Editorial

Physics — the spinning mouse

In the days when shaggy dog stories began and the non-sequitur riddle became fashionable, a question often asked took the form "Why is a mouse when it spins? and to this the answer given in all seriousness was "Because the higher it goes the fewer." It is in this sense that Physics has always been a spinning mouse. The higher levels have always been reserved for very few people. Below the higher levels there was a profession of physics, a mouse whose spin was greatly increased by the achievements of the wartime scientists and national projects based on nuclear energy development and space physics.

Many physicists certainly were higher but there seems to have been an anti-spin movement generated. There is little doubt that opportunities in physics and the call for physics in the schools and undergraduate courses are not in evidence to the extent that they were in the past — but this may well be the fault of the physics profession. I know that many factors can be introduced to excuse the falling interest — money, fashion, disillusionment with technology, the bomb, nuclear energy and others — but there remains a need to convert each generation anew and this is task for practising physicists. Perhaps Physics is not the greatest force for advancement in the world but physicists to whom I talk believe that an understanding of our technological society requires people at all levels to have an understanding of physical principles and their social and economic effects on our future.

Physicists must be seen more as people who have much to give to our social as well as technical and physical development. This does not imply that physicists alone can do it which requires total cooperation but perhaps the image of the withdrawn scientist can be erased.

Start spinning the mouse! — Bill Boundy

AIP Submission

To the Committee Reviewing the Objectives of the Bureau of
Mineral Resources, Geology and Geophysics

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A. Preamble

This report has been prepared from documentation or letters supplied from various sources, chiefly involving geophysics within the Australian Institute of Physics. It is however a fairly limited body of information and ideas — due to the very short time scale provided. Relevant to this matter, it was stated in one letter:

"A basic point that should be made is that the committee of enquiry should seek interviews or personal representations by interested parties. I do not believe that they can accumulate sufficient documentary evidence to draw useful conclusions at such short notice."

The President and the Hon. Secretary of the Institute of Physics note in the same vein that submissions have not been sought by advertisement. It will be clear from the section below on work actually carried out by the BMR (G and G), that it has played a major role in the total geological and geophysical activities of Australia throughout the last 30 years. Therefore any committee which may seek to change the objectives of this big group should not only take a wide view, but be seen to be taking such a view. The Committee itself is limited almost to an internal type of Public Service membership, comprising as it does,

The Deputy Secretary of the Department of National Resources (Chairman)
The Director of the BMR
A member of the Public Service Board
A previous Director (now retired) of the SA Mines Department, and the Australian Mineral Foundation.

The point is therefore made in several quarters that this is a relatively low-key review, not effectively advertised, which could lead to the continuation of what is clearly seen by some as the presently unfortunate aspects of the BMR (G and G) organisation, or to changes which do not tie in with extensive groups undertaking inter-related work in other Australian organisations. These groups would include the State Geological Surveys, with 15 to 20 staff in each of the States, the CSIRO, with about 200 professional staff in its various Mineral Research Laboratories, half of whom are geoscientists, and possibly the Australian Atomic Energy Commission Exploration Branch. There are also of course the Univer-
sities, which in total have a considerable number of applied geologists and geoscientists, and a large private sector of Companies concerned with coal, oil, gas, minerals and groundwater.

The fear is expressed by many that BMR (G and G) may become a non-research unit.

B. The types of work carried out by the Bureau of Mineral Resources, Geology and Geophysics, since its inception in 1946.

The following makes no claim to be complete, but is abstracted from many Reports to give a feel for the types of work that have actually been done.

1. Seismic (man-made), magnetic and electric methods applied to the investigation of land structures, both detailed and regional.

   Notes on seismic studies:
   i. It is mainly an indicator of oil, gas, coal and groundwater.
   ii. It is expensive, with initial equipment costing about $300,000 and a field survey costing $2000 - $3000 per day.
   iii. In conjunction with Australian and US universities, basic studies have been carried out on the earth's crust and upper mantle.

2. Airborne magnetic and radiometric surveys.

   Note: Aeromagnetic surveys had covered 73% of Australia by the end of 1976.

3. Marine geophysical surveys.

   Note: Over the period 1965-1973, 150,000 nautical miles of simultaneous magnetic, gravity, seismic and water depth measurements and 20,000 miles of sea bottom sampling and photography were carried out.

4. Earthquake seismology, and variations of the earth's magnetic field.

   Note: A network of observatories is maintained to record these two sets of data, comprising 2 major and 2 minor stations, 16 seismic recording stations, and the regular reoccupancy of a large number of sites for the observation of the earth's magnetic field.

5. Gravity mapping.

   Note: The whole continent has now been covered at a station spacing of 11km, mostly by BMR (G and G).


7. Instrument design and construction for many of the above.

8. Data handling and mapping. This is now heavily linked to computers.

   Notes:
   i. Geological mapping at 1:250,000 has almost covered Australia, and 1:100,000 is now being done in selected areas. This involves co-operation with individual State Geological Surveys.
   ii. Geological maps date due to the acquisition of new knowledge, new theories and new requirements. It is therefore an ongoing activity.
   iii. Most of ANARE's Antarctic work in geology and solid-earth geophysics is carried out by the BMR.

9. Reports, resource estimates, information dissemination, etc.

10. Foreign aid program.

   Now, as a result of its 30 years of effort, the BMR has become a National repository of a wealth of geophysical and geological data and information. Libraries regard the BMR as the basic National geoscience collection.

   All submissions support the ongoing need for this National work. One refers to it as "essential to the Country's future" and another states "I believe very strongly, that on the highest priority, they (BMR) must continue their program of basic support for exploration."

   "No other body exists to do it, whatever else they do must be in addition to this."

C. Some present troubles

The biggest current problem, perhaps, is money. Since 1972 BMR's funds have dropped in real value at the rate of about $700,000 per annum. At the same time the percentage allocated to salaries has risen steadily from 45% in 1965 to 64% in 1975. This is combined with a fierce manpower cut from an establishment of 644 to a ceiling of 556 set for 30th June 1977. This has the immediate effects of:

   i. Most wastage tending to occur at the lower levels, so that the remaining staff tend to be used inefficiently.
   ii. Capital equipment not being fully used, and the rather more long-term effect that the basic science and research components will tend to be pushed out to make sure that the programs with relevance to short term economic objectives remain. For example, the smaller amount of money available for operations and equipment has a particularly serious effect on projects requiring large expenditure, such as marine surveys. In spite of their national importance, these have had to be abandoned for the present.

   The solution to these problems is probably bound up with the solution to the country's economic problems as a whole, and whatever is done in the short term will probably be only a bandaid procedure. It must however, mean a marked overall slowdown in the quantity of work produced. This is exactly contrary to the complaints in one submission that the airborne magnetic survey is proceeding too slowly. This contributor goes on to state generally "The quality of the work published by BMR is unquestionable, only the rate of production is in question." Obviously the rate of production can only be increased by the temporary elimination of some programs entirely.

   Other continuing problems are associated with research. Even now insufficient encouragement is given to publications of research. A component of research is vital to any program of data measurement and interpretation that has goals beyond the most immediate operational activity. The separation of research and survey work would be to the detriment of both. (Still worse, would be the elimination of research). There is also a probable lack of flexibility in project management due to the requirement by the Public Service Board that staff operate to fixed duty statements. This is a familiar picture, unfortunately, of a non-scientifically oriented Board, by the very nature of the main bulk of its duties, trying to administer scientists.

   At BMR many questions of a semi-technical nature go to the Department of National Resources for decision, rather than reside with a Division Chief, who is a scientist, such as would happen in the CSIRO. Furthermore at BMR all senior staff are obliged to do administration to an extent which practically excludes scientific work.

