR PHYSICISTS IN 1981

John R. Prescott, Department of Physics, University of Adelaide.

This paper reports the fourth year of a survey of job opportunities for physicists as revealed in Australian newspaper advertisements. The earlier surveys were reported in the *Australian Physicist*.

The first report covered advertisements appearing on Saturdays in *The Australian*, *The Sydney Morning Herald*, the *Melbourne Age*, and the *Adelaide Advertiser* during 1978 and 1979. That article also carried a detailed analysis of the statistics of graduates and the nature and trends of employment opportunities. A second report covered positions advertised in *The Australian* during 1980, and this was also the field of the survey in 1981 which is reported here.

Most of the jobs requiring the traditional qualification of an honours or higher degree in physics are advertised in *The Australian*. However, many students graduate with an ordinary degree in physics or applied physics or a diploma in applied physics, and there is a significant number of positions that appear only in the state newspapers (about 60% on the basis of the 1980 report). It is important to recognise this when considering employment issue and when counselling students on the matter.

The total number of positions advertised was 690. This compares with 680 for the year 1980. The increase is not statistically significant but is consistent with employment advertisements as a whole, which were up by 4.2% between November 1980 and November 1981, according to the ANZ Bank *Business Indicators*. This is a little less than in the corresponding period 1979-1980, when it was 8.5%. The ANZ Bank comments that this reflects the trends in other economic indicators. Notwithstanding, there are grounds for continued optimism about the employment prospects for physicists.

The details of the 1981 count are shown in the table where they are compared with those for 1978, 1979, and 1980. Readers are referred to the previous articles for comments and interpretations of the entries. Apart from the total number of advertisements, all entries are in percentages.

There are some trends in the figures that seem worth commenting on: Recruiting into CSIRO remains steady, if less than one would wish. Other Federal and State government agencies are down in 1981 and it appears as if the active recruitment noted in these areas in 1980 has not been sustained. Recruitment into universities continues to decline and activity in this area is dominated by the Australian National University which accounts for about a third of all advertisements in 1981.

There appears to be a firm demand for physicists graduates in commerce and industry, including the sales and service area. It is interesting to note more of the latter class of advertisement is appearing in *The Australian*, which is perhaps an indication that private enterprise is coming to recognise the value of tertiary qualifications in the sales field.

A feature of the table is the great increase in demand for teachers of physics in secondary schools. Seventy-five positions were advertised in 1981 against 41 in 1980, and 35 in 1979. They cover the whole range of independent schools from the largest schools in the capital cities to small country schools. The most interesting action in teaching, however, does not appear in the table. For the first time in some years, the Victorian Department of Education was advertising for physics teachers, not only in *The Australian* but in interstate papers also. Since then, this lead has been followed by South Australia, The Northern Territory and Queensland. It is clear that teachers of physics (together with chemistry, mathematics and foreign languages) are in seriously short supply. It is worth echoing part of reference 1: "Well-qualified teachers of physics have never been plentiful. The highly publicised excess of teachers generally is certain to result in drastically reduced intakes into the teaching profession: it may happen that the paradox of a shortage of physics teachers is about to develop".

Successful prophecy is doubtless gratifying but one would have preferred to be wrong.

It was pointed out last year that the demand for geophysics graduates was strong. In 1981, a record was kept of positions in 'academic' geophysics (as opposed to exploration geophysics) and 23 such positions were advertised in the universities and government agencies. These are not included in the totals in the table.

One of the consequences of having published the previous surveys is that I now receive a lot of information by word of mouth. Late in 1981, an employer asked me, "We are having trouble recruiting adequately qualified staff, where have all the PhD's gone?" As a result of this question, all the advertisements for 1979, 1980 and 1981 were scanned to see how many of them included a PhD as a stated requirement. The results were:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Positions</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>120</td>
<td>21%</td>
</tr>
<tr>
<td>1980</td>
<td>145</td>
<td>23%</td>
</tr>
<tr>
<td>1981</td>
<td>145</td>
<td>22%</td>
</tr>
</tbody>
</table>

In addition, for about half as many again, a PhD was "desirable" or could be inferred to be so. Since the numbers of PhD graduates in these years were 64, 47 and 53 respectively, it would appear that the gap between supply and demand has opened in favour of the PhD graduate and that Australia now has a shortage of higher degree graduates — certainly in some fields.

REFERENCES

ADVERTISED POSITIONS IN THE AUSTRALIA

All jobs advertised in "The Australian", for which a degree in Physics, Applied Physics or diploma in Applied Physics provides a suitable starting point. All figures are percentages.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Permanent</td>
<td>640</td>
<td>570</td>
<td>680</td>
<td>690</td>
</tr>
<tr>
<td>Temporary</td>
<td>5.6</td>
<td>2.3</td>
<td>4.9</td>
<td>4.8</td>
</tr>
<tr>
<td>Technical</td>
<td>4.1</td>
<td>5.3</td>
<td>8.9</td>
<td>6.2</td>
</tr>
<tr>
<td>Administration</td>
<td>1.0</td>
<td>0.7</td>
<td>0.8</td>
<td>1.3</td>
</tr>
<tr>
<td>Permanent</td>
<td>11.9</td>
<td>10.7</td>
<td>18.2</td>
<td>10.8</td>
</tr>
<tr>
<td>Temporary</td>
<td>0.5</td>
<td>0.5</td>
<td>1.3</td>
<td>3.7</td>
</tr>
<tr>
<td>Permanent</td>
<td>3.3</td>
<td>6.7</td>
<td>11.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Temporary</td>
<td>0.6</td>
<td>0.3</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>University</td>
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<td>4.0</td>
<td>3.7</td>
<td>6.8</td>
</tr>
<tr>
<td>Academic Perm.</td>
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<td>2.6</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Academic Temp.</td>
<td>10.9</td>
<td>13.2</td>
<td>7.9</td>
<td>4.9</td>
</tr>
<tr>
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<td>5.8</td>
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<tr>
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<td>4.0</td>
<td>1.7</td>
<td>1.2</td>
</tr>
<tr>
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<td>1.8</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
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<td>7.9</td>
<td>4.9</td>
</tr>
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<td>2.9</td>
<td>2.8</td>
</tr>
<tr>
<td>Senior Posts</td>
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<td>3.3</td>
<td>2.9</td>
<td>2.8</td>
</tr>
<tr>
<td>Private Industry, Commerce</td>
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<td>18.1</td>
<td>13.1</td>
<td>13.0</td>
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<tr>
<td>Non Sales</td>
<td>1.6</td>
<td>2.5</td>
<td>1.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Sales</td>
<td>1.6</td>
<td>2.5</td>
<td>1.8</td>
<td>5.9</td>
</tr>
<tr>
<td>School Teaching, Independent Only (if 'physics' stipulated)</td>
<td>8.3</td>
<td>6.1</td>
<td>5.7</td>
<td>11.1</td>
</tr>
<tr>
<td>Computing (if science background is required)</td>
<td>5.0</td>
<td>6.8</td>
<td>3.8</td>
<td>3.0</td>
</tr>
<tr>
<td>Overseas, various</td>
<td>5.0</td>
<td>6.8</td>
<td>3.8</td>
<td>3.0</td>
</tr>
<tr>
<td>Other</td>
<td>1.3</td>
<td>0.7</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

THE AUTHOR

John Prescott is a graduate of the Universities of Adelaide, Melbourne and Oxford. After graduation he joined the CSIR (as it then was) and was a foundation member of the staff of the Australian Atomic Energy Commission. He left the AAEC in 1956 to join the Physics Department of the University of British Columbia and moved from there to the newly-formed University of Calgary. He returned to a Chair at Adelaide in 1971. His research interests have been mainly in the fields of nuclear spectroscopy and cosmic ray showers and he is now developing a research programme in physical archaeometry. He has published a number of articles on the teaching of physics. He is the convenor designate of the Employment Committee of the AIP. For relaxation he is building a harpscord, sings with the Graduate Singers and contemplates whether to give up hockey umpiring.