   Grading of staff is according to Public Service practice with no Research Scientist grades, no merit promotion.
and no encouragement of science as distinct from administration in promotion considerations. It is therefore sometimes difficult to bring in senior staff.

Frankly, in this area the Public Service Board is still in the dark ages, and it will take a very courageous Committee to recommend the following section of this submission.

D. Major proposals for change

In the documentation read, many lists exist of the objectives of the BMR (G and G) and of what the objectives might be. No attempt is made here to produce yet another list. When a complete list of objectives can be drawn up in detail, that organisation is scientifically dead. It is sufficient for present purposes to know what areas of work have occupied the main thrust of the organisation.

Preceding any re-examination of objectives should be a reorganisation to overcome some of the faults described in Section C above.

An obvious thought is that parts of the BMR should be grouped with parts of the CSIRO Mineral Research Laboratories. At first sight this could result in more mobility of staff, and more economy of equipment and support staff. On closer inspection, however, the CSIRO is found to be mainly laboratory based and is not keen on survey activities, so it does not have the wide experience of field applications possessed by the BMR. The latter has less expertise in some sections of fundamental research of a laboratory nature. The two organisations are also well separated physically. On the other hand the CSIRO has been proven to operate in a structure successful for handling scientific staff and scientific problems. The organisations should therefore maintain close cooperation, but not integrate in the near future.

The BMR Geological and Geophysical Branches and perhaps some other sections of BMR should become the nucleus of an Australian Geological Survey. It should be a Statutory Authority, directly responsible to its Minister, and organised in the same way as the CSIRO. There would then be a place for outstanding scientists not desirous of an administrative position, and somewhat greater fluidity of internal action.

In order to maintain the cooperation of geoscientists, and their organisations, which as seen earlier are widely spread in Australia, a National Geoscience Council should be set up, with senior scientists at least from CSIRO, the BMR (G and G), the State Geological Surveys, the Universities, the Petroleum and Mineral Industries, and the Australian Atomic Energy Commission.

To give teeth to such a Council it must be able to tender advice to the Minister who is responsible for the Australian Geological Survey.

It is possible that in time a greater fusion of the relevant sections of CSIRO and BMR could come about, but this could be left for the present to grow naturally.

E. Minor Suggestions

A number of points were made in the submissions which are of smaller moment, but are interesting and so are mentioned here in random order.

i. The BMR system of advance payments to Australian contracting companies, despite an unfortunate incident several years back, should be made more liberal. This would allow more money to stay in Australia.

ii. BMR needs a closer liaison with exploration companies, particularly to raise the standard of the younger geophysicists. (The writer has personal experience of a small contract awarded by the BMR. His group, which at that time had considerable operating experience, was largely left out of preliminary advice, and was left out entirely from subsequent data study).

iii. A quicker presentation of data to industry is essential. Delays can run into months and years in the desire to present completed reports. Secrecy of any kind should be avoided.

F. Summary of recommendations by the Australian Institute of Physics

I. The BMR is recognised as being a body large enough to maintain continuity in field measurement programs as well as provide the logistics and support work that is necessary for such programs. Such work is seen as providing an essential basic framework of geoscience data, and as encouraging and facilitating exploration for mineral resources in Australia.

2. A component of research is seen as essential in maintaining the vitality of the BMR (Geology and Geophysics).

3. Parts of the BMR should be converted to a Statutory Authority, to be known as the Australian Geological Survey, reporting directly to its Minister.

4. A National Geoscience Council should be set up, containing senior scientists from many Australian groups and organisations concerned with the geology of Australia and its environs, which can advise the Minister who is responsible for the Australian Geological Survey.

APPENDIX — Sources of Information and Views

A. Various printed brochures prepared by the BMR and other organisations.

B. The BMR (G and G) annual reports for 1975 and 1976.


E. Various documents on BMR objectives, 1976 and 1977 and undated, prepared individually or by groups.

F. Submission 28th June 1977, by Mr J. Webb, BSc in Mech Eng. Managing Director, Austral Exploration Services Pty Ltd, and formerly 7 years with BMR and 10 years with SA Department of Mines.

G. Submission 24th June 1977, by Professor F. D. Stacey, Prof. of Applied Physics, University of Queensland.

H. Submission 22nd June 1977, by Professor K. Vozoff, Prof. of Geophysics, Macquarie University.

I. Submission 23rd May, 1977, to the President of the Australian Institute of Physics, signed by 18 members of the BMR staff who are also members of the AIP.

J. Report on visit to BMR, 10th June 1977, by the President and the Hon. Secretary of the Australian Institute of Physics.
Branch News

Report on Victorian Branch Meeting

The June meeting of the Victorian Branch heard a lecture from Dr K. G. McCracken, Chief of the CSIRO Division of Mineral Physics, on the topic “Recycling a physicist”.

In reviewing his early scientific career, Dr McCracken sought reasons for his choice of particular lines of work, and hence an understanding of the significant shift which occurred when he accepted his present position.

Dr McCracken emphasised his need to be involved in national projects of importance to the community, and noted his early work with the International Geophysical Year and the early stages of the US Space program. These were “heady days”, he said, when young scientists were given big responsibilities and became tremendously involved and committed to their work. Following experiments which plotted the cosmic-ray anisotropy in interplanetary space and hence provided evidence of irregularities in the interplanetary magnetic field, Dr McCracken became involved with proving experiments for satellites and undertook some significant early investigations in x-ray astronomy.

Back in Australia (as a Professor of Physics at the University of Adelaide) he continued x-ray astronomy work with balloons flown from Mildura and rockets from Woomera; experiments which indicated the existence of strong and variable x-ray sources. The closure of Woomera brought this work to an end and provided the impetus for his “recycling”.

Confronted with a choice of returning to the USA or becoming involved with the new CSIRO effort in the area of exploration geophysics and mineral physics, the prospect of contributing to a project of national importance seems to have been crucial to his decision. The “mining boom” was in its death throes; serious scientific evaluation of geophysical techniques by CSIRO was in its infancy.

Dr McCracken outlined how his Division operates, and, in particular, stressed the value and importance to the total effort of the following closed-loop system.

He outlined several specific problems which the Division was investigating, including various electromagnetic exploration methods, the accurate and continuous measurement of ore grades using radiometric techniques, and the collapse of coal mine roofs.

Overall, Dr McCracken saw a need to make physics “work” in the community and to make industry aware of what science can offer in the solution of their problems. A lively question time followed in which, for example, the relationship of CSIRO Mineral Physics to the Bureau of Mineral Resources (BMR) was explored. Dr McCracken concluded by saying “forgetting politics, forgetting money, thinking sensible thoughts – CSIRO and BMR could be united”. This struck a chord with the present author, and perhaps said something additional about Dr McCracken’s motivation for “recycling” into a newly created CSIRO Division; namely, his apparent dislike of the politics which seems to hamper so much university activity. It also indicates the way Dr McCracken feels Australian physicists should approach the problem of maximising the practical impact of their science within the very limited funds available.

John Jenkin

New South Wales Branch News

On Tuesday July 12 Scientific Meeting No 133 was held at Sydney University. After a well attended dinner at the Staff Club the meeting was addressed by Dr Brian Window on the topic “Solar thermal research at the University of Sydney”. This was a particularly well attended talk, reflecting the popular current interest in this topic.

Dr Window, leader of the Solar group at Sydney University, showed that the most likely and useful contribution solar energy could make in Australia was in the supply of low grade, 60-120°C, industrial heat. The development of collectors to meet this need involves reducing losses due to conduction, by ordinary good design, due to convection, by use of a vacuum jacket, and due to radiation, by development of selective surfaces. It is in this latter area that the Sydney University group has developed their expertise.

Some glass collectors in the form of long thin vacuum flasks, unsilvered of course, and with the outside surface of the inner tube coated with a selective surface were on display. The use of glass is dictated by the degradation of the vacuum space by diffusion of atmospheric helium and by outgassing. Its cheapness is an added benefit. The selective surface, which has a black mirror-like appearance, consists of iron carbide on copper and is produced by reactive sputtering. It has a solar absorbance of 85% and an emittance of 3%. A lifetime of twenty years is anticipated.

Current work involves the measurement at the operating temperature of the accommodation coefficient for helium in the Knudsen equation, and an investigation of chrome black as a solar selective surface.

A lively question time, terminated by the chairman due to the lateness of the hour, was continued informally over coffee.

-N. Bignell
Report on A.C.T. Branch Meeting
NMR at RMC

On 21 April, 1977 the A.C.T. Branch meeting took the form of a visit to the Department of Physics at the Royal Military College, Duntrun. Professor Geoff Wilson gave a stimulating, entertaining lecture on the development at Duntrun of techniques to detect pulsed nuclear magnetic resonances of radioactive nuclei via observations of the anisotropic emission of γ-radiations at very low temperatures. Recently the Duntrun group has become the first to observe spin echo nmr of radioactive nuclei by studying the γ-radiations at very low temperatures. As a result, the way has now been opened for the rich variety of pulse resonance techniques to be applied to samples with very small concentrations of radioactive nuclei.

During the lecture, demonstrations were given of conventional pulsed nmr of stable nuclei. Afterwards those attending toured the research laboratories to see the results of several current projects. In particular, Reg Foster and Don Chaplin gave a demonstration of the detection of spin echo nmr of 60Co nuclei in a very dilute FeCo alloy at a temperature of about 0.011K.

After the visit to the Physics Department the group made its way to the Officers’ Mess and the meeting finished with some enjoyable experimental research into food and wine. It is hoped that echoes of such meetings will be observed regularly in the future!

Letter—

SIR,

In the July Australian Physicist p.100 you reproduced a new item from Uniken reporting a substantial grant to a Light Scattering Group at the University of NSW, in order to set up a facility described as “the first of its kind in Australia to involve researchers not only from the University of NSW, but from other universities and research establishments in Australia and overseas”.

I would like to point out that a similar and well-equipped Light Scattering Group has operated in the School of Mathematics and Physics at Macquarie University for nearly ten years. For much of that time this group has worked in close collaboration with other research laboratories including those of the University of NSW, and the CSIRO, chiefly on samples of biological interest such as proteins and membrane structures.

I am aware that the editor of the Australian Physicist cannot be responsible for the factual accuracy of news items from other sources, but I feel I must correct any false impression conveyed to your readers by this report.

Guy C. Fletcher.
School of Mathematics & Physics,
Macquarie University

Nuclear Views Needed—

Questionnaire on Physicists’ attitude to Nuclear Power

The response to this questionnaire has been disappointingly small: only about 10 percent of the membership have returned the questionnaire which appeared in the June issue of The Australian Physicist. Does this indicate that the majority of physicists are indeed indifferent to the consequences - beneficial or hazardous - of a rapidly growing nuclear power program?

In order to obtain a larger response we are delaying final analysis of the questionnaires until late September, in the hope that we will receive more replies. We consider it undesirable that the opinions of such a small number of respondents might be interpreted as reflecting the opinions of all physicists.

Your cooperation in completing this questionnaire is required to allow us to obtain a more representative expression of the attitude of physicists to nuclear power.

—I. S. Falconer
D. C. Sams

Late News.................

The SA Branch of Materials Research Laboratories (formerly Department of Defence) will transfer on the 1st of September to CSIRO.

It appears likely that the transfer will be to Tribophysics and the majority of the staff will make the change.
Value for the Major Equipment Dollar
— Experience with a centralised approach in a small university
Alastair N. McKee, B.Sc.(Hons)(NSW) Ph.D.(Leeds)

INTRODUCTION
The Central Science Laboratory (CSL) of the University of Tasmania is a unique venture amongst Australian universities in that it is a shared service facility in which are housed scientific research instruments concerning a diverse range of techniques. The aim of the CSL is to make available instrumentation and techniques, and consultation on their application, to those who have a need for them in their research, teaching or problem-solving. Access is free and open to persons from all University departments, as well as to those from government and industrial organisations on a fee for service basis.

The purpose of this paper is to provide some background information on the CSL, to consider its development to date, and to speculate upon its future. It is believed that the centralised approach permits maximum efficiency and cost effectiveness to be achieved for the benefit of people in many departments, and provides an opportunity for inter-departmental co-operation.

BACKGROUND
The proposal for "a centralised laboratory for chemical, physical and mineral sciences" was raised in 1967 by the Faculty of Science of the University. The intention was to provide a location for major scientific equipment, together with associated instrumentation and servicing facilities, and a staff to operate and maintain the equipment. The equipment was to be made available for post-graduate training and research, and to a more limited extent, undergraduate demonstration in conjunction with lecture courses given in the departments of the University. Centralisation was considered feasible for a university of this size, in terms of geography and of numbers. Equipment to be considered for the CSL was required to have the interest of, and proposed applications by, research workers from a number of departments and disciplines.

The CSL differs from other university equipment centres of which we have knowledge in that it is not restricted to instruments of a similar type, say electron beam instruments in an electron microscopy centre: this is the basis of the claim to be unique. The concept of such a centre is founded on the acceptance of the fact that advanced items of scientific research equipment are becoming increasingly complex and expensive, and so demand increasingly highly trained support staff for their operation and maintenance, as well as for consultation with users. Often a specific item of equipment is of use to persons in a variety of departments, but the conventional structure of the university tends to discourage inter-departmental (and sometimes intra-departmental) usage of equipment. The increasing sophistication of instruments, and in particular the computerisation of the processing of the data collected, means that in many cases the capacity of the instrument is in excess of the useful work which can be given it by the members of a single department. Hence the choice of a centralised operation to increase access to such equipment can be said to promote the cost-effectiveness of its deployment.

The CSL project was supported by the Australian Universities Commission by way of a grant for the first stage of building, which was ready for occupation in 1974. Initial equipment funds were allocated for the 1973-75 Triennium, while additional funds towards the purchase of specific items of equipment have been donated by the University for the CSL by some Tasmanian companies. Organisationally the CSL was established as a University facility, not attached to any faculty or department. This was done to ensure equal access by right to all members of the University who have a need for the services offered.

General policy for the CSL is set by a committee of the Professorial Board. Membership of the committee comprises nominees of the Board plus an elected representative from each of the science-based faculties.

INSTRUMENTATION AND APPLICATIONS
At present, two major items of equipment are fully operational, while a third is being further upgraded, although it has been in restricted operation for some time. In this section, the instruments and some applications will be briefly described, and future plans discussed.

1. Scanning electron microanalyser
The particular instrument installed is a JEOL JXA-50A fitted with detectors for secondary, backscattered and transmitted electrons, and both wave-length and energy dispersive (EDAX) x-ray analysis equipment. A microcomputer is dedicated to the x-ray analysis task and the recent acquisition of additional memory has enabled rapid Z (atomic number) A (absorption) F (fluorescence) corrections to be made at the instrument in the case of quantitative geological applications.

The choice of the microanalyser as the first instrument to be installed (in June 1974) in the CSL was an outcome of the need by the Geology Department for a microprobe: members of that Department had been regular visitors to other establishments on the mainland. Further strong support was given by members of the life science departments - Botany, Zoology, Agricultural Science - whose major interests were in scanning electron microscopy, although it was recognised that analysis applications would also be important in some cases. In terms of the development of the CSL and especially in establishing its position within the structure of the University, the wisdom of the choice of the micro-analyser as the first instrument is illustrated by the fact that users have been drawn from ten departments.