WA Branch News

Branch Meeting

On 25 March a well attended joint meeting of the WA Branch AIP with the Australasian College of Physical Scientists in Medicine heard Dr Rolf Koch, a PhD graduate of the UWA Physics Dept and now at Department of Physics, QTF, deliver an excellently prepared and presented lecture on "Ultrasonic Tomography — a New Method of Medical Imaging".

The talk gave an excellent resume of the process of image reconstruction from scan information and then moved on to discuss the application of ultrasonic scanning with particular reference to diagnosis and mapping of breast cancers.

The techniques described are currently at the stage of clinical trials at the Royal Brisbane Hospital and have tremendous potential as yet only glimpsed.

All present thanked the speaker warmly for his informative and engaging lecture. The writer regrets that all second and third year students from Physics UWA were not present to see a fascinating application of Fourier transform theory at work in a very practical situation.

IUVSTA (Executive Council Meeting 5-7 April, 1982)

Dr J.L. Robins, a member and past Chairman of the AIP Vacuum Physics group, attended the Executive Council meeting in Florence, Italy of the International Union for Vacuum Science, Technique and Applications. Dr Robins is Australian Representative and Recording Secretary of IUVSTA.

R.S. CRISP

Tasmanian Branch Committee for 1982

Chairman: Dr. J. Greenhill
Hon. Sec./Treas.: Mr. R. Underwood
Members: J. Boersun
R. Chappell
P. McCulloch
The AIP Science Policy Committee has had brought to its attention a discussion paper from the Commonwealth Department of Science and Technology (DST) published last October, titled *Bases for Science and Technology Policy*. The discussion paper was written by Mr Geoff McAlpine and Dr Rod Badger of the Department's Policy Studies and International Activities Branch.

The Minister for Science and Technology, Mr David Thomson, explains in the foreword to the paper that it has been prepared to provoke debate on science and technology policies, particularly the role of Government. "The new and different Ministry creates the need for a revised set of policies and programmes."

To follow the paper a general understanding of the issues in science policy and government intervention is required and in view of this, the text may not seem straightforward to some.

The discussion paper has been released on a limited basis to members of parliament and a number of interested academics, business people and government agencies. Mr Thomson has invited those with views on aspects of the discussion paper to forward their comments to the Secretary of the Department of Science and Technology. Copies of this discussion paper may be obtained free of charge from the Executive Officer, Publications, Department of Science and Technology, P.O. Box 65, Belconnen, A.C.T. 2616.

The following is one of the outcomes of meetings between the Minister and DST officers which the Minister initiated following the establishment of the Department in November 1980. These meetings were to discuss the role and objectives of the new Department. The creation of the Department of Science and Technology has combined technology and productivity responsibilities (from the former Department of Productivity) with responsibilities for the science framework (from the former Department of Science and the Environment).

The discussion paper lists and appraises some of the tenets upon which the Science and Technology Ministry's work is based and briefly examines the social and economic premises from which the Ministry can develop effective science and technology policies.

The following summary of the main points of the paper has been prepared for the AIP Science Policy Committee by Mr Richard Joseph.

It is divided into three parts:
- the general conclusions of the discussion paper
- aspects of the theoretical rationale for government support and government policy pronouncements, and
- the policy bases and the Ministry's programs.

The Ministry refers to the Department, the Commonwealth Scientific and Industrial Research Organization (CSIRO) and other bodies which are the responsibility of the Minister for Science and Technology.

**SUMMARY**

**General Conclusions**

The discussion paper points out that while there has been considerable public debate about the merits of some aspects of science and technology, at present there exists a reasonably widespread community consensus that science and technology are worthy of government concern and support. Hence, science and technology (S & T) policy can be considered to include policies of Government financial support for basic scientific research. In addition the potential contribution of science and technology to economic growth is recognised by government policies in that support is provided for industrial research and development (R & D) and innovation.

It is argued in the paper that, being an amalgamation of the former Departments of Science and the Environment, and Productivity, the new department will be well placed to play a coordinating role within government. It would endeavour to integrate policies supporting science and technology with broader social and economic policies. This coordination role for the Department would necessitate liaison between the Department and agencies such as Tertiary Education Commission, Bureau of Mineral Resources, the Defence Science and Technology Organisation and CSIRO in order to integrate policy initiatives.

The paper stresses that the Department's objectives should reflect the emphasis now being placed on the utilisation of science and technology to meet a wide range of objectives such as economic growth, an improved work environment or a better quality workforce. It is argued in the paper that not only pronounced government policies but also a theoretical rationale could be used as one of the bases for S & T Policy. The following section considers these arguments.

**Theoretical Rationale and Government Policies**

The paper points out that there are a number of economic, social and cultural grounds for government intervention in science and technology.

The extent of government support for basic research is seen to depend on the importance society places on the cultural pursuit of learning and the perceived economic contribution that basic research can make. The results of basic research are public knowledge and individual scientists may not be able to obtain full economic return for their endeavours. As well, basic research is usually a risky undertaking (as far as economic return is concerned) and it also involves long time scales before returns occur. The discussion paper recognises that these characteristics of basic research could lead to underinvestment and that government support for basic research may be justified on these grounds.

The paper goes on to state that government support for applied R & D includes ensuring that the
discoverer of a new product or process receives an adequate return for his or her discovery (e.g. through maintenance of the patent system) and improving inadequacies in information flows through the provision of technology transfer programs, extension services and information services. The support for science and technology as part of industry development strategy is an important issue dealt with by the paper. Arguments for government intervention include the benefits of new growth industries, restructuring of existing industries and development of large scale technologies.

Support for ‘key technologies’ is seen in the discussion paper as appropriate for government intervention. The paper compares science and technology policies of the Government and Opposition. There appears to be basic agreement between their policies in that issues such as the need to increase industrial R & D, maintain an effective basic research capability and introduce technological change into industry are all considered to be important. However, as the paper points out, the main differences are that the Opposition would expand the interventionist role of government by measures such as the encouragement of key technologies and key industries, the creation of public enterprises, and expansion of government procurement and the regulation of foreign investment.

The Opposition would also strengthen the government’s coordination role in the science and technology system and introduce stricter controls on technology transfer, particularly with regard to foreign investment and transnational corporations.

The Policy Bases and the Ministry’s Programs

It is pointed out in the discussion paper that the Department has a coordinating policy role to play even though it is not directly responsible for administering many of the programs or funds which affect science and technology and its application. In particular the paper recognises the interdependence of all stages of the innovation process from basic research to commercial success. From this perspective, it is suggested that the Department should aim to improve the level of integration of basic and applied research, technology transfer and assessment.

The paper concludes that S & T policy must incorporate both support for science and technology, and policies for the application of science and technology to achieve economic and social goals. The Department of Science and Technology is seen to be the vehicle for achieving this integration. The recommendations put forward in the discussion paper implicitly suggest that the Government will have to increase its commitment to the integration of science and technology policy with other policies and substantially raise the current status of the Ministry before the Department can adequately play a coordinating role in Australian science policy.

The Science Policy Committee is currently reviewing the discussion paper and it is intended that the review will be published in the Australian Physicist at a later date.

ANU joins forces with industry for radiocarbon project

An $80,000 contract between the ANU and a private company in Finland will allow work to begin on a new radiocarbon dating system capable of handling small samples.

The contract which was signed in late January, gives manufacturing and patent rights to the company, with the University receiving royalties of three per cent of the profits once the system is in production.

The aim is to develop a radiocarbon dating system which would greatly extend the application of existing techniques to prehistory and environmental research in Australia.

It is expected the technology would cost about $100,000 a unit, allowing individual institutions, as opposed to national research centres, to begin dating small samples.

The major application in this field is environmental studies and, for example, the new technology would give researchers a relatively inexpensive tool for tracing the impact of man on the environment.

The ANU work is being carried out in the Research School of Pacific Studies in its Radiocarbon Dating Research unit headed by Henry Polach.

The development work will be carried out at the University of Turku, where two full-time academic staff, including the research leader, Lauri Kalhola, are already engaged on the project.

He said the contract was a result of a personal contact with the company’s research director, Erkki Soini, who had become interested in the commercial potential of the work.

Present radiocarbon dating techniques are based on the detection of radiocarbon decays. These radiometric techniques such as liquid scintillation and gas proportional spectrometry suffer from a common handicap — they require large samples (approximately five grams) of carbon.

For smaller samples (between 10 and 50 milligrams) can be dated by using accelerator mass spectrometry.

The drawback is that these accelerators are very expensive. ANU is at present investigating the accelerator-based dating facilities.

But the present project aims to give an alternative and far cheaper lead into the field of small-sample carbon dating.

The aim is to scale down the existing method of gas proportional counting (the detection of radiocarbon decays) for use on samples of between 10 and 50 milligrams.

Henry Polach said that the system, at an estimated cost of $100,000 a year was cost-effective and its output of about 200 samples a year would be adequate for institutions such as the ANU. The project aims at building a prototype for such small sample counting.

ANU Reporter

The Australian Physicist, Vol 19, May 1982 — Page 79
Solid State Physics Meeting Wagga 1982

The Sixth AIP Solid State Physics Meeting took place from 10th to 12th February at the Riverina College of Advanced Education in the traditional baking heat, with attendance pleasingly up to expectations (107 registrants), despite apprehension about the disruptive effect of a mail strike. This year the Convenor — thoughtfully sparing any of his overworked colleagues the chore, and casting modesty to the winds — has decided to review the conference himself.

When the committee arrived early on Tuesday morning they were appalled (like their predecessors) to find in the College Union where the poster sessions are held, the traditional February building and renovation program in full swing, with a full-blooded accompaniment to jack-hammers, cement-mixers and squeaky wheelbarrows. The committee's adrenaline level rose sharply but was gently lowered by the resourceful house manager Les Allen, who knows how to cope with happenings and committees of that sort. In the event the hectic scene grew unobtrusively quieter and more orderly, the programme went smoothly, the way to the bar was not impeded, and no-one complained.

The ten invited speakers had been chosen shamelessly for their entertainment value and their known ability to keep it simple. They performed splendidly. (Nothing is more embarrassing for an organizing committee than to have its distinguished lecturers confronted by an inert rhythmically breathing mass or alternatively by one that rises with one accord after half an hour and advances menacingly toward the rostrum.) Timing was done to precision with Des Posener's alarm clock and a small glass bell.

Dr. Lewis Chadderton (CSIRO Chemical Physics) opened exuberantly on Wednesday morning with a panoramic survey of ion implantation processes, and gave a vigorous reminder to those of us who looked on during the radiation research of the sixties of how much the subject has kicked on in technique and application since that time. Professor David Beaglehole (Victoria University, Wellington, N.Z.) gave a delightful talk on some very ingenious work, theoretical and experimental, on the nature of liquid surfaces and interfaces in mixtures — a very satisfying piece of condensed matter physics. In the afternoon Professor Colin Sholl (University of New England) gave a nicely balanced talk on hydrogen in metals, and demonstrated that Green's functions and band theory can be mixed with hydrogen storage and metal embrittlement without inflaming the frontal lobes of the average sun-crazed solid-state physicist. Dr. John Riley (La Trobe University) then reviewed the impressive work achieved in angular resolved photo-electron spectroscopy in determining the band structure of transition metals, and showed details of the ambitious high-sensitivity spectrometer now under construction at La Trobe.

That evening there was a discussion on physics funding to universities. Professor Fred Smith gave an exhaustive graphical analysis of the diminishing funds being channelled into university physics via the A.R.G.C., and indicated the increasing number of grants made by that body to his newly aware colleagues from the humanities. (Indelicate comparisons between the relative worth of research into, say, “Portuguese ship building techniques, 1450 to 1485”, as opposed to “Superconductivity in transition-metal di-chalcogenides”, were scrupulously avoided.) In view of the parched nature of the audience, the situation was summed up tersely by Professor Geoff Wilson, and the general view was that physicists will have to be more audacious, ingenious, persistent and numerous in their grant applications. Prior to this discussion there was a resolution to hold the 1983 Meeting in Wagga, and an agreement that a proposal to hold the 1984 Meeting on Pakatoo Island, N.Z., should be put to next year's Meeting.

On Thursday Professor Jan Oitmaa (University of N.S.W.) gave a sympathetic introduction to the new and fashionable topic of solitons in solids, packed with a fascinating array of examples and indications as to where the little darts might be infiltrating your own field. This was an indispensable primer for the solid-state physicist who needs a scapegoat for that unexpected lurch in a curve, or whose cocktail-party conversation wants that extra glitter. Solitons appeared again, with malice aforethought on our part, when Dr. George Paul (University of N.S.W.) gave us the hard word on soft modes. There they were, beavering away, lubricating phase transitions in ferro-electrics. (Meno: must buy George a beer and get an unequivocal answer on what a central peak is.) In the afternoon Professor Fred Smith (Monash University) provided an introduction to the ingenious new technique of Mossbauer gamma-ray scattering, which allows one to distinguish between elastic and inelastic Bragg scattering with an energy resolution of order 10^-3 eV. Your specimen doesn't even have to contain a Mossbauer nucleus; Fred will supply the external Mossbauer source and analyser. The sartorially magnificent Dr. Mike Willsdale (A.N.U.) gave a rumbustious and entertaining review of the theory and practice of mixed magnetic systems another satisfying mix of ingenious and difficult experiments and surprisingly successful theory.

On Friday Dr. David Neilson (University of N.S.W.) deftly reviewed the impact that the recent availability of relatively intense positron sources has had on the study of Fermi surfaces of disordered alloys and defect structures of metals. He also introduced us to the engaging possibilities for studying solids and their surfaces inherent in the very newly available low-energy positron beams. To round off the review talks Professor Severin Crisp (University of W.A.) surveyed the field of soft X-ray studies of the electronic structure of metals and alloys. Once again it was agreeable to be reminded that a field of respectable antiquity (born nearly forty-five years ago) has been rejuvenated by new theory and modern technology.

Of the 80 contributed papers, 30 were allocated as 15 minute talks, and the remaining 50 were divided into two poster sessions and displayed on Wednesday and Thursday respectively. A survey of the contributed talks recorded a pleasing number delivered with clarity, economy and wit (optional). However, a number of senior and experienced
physicists clearly over-estimated the amount of fine detail that even a moderately critical audience could absorb without severe eye-gazing. On the other hand each successive year shows a greater number of poster contributors who have learned the art of good poster presentation, viz. easy legibility from about 3m, vivid (colourful) graphical displays, pithy (even drastic) summary of results, and great economy of words.

The barbecue was held on Thursday night under the trees in front of the Union building and went smoothly and enjoyably. The thirst of the conference members easily exceeded the committee's naive anticipation when buying the wine. Parched physicists were to be seen rummaging through the scattered bottles and holding them up to the light of the moon before stumping purposefully off to the bar.