Applications by users from the life science departments have centred largely on the instrument as a microscope, and specimens from insects, fish crustaceans, marsupials, diatoms and microorganisms such as bacteria have been examined. Other studies have concerned hop and peppermint structures, diseased leaves and fruit, seed morphology and pollen surfaces. Qualitative work
on the ionic components of cells and their localisation, have commenced. Crystal morphology and the growth of
crystals, which have contributed to the decay of bricks of the penitentiary of Port Arthur, have been studied,
while the topography of electrodes and atmospheric and automotive pollutant particles have been analysed.
Geological applications include identification and quantitative chemical analysis of minerals and investigations of
silicate phase relations at high pressures and temperatures.

Industrial applications have concerned the investigation of impurities in metal castings and alloys, intermetallic
phase formation, identification of fly particles from smokestacks, fractography, metal corrosion, wear of
cutting tools, analysis of materials collected on process and pollution control filters, paper-making
materials and pigments in plastics. State Government Departments, such as Mines, Fisheries and Agriculture
have used the instrument, as have the Tasmanian Museum
and Art Gallery for the study of pigments in paintings,
and the Hobart Fire Brigade for an investigation of
asbestos-containing materials.

2. Laser Raman spectrophotometer

The CSL is equipped with a Cary 82 laser Raman
spectrophotometer and a SpectraPhysics argon ion
laser: the latter may itself be used as the source of
illumination or it may be used to pump a Coherent
Radiation dye laser. The recent addition of the dye laser has enabled a much wider and tuneable range of exciting
wavelengths to be used, which is of great benefit in the
study of strongly coloured specimens and those which
fluoresce when illuminated with one of the lines of the
pump laser. A helium refrigerator sample cooling device
is currently being commissioned for use with the Raman
instrument, as well as with an infra-red spectrometer,
which was donated to the CSL by the Chemistry Department.
A more complete vibrational analysis is possible when data from both instruments are utilised.

Below are listed some of the problems to which the technique has been applied since the Raman instrument
was installed in July 1975.

- One problem concerns the way, in which mercury,
zinc and cadmium bond to sulphur atoms in various
environments. This is of particular interest in under-
standing the way in which these toxic materials are
retained in the body, and how best to remove them.

- Certain geological systems are being investigated with
the aim of permitting identification of minerals, and
providing an indication of their structure. An example of
this is a study of various mineral spectra in order
to explain colour differences occurring in crystals of
the same mineral from different locations. Preliminary
work has also been carried out to establish the feasibility of using the Raman technique for the
study of fluid inclusions in fluorite and quartz.

- A dynamic system has been developed for the investigation and identification of unstable high-temperature
(up to 2000°C) inorganic species.

- The closed cycle cryogenic accessory is capable of routinely achieving temperatures as low as 10K, and
will open up several new application areas. At low
temperatures the spectral bandwidth is considerably reduced, enabling resolution and identification of
previously unobservable transitions. Phase changes
with temperature can also be studied. A second new
area is that of matrix isolation spectroscopy, which
allows investigation of unstable species and free
radicals, normally of short lifetimes, by trapping them in a low temperature solid inert gas matrix. The
technique is also used to study stable gas phase
molecules since trapping them also isolates them, and
spectra are obtained without the presence of inter-
molecular interactions which normally complicate gas
phase spectra.

Although to date usage has been concentrated largely
on problems submitted by members of the Chemistry
Department, it is expected that more emphasis will be
placed on biological systems in the future.

3. Neutron Generator

The equipment in the neutron generator facility is used to make materials weakly radioactive by exposing
them to a beam of neutrons. The radioactive materials
may be used as markers for mechanical tracing, as well as
for chemical and biological purposes.

The main use of the equipment is to analyse the
elemental composition of materials by neutron activation
analysis (NAA). This method is usually used to measure
the major components which occur in per cent quantities.
Nevertheless, there are some elements which are readily
measured in the parts per million range.

The reason for using NAA in preference to some
other method is usually either because the analysis for
that particular element by other techniques is difficult,
or because NAA has a high sensitivity for the elements
of interest. Some elements frequently analysed for these
reasons are oxygen, nitrogen, fluorine, phosphorus and
copper. Most of the other elements are also detectable in
sub-milligram quantities. A major use of the facility
to date has been concerned with the teaching of the
principles of the technique to senior undergraduate
physics students.

The technique is of value in environmental studies
because elements such as mercury and zinc can be
detected in small quantities.

The equipment comprises a Raman A-711 sealed
tube accelerator which produces a medium-intensity
flux of fast neutrons. Samples are transported into the
irradiation vault by a pneumatic transfer system, which
returns them to a count station where the gamma rays
emitted by the radioactive species are detected by an
Ortec high resolution semiconductor detector. The
gamma ray spectrum is accumulated in a multichannel
analyser, and is quantitatively analysed by a computer
system based on a Digital Equipment Corp. PDP 11/34
minicomputer.

STAFFING

Staff members appointed to date are all university
graduates, with appropriate experience in the fields in
which they are concerned. Each member of staff is
responsible for training users in the application of the
equipment in his charge, and for instruction in the
techniques and in interpretation of the data acquired.
Seminars and other presentations are offered to depart-
ments and other interested groups and papers have been
presented at conferences. The level of collaboration
varies from user to user. It may be limited to simple
operation of an instrument, acting as a pair of hands in the collection of data, or it may involve innovative collaboration which justifies joint authorship of a scientific paper.

Maintenance of the instruments in the CSL is the responsibility of its staff, and assistance is received from electronics and workshop groups in other departments. This co-operation is required since at present the CSL does not have workshop facilities of its own, and the assistance provided by departments whose members are making use of the facilities of the CSL is generously given. It is intended, however, to set up electronics workspace in the near future.

It has been our experience that once an item of equipment has been fully commissioned it is in demand for more than normal working hours, so the availability of staff becomes a limiting factor in equipment usage. In the case of the microanalyser in particular, those who have a major need for access are encouraged to learn the operation of the instrument. In this way, operating hours can be extended without the necessity for additional staff and those who avail themselves of the opportunity learn a valuable skill.

Staff limitations have also led to the adoption of some solutions to operational problems which might not have been taken had additional people been more readily available. In general, users are expected to prepare specimens to the stage where they can be examined. In the case of the microanalyser, for example, this means to the stage where a conductive surface coating can be applied. A full service operation including specimen preparation would be convenient to many, but the additional personal involvement is usually translated into a better understanding of the technique and interpretation of the data. In addition, users may be given the responsibility for carrying out some of the development work associated with matters of special interest to them. Some, but not an excessive number, of problems associated with multi-user operation of instruments have occurred—present trends in the human engineering of instrumentation tend to reduce the problems associated with many users and one machine.

THE FUTURE

It is not envisaged that the CSL will change its role from that of a support, i.e. service facility to one in which post-doctorial or other research fellows would be housed. Rather, it would seem appropriate that the equipment and expertise offered by the CSL could be used to support post-graduate research centres attached to departments, should these be funded in the future. On the other hand, investigations initiated with colleagues from other universities and organisations could develop to a point where they might visit the CSL as guests.

The CSL has conducted a survey of additional requirements for major items of equipment among staff members of the University, and has drawn up a priority list based upon the responses. The next major item will be a high resolution organic gas chromatograph/mass spectrometer: arrangements to finance it have been initiated and it is hoped that it will be ordered within the next year. This will be used in conjunction with a quadrupole mass spectrometer, also fitted with a gas chromatograph inlet, which is being relocated from another department. Other areas in which a demand is evidenced by the responses to the survey are quantitative light microscopy (in which the first stage represented by photometer equipment is already installed in the University), x-ray diffractometry, Fourier transform nuclear magnetic and electron spin resonance spectrometry and upgrading of electron microscopy capability.