At mid-day on Friday next year's chairman, Professor Geoff Wilson, thanked the organizing committee in very acceptable terms, and the conference dispersed until next February.

T.J. BASTOW

Report on the Crystal XIII Meeting

The Society of Crystallographers in Australia held their thirteenth meeting at Cromwell College, University of Queensland, from Tuesday 2 February to Friday 5 February 1982. Fifty-eight Crystallographers were registered and came from most Australian States and New Zealand.

A social between the Department of Chemistry of the UQ and Crystal XIII was the first item on the Agenda for Tuesday afternoon. David Hartley, a local businessman who started his own computer software company and now also makes his own hardware gave a talk dealing with the problems of developing and marketing his product in a field as competitive as "The Computer Business".

Wednesday morning saw the start of the Crystallographic papers with sessions on Large and Small Molecule Structure Determination. Featured lecturers were Hans Freeman on "X-ray Absorption Spectra of Oriented Metalloprotein Crystals", John Varghese on his enzyme "Neuramidase", and Jenny Glusker from the Institute for Cancer Research, Philadelphia, reviewing "Drug Receptor Interactions".

After lunch Igor Ortabasi, from the Solar Research Centre of the UQ talked about "Materials Problems Associated with Alternative Energy Applications". The remainder of the afternoon was devoted to a workshop on Powder Methods, organized by Chris Howard and Rod Hill.

One of the highlights of the conference was the ferry trip that evening on the "Captain Cook" sponsored by Philips Scientific and Industrial Systems. This took place from 6.30 to 10.00 p.m., and the members of Crystal XIII saw a beautiful Brisbane by the river.

On Thursday morning the session on Solid State began with another featured lecturer, Stewart Anderson from the Australian National University, reviewing recent work on HRTM Studies of Solid State Reactions. After this session the Hon. J. Moore, Minister for Business and Consumer Affairs in the Federal Parliament, officially opened the Conference and then discussed problems of science policy informally with those present.

The next session on Physics/Mathematics dealt with current developments in direct methods, disorder and electron diffraction. The afternoon meeting on Mineral Crystallography took place in the Julius Kruttschnitt Mineral Research Centre of the UQ where its director, Alban Lynch, discussed recent CSIRO initiatives in the interpretation of electron probe results for on-stream analysis of ores. Some members of Crystal XIII then went down the mine and inspected the research facilities before returning to Cromwell for the session on Charge Densities and the Annual General Meeting of the Society. The traditional dinner was held that evening at "Dirty Dicks" in Petrie Terrace, Brisbane.

The last day started with a display of Teaching software from Christchurch, and hardware from St Lucia, and a final session on Powder Diffraction featuring a lecture by Terry Sabine on "Structure Refinement from Pulsed Neutron Powder Data".

The choice of Cromwell College in February was a good one. The weather was good, the insect population low, and John Argus, the host at Cromwell, went out of his way to make Crystal XIII successful. Perhaps some of the novel things introduced at the meeting might be considered by others for the future:

(a) The presentation of a brief oral "abstract" of their paper at the end of the appropriate formal Session by those individuals who had prepared a poster.

(b) The use of a 15 seater microbus for ferrying purposes.

(c) Replacement of the traditional biscuits at morning/afternoon tea with sliced pineapple, watermelon, pawpaw, apples, oranges, etc.

(d) Social gathering with an academic Department from the host University.

COLIN KENNARD

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advantage of this style of book editing is that individual chapters may be read and studied, without any reference to other chapters in the book. The inevitable result on the other hand, is a great deal of repetition, since each chapter addresses the specific topic anew. Some examples of annoying repetitions are: Fig. 2 (p. 4), Fig. 2 (p. 27), Fig. 6 (p. 38), Fig. 2 (p. 100) and Fig. 2 (p. 331) for atmospheric attenuation; Fig. 4 (p. 36) and Fig. 8 (p. 109) for factors affecting received radar signals; mm wave advantages on p. 25 and p. 97; and signal sources, which are discussed independently with considerable overlap in Chap. I. (p. 6), Chap. II (p. 38), the whole of Chap. IV and Chap. V (p. 257).

For pedantic readers the use of mixed units may also be disturbing, such as Fig. 32 (p. 139) which plots radar cross section in square metres versus range in kilofeet (KFT), and also on the next page in Fig. 33. Similarly, Fig. 3 on p. 33 plots range (m) versus target cross section (dBSm), a most unfortunate nomenclature for (presumably) decibels referenced to one square metre, although 's' is the agreed symbol for seconds not for mm or m.

There are examples of loose speech; for example, in a sentence on p. 117: "Range is relatively insensitive to the S/N in the output bandwidth." In a sentence on p. 149 (i) "Absorption blankets: target coverings, possibly using graphite fibers to absorb incident energy for reradiation at longer wavelengths." Surely shorter wavelengths, i.e. infrared heat, is meant.

Despite this criticism, the book is a worthwhile investment for students of mm wave technology, providing a basic understanding of the present means of generating, detecting and generally using mm waves. I think that because of the nature of the subject, Chapters IV on sources, Chapter V on dielectric waveguides and mm wave integrated circuits and Chapter VI on mm wave experiments will be the ones of more lasting nature, since the other chapters dealing with the uses of mm waves present material which is largely empirical, and for the above reasons are already partially superseded at the time of the printing of the first edition.


Reviewed by L.J. Lynch, CSIRO, Physical Technology Unit, Ryde, N.S.W.

This book is true to title and the Authors’ preface is an accurate description of its contents. Their intention to write a wide ranging guidebook and handbook for experimental pulsed NMR spectroscopy has been achieved. A wealth of information is contained that would be invaluable to any NMR laboratory. This book is a ready reference for the experimentalist, a readable introduction to the myriad aspects of NMR spectroscopy, and a source of practical advice on technique and equipment design and purchase. The chapters on NMR HARDWARE and PRACTICAL TECHNIQUE comprise a unique compendium of ‘nuts and bolts’ knowhow. Another feature is the extensive treatment of techniques and problems encountered in high power pulsed NMR experiments on solids.

The method of the book is to give brief

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**BOOK REVIEWS**


Monsoon Dynamics is described by the editors as being aimed at presenting an up-to-date survey of our state of knowledge of the physical and dynamical processes involved in the Asian monsoon. It is essentially the proceedings of an International Symposium on the subject held in Delhi in December 1977. The above aim is well achieved despite the facts that the symposium was held four years ago (which is prior to the Global Atmospheric Research Programme Monsoon Experiment, MONEX, in 1979) and that the book to some extent duplicates a special 1977 volume of Pure and Applied Geophysics, also titled Monsoon Dynamics.

The book’s main strength is that it is extremely well edited, so that the 46 separate contributions all read in a text-book style rather than as research papers. As a result the reader can quickly and easily gain an appreciation of the research methodology or way of thinking of various scientists without having to wade through their research publications.

Besides covering meteorology it devotes ten chapters to oceanographic and three to hydrological aspects of the monsoon. The scientific quality of the papers is inevitably mixed. Several constitute major contributions to the field, yet others make inferences I would challenge if refereeing for a journal.

Overall, the book is an essential acquisition for libraries of institutions where meteorological or oceanographic research is performed. Its high price, however, makes it difficult to justify purchase by any but the most dedicated individual scientists.


Reviewed by P.J. Somlo, CSIRO Division of Applied Physics, West Lindfield, NSW.

The topic is a different one, since at present most millimetre systems are used in military applications and so the information the reader receives must be to some extent superseded as far as Systems are concerned. The fundamental design considerations are of course important, and do not date.