The continuing development of the laboratory is constrained by the factors which are presently limiting expansion of other university and government activities. Allocations of money to CSL projects by the University have been generous, but in the context of an equipment budget the size of the one which exists in this University, major items costing in the range of $100-200,000 must be funded over a two year period. Even with the wholehearted support of the members of the University, therefore, development is slowed, and such development is at the expense of other departments or services.

A new and central facility such as the CSL represents a special case. An established department can re-allocate resources in order to accommodate new techniques and equipment, whereas for the CSL to expand, funds for equipment and for additional staff must be concurrently available, since neither can be properly justified in the absence of the other. Decisions on all matters of this nature are in the province of the individual university, which must set priorities for the allocation of funds granted as block votes by the Australian Universities Commission. It could be suggested, however, that if it were recognised that a central facility is of special benefit to the university since it maximises efficiency in this area of its operation, then it is reasonable that such a centre could be funded separately from the rest of the University. This would be somewhat analogous to the proposed centres for post-graduate studies.

ASSESSMENT

It is believed that the CSL is generally well regarded within the University. This statement is based on the evidence of the support given to the proposals by the CSL to broaden the range of equipment installed there, as well as to provide additional staff, these being in times of financial stringency. In addition, items of equipment have been relocated from individual departments to the CSL causing them to be accessible to the whole of the academic community. In a time of staff ceilings, an instrument technician has been seconded from a department to the CSL so that an incoming item of equipment can be operated to the benefit of a wider range of users. It is evident that the pressures leading to such factors are widely based, but it is clear that the CSL does help to ameliorate the current circumstances. Naturally, there are some differences of opinion about the direction in which resources are being allocated, and in the choice of future items of equipment, especially in terms of priority. It can only be said that effort is made to progress in a way which appears to benefit as many people as possible in a worthwhile fashion.

CONCLUSION

It has been shown that the CSL is a novel organisation, and as a result precedents have had to be developed as time passed. Major questions are still unanswered, of which funding is the most uncertain in the present economic conditions. It is recognised that the future of this laboratory depends largely on its continuing and
increasing usage by its customers, namely the staff and students of the University of Tasmania.

The conclusion may be drawn, however, that in its first three years of operation the CSL has shown that it has a place in the University, and that its continued development is being actively supported by the University.

**IAEA Bulletin**

The AIP receives a copy of the IAEA Bulletin which is published six times per year by the International Atomic Energy Agency, Box 590, A-1011 Vienna, Austria. The index page includes this note: "This Bulletin can be obtained, free of charge, by writing to the Public Information Section, Division of External Relations, at the address given above."

You might expect this bulletin to present high-pressure support for nuclear power, on behalf of the 'nuclear lobby'. Instead, it presents short, low-key, wide-ranging reviews of all aspects of nuclear science. This is demonstrated by the tables of contents for the three issues received during 1977.

Certainly, many of the articles assume that nuclear power has a valuable role to play. For example:

"Nuclear reactors are both users of water on a gigantic scale and, potentially at least, important sources of new and much needed additions to the total fresh water supply of the world." — Yahia Abdel Mageed, Sec.-Gen. World Water Conference.

"Reactors will need enrichment services far into the next century." — Ole Pedersen, IAEA.

However, the problems also receive attention:

"The regulatory organizations of developing countries with active nuclear programmes can be classified as sub-minimal." — Morris Rosen, IAEA.

Members of the AIP who would be interested in seeing the IAEA Bulletin may write to the AIP Office. However, at least some of the major physics establishments may like to apply for a copy of their own.

—R. Bind

**INTERNATIONAL ATOMIC ENERGY AGENCY BULLETIN**

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Co-ordinated Research Programmes on the Management of Radioactive Waste completes its first three years of operation the CSL has shown that it has a place in the University, and that its continued development is being actively supported by the University.
A Decade and a half of Rocket Research at the University of Adelaide

B.H. Horton, Department of Physics, University of Adelaide

The presence of the Woomera Rocket Range in South Australia placed the infant Space Age on the doorstep of Adelaide University. While refusing full duties of parenthood, the University took some interest in the child.

Professor J. H. Carver's establishment project, following appointment in 1961 to the Elder Chair of Physics at the University related to the laboratory study of photo reactions in the ultraviolet region of the spectrum with gases of the atmosphere and a parallel development of rocket borne sensors to study in situ, the effects of solar radiation in the same wavelength band in the upper atmosphere. A cooperative programme was arranged with Mr. R. W. Boswell, Controller, Weapons Research Establishment, whereby Professor Carver would have the assistance of the Flights Projects Group of the Weapons Research Establishment, headed by Mr. Bryan Rofe while financial assistance was also given in the form of a grant from the Department of Supply.

The first experiments planned for the rocket programme involved the use of ion chambers of the type developed by Friedman et al. (1958) for measurement of the intensity distribution with altitude of the solar Lyman α line of atomic hydrogen. Due to the component constituents of the atmosphere the penetration height of solar u.v. is as shown in Figure 1 where it may be seen that O₂ is the predominant absorber of the Lyman α line at 121.5 nm. By measurement of the absorption profile, the variation of number density of O₂ with height could be obtained.

The rocket used in these first experiments was the H.A.D. vehicle, a two stage solid fuel rocket developed by Flight Projects Group for making measurements of high altitude (total) density and winds employing the falling sphere method (Malcolm, 1972). The H.A.D. vehicle had a 5 inch diameter second stage with the payload at the forward end and could lift a 14kg all up payload to 100km. The vehicle performance was such that the instrumentation to be flown had to survive up to 3 seconds acceleration at some 50 - 70g while vibration resulted in accelerations up to 10 g covering a frequency range of 0 to 2 KHz. Temperature variations, due to aerodynamic heating of the skin and conduction to the instrumentation, may range to 120°C during flight, increasing the design problems of the instrumentation. The rocket was also unsharped and spin rates were not easily predictable. This, coupled with limitations on data transmission rates, made the design of a new type of solar aspect sensor necessary for observation of solar radiation intensities, imperative.

It is perhaps surprising in these days of integrated circuits of microscopic dimensions, to consider the manufacture of amplifiers accepting inputs of up to 500 mV with an input impedance 30 MΩ with stability of 0.7% of full scale over the range of conditions described above, based on valves and individual transistors and other components, but this work was successfully carried out by Dr E. L. Murray, P. Stevenson and J. McFadyen who formed the electronics section of the group.

The design, testing and calibration of the ion chambers were carried out by Dr P. Mitchell. A number of small problems had to be overcome and a range of ancillary equipment produced. Recalling that the whole experiment had to go to the range, be finally checked there before flight and then flown fully self-contained, it is not hard to imagine the new procedures that had to be developed. The whole operation was based on materials available: for example, battery packs to supply power to the experiments during flight were those available in the supermarkets, not special items of the "new space age". Fuller descriptions of all the items are recorded (Mitchell, 1966).

The culmination of this work came at 0930 on December 6, 1963 when HAD 301 was fired from the Woomera range. The instrumentation carried was two Lyman α ion chambers, an altitude camera and sunslits for aspect sensing and associated electronics, modulators and telemetry transmitters. The rocket reached an altitude of 88 km and all systems operated correctly. The first results of these measurements of O₂ densities, probably the first in the Southern Hemisphere, appeared in 1964 (Carver et al., 1964). HAD 302 suffered a structural failure and HAD 304 was successful, with the inclusion of the Adelaide designed solar aspect sensors, reaching an altitude of 91.1 km. The results of the payload of HAD 304 is shown in plate I.