The main criticism of the book is that the different chapters were written by different authors, and there does not seem to be evidence of an underlying editorial effort to unite the book beyond a well written set of overviews of selected topics. The

introductions to particular topics sufficient for experimental guidance (invariably conveying considerable physical insight in the process) and to direct the reader to a small number of carefully selected references. For the many topics of the book in which I have particular expertise the treatment is accurate, informative, and up to date (one important reference is to J. Magn. Reson. August, 1983). I have gained much insight into unfamiliar aspects of NMR spectroscopy by reading this book. Mathematical derivations are not used and the skilful presentation is aided by a large number of incisive diagrams. This book could be read before the formal NMR texts by beginners in NMR spectroscopy. The many references to Abragam and Slichter could indeed serve as a guide to the selective study of these texts.


Reviewed by E.T. Linacre, School of Earth Sciences, Macquarie University.

‘Global Talk’ by J.N. Pelton, is a most confusing book. It is written in a jokey style, alternatively verbose and cryptic. For instance, it is not immediately clear that the book’s title means ‘satellite communication’. In this connection, the book does contain considerable interesting material on the recent and future development of organizations like INTELSAT, for which the author works. But beyond the confusion and irritation caused by the ponderously racy language there is the obscurity due to an erratic train of thought. The educated layman can learn many items of fact. Did you know that 8 bits equal 1 byte; each person speaks about 10 thousand words a day; there are now over 100 satellite systems for experimental, scientific, military and communication purposes, 5-year future tends to be overoptimistic but 10-year predictions too pessimistic; a 6-fold growth of satellite communications is expected during 1979 to 1993; each American has 1.99 radio receivers; 10 thousand microcomputers are going into French schools by 1985 — and so on and on? Such information is fascinating and provocative, but it induces vertigo when thrown at the reader so randomly. The author roams well beyond the title’s reference to satellite communications. The book has substantial sections on city planning, on the energy crisis, on the social impacts of future technology (displacement of human labour, homogenisation of society, increased productivity, more concentration of power), on messages from other civilizations in space, etc. Once again, stimulating but insufficiently co-ordinated to convey any particular message. This is revealed most clearly at the end of the book, where the forceful lungs of the colourful language used in the earlier chapters collapse into feeble platitudes.

In short, about half the book contains valuable information on the future of satellite communications, with useful explanations for the layman on many technical aspects of telecommunications. In this field the author is clearly a professional. It is a pity that he chose to spic the language so indigetably, and to stir in so much irrelevancy. Perhaps the best chapter (out of his 16) is that resulting from a survey of 80 experts on satellite communications, consulted on their views of future developments. But even these are presented as a sily conversation between fictional characters: “Rather than a buckler recital of the results, I have decided to exercise some literacy license and add a dash of embellishment here and there.”

RES MECHANICA LETTERS.
Reviewed by P.M. Kelly, Lucas Heights Research Laboratories, A.A.E.C., Sutherland, N.S.W.

Nowadays the creation of a new journal is greeted with mixed feelings. While an addition to the scientific literature in a specific field may be welcomed by those specialists in that field, the scientific community at large often reacts with dismay — the “not another journal” syndrome. Res Mechanica Letters will be clearly welcomed by those interested in problems of structural mechanics and materials science and the interaction between these two disciplines — in essence the readership of the existing sister journal Res Mechanica. Judging from the list of members of the Editorial Board the journal already possesses a substantial captive audience!

For those scientists on the periphery of the field, who may resent the implied obligation to read yet another journal, Res Mechanica Letters offers some comfort. The Editorial Board has recognised that “many readers of scientific papers are already compelled to concentrate on the ‘Summary’ and ‘Conclusions’ because they do not have time to devote to a further examination”. Consequently Res Mechanica Letters intend to publish only high quality letters and brief papers (less than 2000 words) within a time scale of 6 to 8 weeks from receipt of an approved manuscript. In an era of information digestion such an approach is to be welcomed, and the rapid dissemination of information in a brief, digestible form is to be commended. Let us hope that this new venture proves successful and that Res Mechanica Letters finds ready acceptance among materials scientists, engineers and physicists.

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Letter

Dear Sir,

There is almost an error in the note ‘More Satellites’ on p. 11 of the March issue. You say that, “Pictures are beamed first to Japan, where a computer adds coastal outlines and grid lines. The pictures are returned to the satellite, and finally to the Bureau of Meteorology’s Melbourne headquarters.” Well, the picture does automatically go to Japan and back, but then is broadcast in the widest sense, for anyone to collect, not only the Bureau of Meteorology. At Macquarie we collect high-quality pictures two or three times a day, and have collected them regularly for years.

More significant in many ways are the orbiting meteorological satellites, since they come much closer to the earth’s surface, two or three hundred kilometres instead of 35,000. This allows higher resolution of surface detail. Teams at Perth and Macquarie are approaching achievement of reliably receiving pictures from such satellites, and CSIRO is embarking on the same.

Edward Linacre,
Satellite Data Unit, Macquarie University

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PEOPLE

At the 9th International Conference on Atomic Spectroscopy in Tokyo last September, Sir Alan Walsh was admitted to Honorary Membership of the Japan Society for Analytical Chemistry. V.S. Fassel of Iowa State University was accorded the same Honour for his work on Inductively Coupled Plasmas.

Mr R.J. MacLean has been appointed Temporary Lecturer in Physics at Macquarie University. He was previously a doctoral candidate at the University of Otago.

Two ANU physicists are among five Australians elected Fellows of the Royal Society of London in March.

They are: Professor R.J. Baxter, Professor in the Department of Theoretical Physics, Research School of Physical Sciences, and Professor J.S. Turner, Foundation Professor of Geophysical Fluid Dynamics in the Research School of Earth Sciences.

Professor Baxter’s field of study is the way gases, liquids and solids behave. He has been honoured for his brilliant contributions to the field of critical phenomena in the form of remarkable and exact solutions of several two-dimensional models.

Professor Turner is interested in convection and mixing in stably stratified fluids.

Dr. Martyn Kibel has been appointed as ARGC research associate in the School of Physical Sciences at Flinders University, commencing in January, and will study adsorption on metal crystals by reflection infrared spectroscopy and photoelectron spectroscopy in collaboration with Bruce Baker.

Dr. Philip Chappell has been appointed as ARGC research associate in the School of Physical Sciences at Flinders University. He is working on catalyst characterization by electron spectroscopy in collaboration with Bruce Baker and Neville Clark.

Doug Bradhurst has been seconded from the AEC to the new CSIRO Division of Energy Chemistry where he is continuing his involvement in a NERDDC-funded project on the production and storage of hydrogen using metal hydrides, as well as beginning some new work on photochemical hydrogen generation in homogeneous aqueous systems.

Professor Dan Haneman, Division of Surface Physics, University of New South Wales, spent most of last year on sabatical leave at Palo Alto Research Centre, Palo Alto, California, U.S.A. He returned to Australia in early February.

Professor Rob Segall is spending the period November, 1981, to July, 1982, at the University of Oxford in Professor Sir Peter Hirsch’s group. Rob will be using the array of electron microscopes (HVEM, STEM/EDS, etc.) in an attempt to define the microstructure of Synroc B (i.e. perovskite, B-hollandite, zirconolite and some new phases) and Synroc C (with simulated radioactive waste). Leaching of the surface of Synroc samples is of direct interest in the stability of the waste form and requires detailed information on the distribution of elements between phases, at grain boundaries and between different fabrication methods.

Associate Professor Jim Piper in the School of Mathematics and Physics at Macquarie University has been awarded the 1982 Pawsey Medal by the Australian Academy of Science for distinguished research in experimental physics. He is regarded as one of the leaders of laser research in Australia.

Fred Darby, formerly Information officer with the Division of Energy Technology at Highett, has been seconded for two years to the Victorian Energy Council. Fred will be working with the former Chief of the Division of Mechanical Engineering, Roger Morse.

The Assistant Chief of the Division of Applied Physics, Dr Bill Blevin, has been appointed the fourth Chairman of the National Standards Commission. The Commission is a statutory authority reporting to the Commonwealth Minister for Science and Technology.

Bill is the second CSIRO scientist to hold the position of Chairman. Mr A.F.A. Harper, a former Senior Principal Research Scientist at Applied Physics, was Chairman from 1978 to 1981.

American Men and Women of Science

American Men and Women of Science is about to undergo a major revision. The 15th edition of this respected biographical reference will be published in August of 1982. The seven-volume directory contains approximately 130,000 brief biographical entries of men and women who have education and training equivalent to the doctorate and who have attained a position of responsibility in the physical, biological, mathematical or engineering sciences. Coverage includes researchers, educators and administrators who are citizens of the Americas and non-citizens working in the Americas on a permanent basis. Prospective entrants may request a questionnaire on which to submit information from the editors through April of 1982.

Current entrants will be sent copies of their existing data for review and updating during the fall and winter of 1981-1982. All address changes occurring since 1978 should be reported to the editors promptly.

Information or requests should be addressed to the Editors, American Men and Women of Science, P.O. Box 25001, Tempe, AZ 85282.

CSIRO Executive Appointment

A distinguished Australian scientist with a background in energy resources and industry has been appointed as a full time member of the CSIRO Executive.

Professor Geoffrey Taylor, Director of the Centre for Resource and Environmental Studies at the Australian National University will join the CSIRO Executive early this month.

His responsibilities will include, in addition to the
energy area, a major concern for scientific and technological developments related to manufacturing industry.

Professor Taylor, 57, is one of the world’s leading coal petrologists. His research interests include fossil fuels, uranium and the assessment and use of energy resources.

Sir Ernest Titterton — looking back on a life without regret

Professor Sir Ernest Titterton, on retiring after 32 years as Professor of Nuclear Physics, Research School of Physical Sciences, said he was concerned at the direction the University was taking.

In reviewing his academic career Sir Ernest said that his fifty years in science had coincided with and aided all the significant developments in nuclear physics.

‘My first physics work was in what we now call radar, radio direction finding. It was necessary to develop modulators and this led me to develop the triggered sparkgap,’ he said.

From 1942-47 he worked with Professor O.R. Frisch on the first cross-section measurements on Uranium-235, and was the discoverer of the spontaneous fission of Uranium 238. Having gained a reputation as an eminent scientist, Sir Ernest was part of the British mission to the United States of America on nuclear weapon development. This work was carried out in secret at Los Alamos. He took an active part in the development of the first ever use of a cyclotron for neutron time-flight experiments.

‘I fired the world’s first nuclear bomb, the Trinity explosion at Alamagordo in 1945, thus gaining a place in history as a result,’ he said.

As if to dispel anti-nuclear opinion, Professor Titterton reminds one that at that stage of World War II, people were crying out for a means to end the war.

‘I believe that less lives were lost through the Hiroshima explosion than if Japan had been invaded. Certainly a lot of Australian lives were spared.

‘Further,’ he added, ‘nuclear weapons have now made world war obsolete both politically and practically and have provided a deterrent of great importance.’

After the war Professor Titterton returned to Britain and led the nuclear emulsion and cloud chamber group at the newly formed Atomic Energy Research Establishment at Harwell and carried out work for the first nuclear power station at Calder Hall in England. ‘It is still operating today and going better than ever,’ he said, ‘and likely to have 20-30 years more life.’

In 1950 he was appointed foundation professor of the Chair of the Nuclear Physics in the Research School of Physical Science. He served as Director of the School for seven years.

‘After establishing our laboratory here we discovered many new nuclear reactions which put Canberra on the map and helped to reverse the brain drain of gifted Australian physicists who previously had sought work overseas.

‘I built a number of accelerators here, the most recent of which is the 14UD pelletron accelerator developed by one of my lifelong friends, Professor R. Habin, of the University of Wisconsin. This machine was the first of its kind anywhere in the world. But now it is being passed by bigger and more costly accelerators coming to completion in the USA, Britain and Japan.

Before retiring he designed a new post accelerator to increase the capacity of the 14UD. ‘The design was completed and the blueprint outlined in reports published before retirement and is within the capacity of the School’s workshops and the nation’s capacity to fund it,’ he added.

To help finance the new machine Sir Ernest has sold two redundant accelerating machines to New Zealand and Japan. These sales have provided 30 per cent of the funds necessary for the new accelerator.

‘Looking back on my own career, I must say that Nuclear Physics has been an immensely successful discipline. It has solved the cosmological problem of how the elements were formed; solved the problem of the energy source of the Universe; provided radio isotopes of critical importance for medical diagnosis and treatment; provided accelerating systems for the therapy of cancers and other diseases; it has provided through nuclear energy or atomic energy, the solution to the world’s energy supplies. Not least, the development of nuclear weapons has made war obsolete.’

Sir Ernest, a tireless advocate of nuclear physics, wishes that lay people would understand the role of nuclear energy in their lives and be less emotional and more factual in discussions of it.

‘Physics has been my life and I will always work for it. Although officially retiring I will be an honorary Visiting Fellow in the Research School for the next two years,’ he said.

‘In forty years time I’ll be proved right. There will be nuclear power everywhere and people will be boiling kettles by it, even critics of nuclear energy.’

‘I have been fortunate that all my life I’ve been paid to do what I would have done in any case.’

ANU Reporter

Visitors to Australia

TO ANU:


Dr Joseph D. Laposa, McMaster University, Visiting Fellow in Research School of Chemistry until Dec 1982. Main interest: Photooluminescence, ex 4122.

TO UNIVERSITY OF QUEENSLAND

PHYSICS

Professor I.R. Pegg of Waterloo University from June to December 1982.

Professor L.G. Smith of the University of Illinois, U.S.A., from February 5 to July 24, 1982. Interests: Ionospheric physics concerning the E-region of the ionosphere, particularly in the phenomena of Sporadic E, and the investigation of these phenomena using rocket-borne experiments.

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PHYSICS
ROUNDABOUT
New SEM for CSIRO

The Advanced Materials Laboratory of the CSIRO Division of Materials Science, situated at Fishermen's Bend, announced that it has just installed a Hitachi S 450 LB scanning electron microscope. This machine, with a lanthanum hexaboride source for higher beam current, is capable of 50 Å resolution. Fitted to the instrument is a Tracor Northern TN2000 EDAX system for element analysis complete with computer control and colour graphics. This equipment is being used in studies on the processes whereby zirconia is toughened by partial stabilization. Soon to be installed at the Advanced Materials Laboratory is a hot isostatic press capable of subjecting specimens to a temperature of 2000 °C and a pressure of 30,000 p.s.i. simultaneously. The press will be used to remove the last traces of porosity from ceramics and metals. Theory predicts striking improvements in mechanical properties when porosity is eliminated, especially if grain growth can be minimized. This may lead to further developments with partially stabilized zirconia, already one of the strongest and toughest of the poly-crystalline oxide ceramics.


'Sandwich' Wraps Up Film Problem

CSIRO scientists have devised a new method for measuring the permeability of plastic wrapping film — its effectiveness as a barrier — to oxygen and water vapour. The new method requires a little equipment and is both rapid and accurate.

The shelf life of many foods depends on the permeability to oxygen and water vapour of the flexible films and film containers used in packaging — so the new method will enable control laboratories to assess the films more easily.