In 1965 the Australian Research Grants Committee provided funds for support of the rocket programme. These proved invaluable in extending the range of materials and components available for consideration in design and opened opportunities for increasing the technical support. While the Lyman α HAD project was proceeding two parallel projects were under way. It was known that, above the mesopause, the photochemistry of the atmosphere became more complex with the level of dissociation of molecular oxygen increasing but few quantitative results were available for these altitudes, while in the mesosphere itself the chemistry of ozone in absence of solar radiation was the subject of theory but no measurements had been made.

Ion chambers with different windows and gas or vapour fillings provided spectrally sensitive detectors and the spectral bands in combination covered a range of some two orders of magnitude in the size of absorption cross section of molecular oxygen. A number of different types of ion chambers were made and their characteristics determined (Carver and

![Fig. 1. Height of 10% attenuation of solar radiation by the atmosphere as a function of wavelength.](image-url)
Mitchell, 1964) and a Long Tom rocket (Malcolm 1972) was prepared for them. The payload was also to carry soft X-ray detectors to enable measurement of total atmospheric density. At the same time a report in the literature (Heddle, 1962) suggested that near ultra-violet radiation reflected from the moon was detectable. Ozone is a strong absorber in the wavelength range 220 to 290 nm and, while insufficient to be photochemically active, lunar radiation could be used by absorption measurements to give ozone densities at night. Photometers were designed to detect the low fluxes expected (10\(^{11}\) - 10\(^{12}\) watts cm\(^{-2}\) m\(^{-1}\)) employing interference filters and the 1P28 photomultiplier. This detector, while no way ruggedised for the harsh environment planned for it, was found to survive ground acceleration and vibration tests providing the high tension was not applied during the period of motor burn. Both these projects came to fruition (Carver et al., 1967), (Carver et al., 1969), plates 2 and 3.

During this period some changes had occurred in the staff. Dr Murray and J. McFadyen had left the group while S. Dowden, R. Hurn, A. Robertson and A. Suskin had joined. Professor K. McCracken had been appointed to the Department and had taken an interest in use of rockets for X-ray astronomy. While the Australian vehicles available were unsuited for the tasks envisaged space was made available on UKSRC Skylark vehicles. Working with investigators from the Department of Physics, University of Tasmania, X-ray proportional counters were integrated into an instrumentation package, which, with some modification, was flown on two UKSRC Skylark vehicles from Woomera. These flights contributed considerably to the knowledge of variations in the observed flux of X-ray stars (Francey et al., 1967). The development of rocket instrumentation for X-ray studies over this period is described by Francey et al., (1969), while an example of a payload is shown in plate 4.

In January 1967 the Adelaide group became involved in a project of great interest. As part of a cooperative programme with the United States, a Redstone launch vehicle was made available for the launch of an Australian Satellite. Although the time scale was short for such a project, all concerned were eager to attempt the task. Weapons Research Establishment were to produce the satellite structure, power supplies and telemetry systems while the experiments were the joint responsibility of Adelaide University Space Group and Flight Projects Group of W.R.E. The experiments to be flown included thermal monitoring of space craft environment, a magnetometer aspect detector, a telescope sensitive to geocoronal Lyman \(\alpha\) radiation and X-ray and ultra violet detectors to measure atmospheric densities at satellite sunset and sunrise. Cost and time limitations precluded the use of solar panels for power supplies so that the vehicle had a planned active life of some four days. Structural tests for vibration, acceleration and aerodynamic patterns were carried out at W.R.E. while thermal and vacuum environment testing was done at the space environment chamber at Adelaide Physics Department (see plate 5). Telemetry compatibility with the NASA data net was proven by transporting the space craft to the Orroral Valley Tracking Station in the A.C.T. prior to transporting it to Woomera for launch.

The space craft consisted of a protective nose cone within which the instrumentation was housed plus the third stage motor which was made to remain attached after injecting the payload into orbit. Two sets of detectors were warranted viewing along and normal to the cone axis. An angular momentum converter was included such that the axial rotation, supplied for stability at launch, would be converted to rotation about an axis normal to both the cone axis and the boresight on the side viewing experiments. The spin plane had to include the sun direction such that the sun was viewed by both the "forward" and "side" viewing detectors. It was with some satisfaction that the spin modulation reports coming in from the world wide tracking stations during the first orbit showed the expected change in angular velocity and later data analysis showed that both sets of solar detectors viewed the sun while the Lyman \(\alpha\) telescope looked at such an angle that the sun was well out of the field of view. The amazing amount of information coming from satellite experiments was soon made apparent. Some results obtained were published (Lockey et al., 1969), (Carver et al., 1973) while a number of results were presented in Lockey (1972). The WRESAT project was extremely successful and appears to hold the world record for a scientific satellite for short preparation time, covering a period of less than eleven months from conception to orbit. A lot of the drive behind the project came from Bryan Rofe of Flight Projects Group at W.R.E. Bryan had left W.R.E. for Antarctic Division by 1970 and it was with a considerable sense of loss that the space group heard of the death of this active and dedicated leader of Australian rocket research in August 1971.
Another cooperative programme, this time involving photometric detectors rather than X-ray equipment, was entered into with the Southwest Centre for Advanced Studies at Dallas, Texas, U.S.A. The project, titled Modular Auroral Probe, was conceived to study the particle energy and distribution and the intensity of radiation at a number of regions of the spectrum during intense auroral activity. The instrumentation was to be flown on Nike Apache rockets launched from Fort Churchill, Manitoba, Canada, these vehicles being recoverable and thus allowing refurbishing and further flight of equipment. The space group accepted responsibility for the radiation photometers involving two of 557.7 nm (OII) 486.1 nm (Hg) or 391.4 nm (N^2) in the visible region, these being interchangeable, and ion chambers operating in the gas gain region to study 120.0 nm (NI), 121.6 nm (HIX), 130.4 + 135.6 (OIII) as well as that portion of the LBH N^2 bands in this region. A number of firings took place in this programme with some problems, such as a descending payload falling through ice and being lost, but some success was achieved and reported (O‘Connor, 1973).

Other groups were employing ion chambers for the investigation of oxygen densities and in 1971 the space group became involved in a cooperative programme with the United Kingdom Meteorological Office, sharing a payload on a U.K. S.R.C. Skylark. Despite earlier contacts by Professor McCracken this was the first payload of UV absorption instrumentation to be successfully integrated by mail and telex and saw the start of attempts to increase the number of atmospheric parameters measured at the same time. In this payload X-ray and UV solar intensities were measured together with three air glow lines of interest in photochemistry of oxygen. This experience of integrating a payload by telex and letter, though finally successful, coupled with a failure to integrate a package on an I.S.R.O. rocket at Thumba, India at about the same time, resulted in a decision to send an experimenter to the site for integration where possible. Two further international cooperative programmes were entered into on this basis. Space in a second U.K. S.R.C. Skylark was made available to the group. This experiment package saw extension of the measurements made to cover not only solar radiation and air glow resulting from interaction between sunlight and the atmosphere but also the energy spectrum of non thermal electrons at the altitudes involved. One experimenter, A. Davis, spent a short time at BAC in Bristol and MSSL in Surrey, England, integrating the Adelaide instrumentation into the second round. Much information and many contacts with those involved in the Skylark resulted from this cooperative exercise. This resulted in a successful flight from Woomera—delayed somewhat, but not by the Adelaide experimenters. The hospitality shown to our experimenter was gladly repaid when U.K. experimenters, in need of help in round preparation while in Australia, were given access to our laboratories and equipment in the Physics Department at Adelaide.