As described by Dr Bob Holland, a scientist with the Division of Food Research in Sydney, the basis of the method was a plastic detector film impregnated with a reagent that is sensitive to the gas being measured. As the gas or vapour is absorbed, the film’s absorption spectrum changes. This change can be monitored by a spectrometer — a common piece of laboratory equipment.

The detector film is sealed between two pieces of the wrapping film to be tested, so that the permeation rate of the penetrant gas or vapour can be readily measured. The 'sandwich' goes between two small identical brass plates with holes in the centre, with a copper wire gasket slightly larger than the holes. The 'sandwich' and the gasket are placed between the two plates which are then screwed together until a firm seal is obtained.

Dr Holland claims that the detector film method was much more sensitive than most other methods — so either smaller film samples can be used or more rapid permeability determinations made.

The response is rapid because the distance between the detector and the test film is short, and because the total volume of gas inside the film envelope is extremely small.

Dr Holland said the method had a wide range of applications in laboratories handling plastic-wrapped products, and in the electronics industry. CSIRO Newsfile.

Jindalee — Experimental Transmissions

Stage B of Jindalee, the novel very-long-range radar being developed by defence scientists for surveillance of the northern approaches to Australia from Alice Springs, began experimental transmissions in April.

The Minister for Defence, Mr D.J. Killen, said Jindalee was one of the most promising research and development projects ever mounted for the defence of Australia.

The more advanced Stage B system was approved by the Government in 1978, after excellent results had been obtained from the initial experimental equipment set up near Alice Springs by the Defence Science and Technology Organisation.

A new Stage B receiving station had been constructed near Alice Springs, next to the original Stage A site on Bond Springs Station. The new main receiving antenna array was 2.8km long.

Much of the large transmitter complex at Harts Range, about 160km from Alice Springs, had been
completed. It had been necessary to construct a new three-megawatt power house and buildings to contain additional transmitter equipment.

Complex and novel Stage B equipment had been developed at Electronics Research Laboratory, South Australia. Most of this equipment was moved to Alice Springs in 1981.

Mr Killen said the major projected improvements in Stage B would be the ability to swing the radar beams over a wide arc together with the use of much more powerful computer systems, including "state of the art" equipment developed by the staff of Electronics Research Laboratory. This would enable targets to be tracked while the beam continued to scan the whole area under surveillance. Already defence planners were working on ways to incorporate Jindalee techniques into Australia's surveillance and early warning systems.

Much of the $24.6 million allocated to the project had been spent on tasks involving Australian industry.

1987 I.U.Cr. Meeting

The Society of Crystallographers of Australia had its offer to host the 14th I.U.Cr. meeting formally accepted by the I.U.Cr., during the 12th meeting at Ottawa in August 1981. While the Australian Academy of Science is willing to help with organizational and secretarial assistance, the financial responsibility for the meeting rests solely with the SCA.

The AGM approved Council's recommendation of Perth as the venue for the meeting. Dr E.N. Maslen has agreed to Chair the Organizing Committee formed to handle arrangements for the Congress. Other members are Professor H.C. Freeman (Program), Dr E.H. Nickel and Dr J. Graham. Correspondence of a specific nature relating to the I.U.Cr. meeting should be directed to Dr Maslen.

Robust Digital Caliper for Workshop Use

The sophisticated electronic digital-readout caliper, previously something of a hothouse flower, has been developed by the Swedish company C.E. Johansson. The Jocul® digital caliper provides the accuracy expected from a precision instrument, but is claimed to be insensitive to dust, oil, filings, shavings, and all the contaminants common to the working environment.

Its micro-electronics are also insensitive to surrounding electrical magnetic interferences, such as from high frequency welders, which traditionally cause problems with more delicate electronic instruments.

It weighs only 150 grams, and has resolutions in 0.01mm and 0.0005" and a repeatability of ±0.01mm (±0.0005") with a measuring range of 0-150mm (0-6").

Its liquid crystal display (LCD) readout can be seen even in near darkness, and a simple switch provides the choice of millimetre or inch readings. The error potential of the conventional vernier readings (and the time-consuming care necessary when reading) no longer exists.

Comfort in Prospect From Variable Roof

A University of Queensland researcher believes radical changes in roof design could make many Australian homes more comfortable in which to live.

Dr Steve Szokolay, of the University's Architectural Science Unit, has spent the last two years investigating a 'variable emittance roof', based on a series of reversible aluminium louvres mounted on specially designed rollers above a large slab of concrete.

The louvres are highly polished on one side, and painted black on the other.

During summer days the louvres sit above the concrete slab with the polished, or reflective side up, to reflect heat.

At night the roof is reversed, with the louvres turning to sit flush on the slab, black surface turned to the sky to release heat as quickly as possible.

The system is reversed for winter operation.

$6.5 Million CIG Plant for Western Australia

The Commonwealth Industrial Gases Limited is to build a new $6.5 million air separation complex in Western Australia, at the Company's present Kwinana industrial area site.

Principal products from the ASU (Air Separation Unit) will be liquid oxygen, liquid nitrogen and liquid argon and will more than double CIG's capacity for liquid oxygen and nitrogen.

The new plant represents the first major expansion in Western Australia since CIG established the Kwinana site in 1970.

The plant is expected to be on stream in the last quarter of 1983, and civil and construction work will begin within six months.

Major machinery and plant equipment will be supplied by a British company, and the installation will be contracted locally.

The new plant will produce, for the first time in Western Australia, considerable quantities of liquid industrial argon for 'shielding' in welding processes, and will accommodate much of the State's current needs presently imported by road tanker from Eastern States.

Laser Physics

The third New Zealand Summer School in Laser Physics will be held at the University of Waikato, Hamilton, New Zealand from January 17-22, 1983.

The school is arranged into short courses from international speakers, covering experimental and theoretical techniques used in laser physics research. Topics to be covered will include optical bistability, multiphoton processes, quantum optics, and new laser systems.

Further information about the school may be obtained from J.D. Harvey, Physics Department, University of Auckland, Private Bag, Auckland, New Zealand.

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22nd Conference on Physical Sciences & Engineering in Medicine & Biology

The Australian College of Physical Sciences in Medicine (A.C.P.S.M.) continues its series of annual conferences with the 22nd conference to be held in Perth, Western Australia, on the 9th-13th August, 1982.

*Physical Sciences* is the generic term covering the physics, mathematics, computing and engineering skills required in a modern medical or clinical setting. The theme of the 22nd Conference is the "Physical Sciences: Clinical Relevance in the 80's" and will highlight the increasing role that will be demand of the scientist/engineer in providing a service to the patient, in developing scientific skills and technology to meet a clinical need and in conducting meaningful research.

The College is proud to announce that Prof. J.M.A. Lenihan has consented to be guest lecturer to the Conference and will present two keynote addresses entitled:—

1. "Clinical Physics — Prospects and Pitfalls" and,
2. "Is Man a Machine?"

Professor Lenihan is the Director of the Department of Clinical Physics and BioEngineering, West of Scotland Health Boards, Glasgow and is well known for his work in activation analysis. He is a world authority on the application of both physics and engineering skills to medicine and is respected, both as a leader in the field and as a pioneer in establishing the important interface between the physical sciences and medicine.

The Conference Programme comprises the keynote addresses, workshop sessions and the scientific programme of contributed papers. A "Call for Papers" is current and papers are sought on all aspects of physics and engineering applied to medicine and biology. Contributions by the medical and allied health professions and all physical scientists are encouraged in topics including:

- physics applied to radiology, radiotherapy and nuclear medicine, etc.,
- non-ionizing radiation and ultrasound,
- health physics and quantity control,
- electrophysiology,
- mathematical modelling and computing,
- clinical instrumentation and technology,
- biomechanics and rehabilitation engineering.

Innovations to the traditional conference programme include:—

- Review papers by leading medical consultants including:
  1. Sir George Bedbrook on Rehabilitation and,
  2. Dr. J. Holt on Microwaves in Cancer Treatment.
- Breakfast session: providing contemporary views on topics as diverse as psychiatry and rehabilitation engineering.
- Workshop sessions.
- Commercial "State of the Art" papers.

With regard to the latter, the College actively seeks the support of relevant commercial organizations in the venture and welcomes close participation in PHYSCI 82. Provision has been made for the traditional support through displays and promotion, and time has been allocated for the presentation of up to eight commercial papers dealing with the scientific basis of an instrument, process or product. Such papers, delivered by the company representative, will be included in the scientific programme and may be followed by a demonstration of the equipment concerned.

University House pioneers in solar heating installation

University House at ANU is the first institution in the University to have installed a solar heating plant to keep energy costs down. The benefits are now becoming apparent.

During 1978-80 the House carried out an energy audit with a firm of consulting engineers. The conclusion was that an ideal opportunity existed for a large installation using solar panels to boost the supply of domestic hot water.

The solar unit was installed on the roof of the one-storey Common Room block in time to derive full benefit from the 1980-81 summer. A not unattractive feature, blending easily with the roof line, the unit consists of a set of 84 collectors giving an exposed area of 172 square metres.

The collectors are coupled together to supply domestic hot water which is electrically pumped and transfers heat to a large bronze water tank in the tower above the main entrance to the House. The tank was already there but has now been properly insulated. Before entering the solar plant the water is warmed by the heat from the kitchen refrigerators, so as and as a result of this 'heat pump' the heating of water in the House is made more efficient, and the hall and kitchen areas are better cooled.

The solar installation was designed by the consulting engineers to supply approximately half the average demand of 80kW for University House. What it achieves is to raise the first year's use of domestic hot water to a satisfactory level for use in bathrooms under optimum conditions of sunshine. Any additional boosting, such as for the main kitchen where sterilisation of utensils demands a hot water temperature of 75°C, is met by electricity. Accurate measurements of the energy saving will require more time but it is estimated that about $10,000 will have been saved in the first year, so that the unit will be paid for in less than five years.

University House has thus proved itself a pace-setter in energy economy. The Governing Body is satisfied that its expenditure of a considerable sum from House funds was justified and that it now has an economical, attractive, and maintenance-free facility. Inquiries about the details of the system will be welcome from any member of the University. *ANU Reporter.*

New Camera

A Sydney firm, Analytron Pty. Ltd., is to manufacture an X-ray diffraction camera invented by Mr. Vince Manners while he was a scientist with the Defence Science and Technology Organisation’s Materials Testing Laboratory at Alexandria, NSW. The camera is capable of producing true powder patterns from single crystals and fibres. It permits more rapid analysis than is possible with earlier cameras.
Automated Image Analysis

An automated image analysis system has been developed by the CSIRO Division of Mineral Chemistry. Known as QEM*SEM for Quantitative Evaluation of Minerals by Scanning Electron Microscopy, the system can scan a sample of ore, identify the number of minerals present, their types and amounts, and their position in relation to each other. It is particularly useful in the characterisation of complex particulates obtained after grinding ores and of mineral concentrates obtained after flotation or gravity separation. The information provided by such analysis is expected to be of importance in the operation, design and control of mineral concentration processes, and for this reason the CSIRO research has been supported by the Australian Mineral Industries Research Association. The Australian company, ETP Pty. Ltd., has been licensed to manufacture and market the system, primarily aimed at mining, metallurgical and materials science applications.

QEM*SEM is a fully automated image analysis system based on a computer-controlled scanning electron microscope fitted with an energy-dispersive (multi-element) X-ray detector and backscatter electron detector. The electron beam is automatically positioned at points regularly spaced over the sample area, and at each point, computer interpretation of the pattern of elemental X-rays, and of electron signal intensity, defines the mineral or phase present. A map, or image, of the mineral distributions in the sample is thus produced (as distinct from an elemental distribution), and is stored in computer memory. For particulate samples, individual particle images are located within the map and, for the minerals within each particle, the amounts present, the mineral-mineral associations and the size distributions, are determined. Population distributions, especially those of liberation and intergrowth, are derived from the total data sets. For drill-core or ore-chip samples, similar measurements are made, but without reference to individual particles.

Physics Degree to Close at D.D.I.A.E.

The Council of the Darling Downs Institute of Advanced Education in Toowoomba, Queensland, has announced that as from 1983, no new enrolments will be accepted into the B.App.Sc. (Physics) course. Three other Degree courses (Chemistry, Australian Studies and Economics) are also being closed down, as part of the Institute's economy drive.

New IOP Group

The Council of The Institute of Physics has approved the formation of a new group, the Semiconductor Physics Group, under the Chairmanship of Professor R.A. Stradling (St. Albans). The object of the Group is to provide a forum for the discussion of current developments in fundamental and related aspects of semiconductor physics.

Further details about the planned activities of the new Group may be obtained from Dr. B.C. Cavenett, Department of Physics, University of Hull, Hull HU6 7RX.
Conferences and Meetings

1982
July 19-23  Gordon Research Conference on Electron Microscopy. USA.
DER Congress German Convention Service, Dammtorstrasse 12, D-2000 Hamburg 36, F.R.G.
C.B. Hallam, Australian National University, Canberra, A.C.T.
R. Bowman, CSIRO Building Research, PO Box 56, Highett 3190.
Aug 24-27  5th European Conf. on Surface Science (EOCSS 5) Gent.
Prof. J. Vennik, Gent University, Solvay State & Cryst. Laboratory, Krijgelaan 271, B-9000 Gent, Belgium.
Prof. R. Ueda, Science & Engineering, Waseda University, 3-4-1, Ohkubo, Shinjuku-ku, Tokyo 160, Japan.
June 1983  Maths Dept. Kings College, Strand, London WC2R2LS.
1983
Jan 17-22  3rd NZ Summer School in Laser Physics, Hamilton NZ.
J.D. Harvey, Phys. Dept., University of Auckland, Private Bag, Auckland NZ.

THE UNIVERSITY OF AUCKLAND
New Zealand

PHYSICS — LECTURESHIP
Applicants must be qualified in Physics and preferably have had some teaching experience. Preference will be given to those with a record of successful involvement in experimental laser physics projects. Commencing salary will be established according to qualifications and experience within the scale for Lecturers, at present NZS$21,660 — $25,684 per annum. Conditions of Appointment and Method of Application are available from the Assistant Registrar (Academic Appointments) University of Auckland, Private Bag, Auckland, New Zealand. Applications close 28 MAY 1982.

Energy Projects Listed
The Federal Government has published the third issue of the “Compendium of Australian Energy Research, Development and Demonstration Projects”.

The compendium incorporates summaries of many energy research, development and demonstration projects being undertaken throughout Australia. The latest issue includes details of more than 700 projects.

Women in Science
In the November 1981 issue of Physics Bulletin (p309) Professor Willmott highlights the dearth of women in science and technology. What is needed to combat this is an effort in the schools, showing not only that women are accepted in science, but that they are needed and are successful in science. The engineers are now doing this with the ‘Insight’ programme, run under the sponsorship of the Engineering Industry Training Board. For the past three summers, groups of pre-A-level schoolgirls have been spending a week at one of several engineering departments. They attend lectures on engineering, lectures from women in engineering, visit engineering concerns and do an engineering project. They are placed under the care of tutors who are practising women engineers. The demand for places on these courses is several times the number available. The objectives of ‘Insight’, to generate an interest in engineering among girls, to inform them as to the nature of engineering in practice and to show that women can make a contribution to engineering indistinguishable from that of men, are being admirably met.

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