A further experiment in collaboration with scientists at the U.S. N.R.L. involved a package to observe electron energies and 630.0 nm airglow from the atmosphere and to study the distribution of Extreme Ultra Violet emission from the galaxy during a night flight while the US observers took vacuum ultra violet spectra of selected stars. D. Gigney travelled with the Adelaide package to the US, funded by a US grant for travel, and successfully completed the integration. It was disappointing, after a lot of ingenious design effort, construction of a removable door and the high density instrumentation, to hear of a vehicle failure in flight.

In parallel with these activities the Cockatoo rocket programme continued with day and night flights observing atmospheric molecular oxygen and ozone (Carver et al., 1974a), (Carver et al., 1974b). In 1973 there was a policy change relating to the construction of the Australian rockets for the Adelaide University Program. Whereas previously only the payloads were constructed at the University, mounted in metal work from W.R.E., after this time the whole responsibility for the rocket was given to the University. While the handling of motors and launch was contracted to W.R.E. the remaining metal work was designed at the University and contracted to outside firms. The complexity of the items needed and the obtaining of them

Plate 3. Lunar UV photometers in the payload of HAD 212.

Plate 4. X-ray astronomy payload showing proportional counters to fly under the nose cone of a Skylark rocket.

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presented a challenge and gave an education to those used to the mothering care previously given by WRE. With the background support from this guiding hand and one more staff member, D. Rose (later replaced by A. Jones) who handled the drawing and design stages, the programme went ahead. With the addition of G. Bibbo to the group and the assistance of CSIRO Division of Chemical Physics, work expanded into the field of rocket borne mass spectrometry and Dr. Schaeffer as a Research Fellow supported by ARGC succeeded in the task of fitting forward viewing airglow photometers into the 12.5 cm diameter Cockatoo without requiring the complication of a removable nose cone. This design problem was met and solved for the mass spectrometers in a short time and proved satisfactory.

In 1975 the group was given the opportunity of taking a major part in the Goddard Space Flight Centre Woomera Expedition of 1977. There had been participation in a previous expedition in 1974 but this was a minor exercise in preparing a small instrumentation package. The 1977 exercise was based on the supply of a complete Aerobee 170 payload to be fired by the Goddard team while in Australia. These firings were undertaken for a number of US institutions. While it was known that acceptance would severely inhibit continuation of the Cockatoo-Lorikeet programme the chance to instrument a multi purpose payload was eagerly accepted. During 1976, with considerable engineering advice from Goddard and work at Adelaide, a very comprehensive set of upper atmospheric experiments was assembled. The solar spectrum over the range from X-rays to the near UV limit was investigated by X-ray proportional counters, a grazing incidence scanning monochromator, designed by J. Lean, (looking at three EUV Bands), ion chambers for Lyman α and other VUV band intensity determinations and a scanning monochromator covering the band 130.0 – 180.0 nm. A four band atmospheric airglow photometer completed the radiation detectors. Two mass spectrometers, one for neutral and one for positive ion species, were supplemented by a retarding potential ion energy analyser while electron energies were to be studied by electrostatic and retarding potential analysers. The binned experiments made up one of the more detailed studies of solar radiation reactions with the atmosphere that has been flown on a rocket anywhere in the world. The rocket was fired successfully at 7:30 a.m. on February 22 1977, a time well suited to the study of the developing ionosphere. Despite the possibility that the removed nose cone appeared to have remained in view of the airglow photometers, all instruments performed satisfactorily and analyses of results is now proceeding.

To date the Adelaide University Rocket Group has instrumented some forty rocket payloads as well as playing a part in the preparation of Australia's satellite WRESAT 1 and several international programmes. The technology developed has also been applied to balloon payloads launched in Australia. Research students involved in the programme have obtained seven Ph.D. degrees with, it is hoped, more to come based on work already performed.

In common with most rocket groups around the world, since 1972 economic restrictions have severely curtailed operations. It is hoped that an improvement in the financial situation will permit these restrictions to be overcome and the present capabilities applied to the search for knowledge in this challenging field.

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People and Institutions

Selby's Scientific Ltd. opens office in Papua New Guinea

Selby's Scientific Ltd. announce that they have opened in Port Moresby, Papua New Guinea.

The new branch includes modern office, showroom and warehouse facilities at Waigani Drive, Hohola (a suburb of Port Moresby). A comprehensive stock of laboratory apparatus and chemical reagents has been assembled at the Waigani Drive warehouse, together with a range of scientific instruments. This will enable Selby's to provide prompt delivery of the items commonly used in the fields of education, health, agriculture, mining and general industry.

Mr Chris Elliot, a naturalised citizen of Papua New Guinea has been appointed manager of the new office. Born in Australia, Mr Elliot has spent nearly 10 years in Papua New Guinea where he has been active in the field of education including the teaching of science and mathematics.

Selby's Scientific Ltd. is the main distributing subsidiary of the Selby Group which first commenced trading in Australia in 1900. The company represents many of the world's leading manufacturers of scientific equipment and has a large number of highly qualified sales and service engineers working from its ten offices throughout Australia and New Zealand. The Papua New Guinea office will have access to the extensive stock of instruments and general laboratory equipment which is held in Australia and will have the support of the Australian technical staff. It will also market the products of Selby's manufacturing subsidiary, Analite Pty. Ltd.

Frontier Lectures

Professor K. D. Cole of La Trobe University has been invited to present one of four "Frontier Lectures" at the Joint Assembly of the International Association of Geomagnetism and Aeronomy and the International Association of Meteorology and Atmospheric Physics at Seattle in August 1977. His topic will be "Energy Balance of the Ionosphere-Armosphere System".

Radiation Physics

The former "International Journal for Radiation Physics and Chemistry" now known as "Radiation Physics and Chemistry" aims to provide a medium to assist the growth in knowledge of radiation reactions and processes and of their application in technological and other fields.

In addition to scientific papers dealing with the interaction of ionizing radiation with matter, therefore, it is proposed to include papers of a more technical nature. The Editor-in-Chief is Professor A. Charlesby, Physics Department, Royal Military College of Science, Shivenham, WILTS., UK.

Energy Information Sources

A permanent directory containing sources of information on energy has been published by the Commission of the European Community. It lists the names of information services, persons in charge and the aims and objectives of the organizations concerned. This "Permanent Directory of Energy Information Sources in the European Community" by E. Allaire, F. Blamontier and M. Maurice (EUR 5425) is now available from the Office des Publications, Luxembourg or from Eureot News, c/o Directorat General Scientific and Technical Information and Information Management, Commission of the European Communities, Centre Europeen, Kirchberg, Luxembourg. price BF 1.600. [Physics Bulletin, June 1977].

Engelhard Industries Pty Ltd have announced the appointment of Mr. A. D. Alexander as Managing Director.

Mr. A. D. Alexander, a Chemical Engineering graduate from University College, London, joined Engelhard in the United Kingdom in 1968. Before coming to Australia he held the position of General Manager for South East Asia based in Singapore and Hong Kong.

Engelhard Industries Pty Ltd is the Australian Division of Engelhard Minerals and Chemicals Corporation, a leading worldwide refiner of precious metals and fabricator of precious metal products for industry and the arts.

Dr Alan Walsh was created a knight bachelor by the Queen last month in the silver jubilee honours list.

Dr K. Rachel Makinson of the Division of Textile Physics in Sydney has been made a Chief Research Scientist and is the first woman to achieve this distinction within CSIRO. She first joined CSIRO in 1944 as an assistant research officer and on certain occasions has been Acting Chief of the Division.
Conferences and Exhibitions

STANDARDS ASSOCIATION OF AUSTRALIA
Seminar on AS 1269 SAA Hearing Conservation Code
The Standards Association of Australia will be holding a series of Seminars on AS 1269 Hearing Conservation Code, in the following centres on dates shown:
Adelaide — Monday, 17 October 1977
Perth — Tuesday, 18 October 1977
Brisbane — Tuesday, 25 October 1977
Sydney — Wednesday, 26 October 1977
The purpose of the Seminars is to explain and introduce AS 1269. This standard has been or is being considered as a basis for industrial noise-control legislation by various statutory authorities and the seminars will give those attending an opportunity to gain a better understanding of the code and to provide user comment during the discussion period. It is hoped that written comment will be submitted consequently so as to provide a basis for a possible future revision or amendment of AS 1269. Preprints will be issued to registrants.
Telephone enquiries: Sydney 929 6022; Newcastle 2 2477; Melbourne 347 7911; Brisbane 221 8605; Adelaide 267 1757; Perth 21 7763; Hobart 34 6811.

44th Canadian Spectroscopy Symposium
Ottawa, October 23-26, 1977. For information write to Dr G. A. Neville, Program Chairman, Health and Welfare Canada, Tunney’s Pasture, Ottawa, Canada, KIA OL2.

Second Biennial Conference on Laser and Electro-optical Systems
San Diego, California, February 7-9, 1978. Information can be obtained from Milton Chang, Newport Research Corp., 18235 Mt. Baldy Circle, Fountain Valley, California 92708.

Photo- and Electro-imaging

Engineering Problems of Fusion Research
25-28 October, 1977. Knoxville, Tenn. USA. Information from M. S. Lubell, Oak Ridge National Laboratory, PO Box Y, Oak Ridge, Tenn. 37830, USA.

2nd Symposium of the Federation of Acoustical Societies of Europe
Information: Secretary, Institute of Acoustics, 47 Belgrave Square, London SW1X 8QX. 14-17 November, 1977, London.

Solar Energy
New Delhi, 14-19 November, 1977. Information is available from The Technical Committee, International Solar Energy Congress 1977, C1-ESNP Division, Bharat Heavy Electricals, PO Box 402, New Delhi, India.

World Instrumentation Symposium and Exhibition
November 22-26 1977, New Delhi. Information from Assistant Secretary, IMC, 20 Peel St., London W8 7PD.

Standards for Radiation Dosimetry
5-9 December, 1977, Atlanta, Georgia. Information from J. H. Kange, Office of Public Affairs, US ERDA, Washington DC 20545, USA.

Advances in the Application of Scanning Electron Microscopy
4-8 January, 1978, Oxford. Information from Administrator, RMS, 37/38 St Clements, Oxford OX4 1AJ.

Limitations of Non-invasive and Non-destructive Diagnostic Methods in Medicine and Engineering
16-17 February, 1978, London. Information: Royal Society, 6 Carlton House Terrace, London SW1Y 5AG.

Light Scattering in Physics, Chemistry and Biology

Materials Testing 78 Exhibition

Vacuum Technology
5-6 April, 1978, Oxford. Information: Meetings Officer, Institute of Physics, 47 Belgrave Square, London SW1X 8QX.

Reactor Congress
Hanover, West Germany, 4-7 April 1978. Information from Deutsches Atomforum e.V., Allianzplatz 10, D-3500 Bonn 1, West Germany.

8th Experimental Thermodynamics Conference
5-7 April, 1978, Guildford. Information from Dr F. H. Hayes, Joint University and UMIST, Metallurgy Department, Grosvenor St., Manchester M1 7HS.

10th National Atomic and Molecular Physics Conference
17-20 April 1978, Royal Holloway College, Egham. Information from Meetings Officer, Institute of Physics, 47 Belgrave Square, London SW1X 8QX.

Electron and Ion Beam Science and Technology
7-12 May, 1978, Vancouver, Canada. Information from Electro-chemical Society, PO Box 2071, Princeton, NJ 08540, USA.

Plasma Science
15-18 May, 1978, Monterey, California. Information from F. Schwirzke, Physics Department, Naval Postgraduate School, Monterey, California 93940, USA.

Solar — Terrestrial Physics
28 May - 3 June, 1978, Innsbruck, Austria. Information from SCOSTEP Secretariat, c/- National Academy of Sciences, 2101 Constitution Ave NW, Washington, DC 20418, USA.

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Science in Australia

Science and Environment Counsellor appointed to Australia's OECD delegation

Dr. J. D. Bell has been appointed as Counsellor (Scientific and Environment Affairs) on the permanent Australian delegation to the Organisation for Economic Co-operation and Development.

Dr. Bell is at present acting as an Assistant Secretary in the Department of Environment, Housing and Community Development. He heads a branch which develops environmental policy on natural resource and energy matters and is the first officer from the Department to be appointed Counsellor. The present Counsellor is Mr. D. G. Keeley of the Department of Science. Dr. Bell, 35, has a PhD from Sydney University and MSc from Auckland University. He is expected to take up his duties in Paris in December.

As Australia's Counsellor he will be responsible for the environmental, scientific and technological aspects of our participation in the OECD program.

Aeronomy Laboratory for Antarctica

The Minister for Science, Senator Webster, has announced that a contract has been let for the prefabrication of a new building to be erected at Australia's Mawson station in Antarctica.

The building, an Aeronomy Laboratory, is the first of a new range developed to replace the existing ageing buildings. The design provides a strong steel frame and supporting walls of steel-faced polystyrene foam panels similar to those used in refrigerated coolrooms. A small prototype building based on the new design was successfully tested at Mawson earlier this year.

The Aeronomy Laboratory will house delicate optical equipment which is used to make observations of the temperature and wind in the upper atmosphere over Antarctica. The observations are used in studies of weather patterns and long-term climate change.

Senator Webster said the Aeronomy program may later be developed to include monitoring of trace elements and pollutants, including freon and dust particles.

The components of the new building will be completed and available for shipment to Mawson in December 1977.
The Australian Institute of Physics

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Philips Sequential X-Ray Spectrometer uses Hewlett-Packard desk calculator to give direct print-out of analysis results.

The PW 1410/20 AHP X-ray spectrometer/desk calculator system is designed to meet the needs of users in small to medium-size plants extracting and or processing metals, minerals, oils, glasses, cements, ceramics and plastics etc. Samples are analysed and their element concentrations calculated and printed-out, in directly usable form, within a matter of seconds.

The new system, available from Philips Electronics Systems - Scientific & Industrial Equipment, bridges the gap between manual spectrometers and the large computerised instruments. It offers users an automatic machine producing fast results at a moderate price. This has been achieved by combining the Philips spectrometer with a compact yet powerful programmable desk calculator - the Hewlett-Packard 9815A.

The successful interfacing of the two instruments was the result of intensive collaboration between specialist teams from Philips and Hewlett-Packard. One notable achievement of this collaboration was the development - for a major oil company - of a complete system using a software package involving six elements with thirty-six “Alpha” factors.

The spectrometer incorporates a micro-processor programmer which can accept and store a large number of analytical programmes. The operator simply loads the sample and selects the desired programme via the calculator keyboard. Analysis is performed entirely automatically and the calculator converts the received intensities into element concentrations, which it then prints-out directly.

Where repeated analyses must be carried out many times each day - such as in production-line quality control - the PW 1410/29 AHP system provides major savings in both time and labour and reduces the risk of operator error.

As well as economy of operation the system is also economic to install. No input or output keyboard terminal is required since the calculator incorporates both of these functions. Additionally, the calculator can be used independently for other work in the laboratory. A further advantage is that the system will easily interface into existing production control systems.

For further information or a demonstration please contact Philips Electronic Systems - Scientific & Industrial Equipment, PO Box 119, North Ryde or phone 888 8222.
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