

1- Mark Oliphant's (1901-2000) Controversial Visit to Sydney 30 May to 26 October 1942

2- "The Physical Sciences in Australia in War and Peace" a document written by Oliphant on the return voyage from Australia to the UK, November 1942

During the War I worked practically the whole time on defence research. I worked then on nuclear weapons so I, too, am a war criminal ... I've come to realise that science allied with mathematics is the highest form of human thinking. It is an incredible addition to the statute of man. ¹ --Mark Oliphant

During Madsen's visit to the UK in 1941, he made contact with Mark Oliphant, an Australian physicist, who had played a key role in the initiative for the first workable magnetron at centimetre wavelengths at the University of Birmingham. The discovery was made on 21 February 1940 by John Randall and Harry Boot; this discovery led to major developments in centimetre radar with major impacts on airborne radar.

Oliphant had been in the UK since 1927, having come from Adelaide to the Cavendish to work with Rutherford, funded by an 1851 Exhibition Scholarship. Clearly these earlier conversations with Madsen were to lead to Oliphant's visit to Australia in 1942. Madsen (likely mid-July 1941) had received a cable from Rivett about Oliphant and rushed up to Birmingham to visit since he thought Oliphant was about to leave for a visit to the US. (The visit was, in fact, delayed by some days.) The summary of these events appeared in a letter from Madsen to Rivett on 14 August 1941, "Re: Interview with Professor Oliphant"². Oliphant had been in communication with colleagues in Australia (perhaps Laby from Melbourne and Kerr Grant in Adelaide) and had received some exaggerated reports about RDF research in Australia. Madsen to Rivett:

I had a long chat with him [Oliphant], and found, as I expected that his information was by no means as sound as it might have been. In the first place, he expressed some surprise at the fact that you [Rivett] should have taken his letter so seriously. Apparently people over here [in the UK] are used to receiving letters of that type [exaggerated?] from [Oliphant], and do not take them nearly so seriously. This I gathered from Tizard as

¹ Cockburn and Ellyard, *Oliphant, The Life and Times of Sir Mark Oliphant*, 1981, "Sayings of Mark Oliphant", p xiii-xiv. The authors had earlier carried out numerous interviews with Oliphant and his family.

²Evans (1970), Supplementary Document No. 34. Madsen (in UK) to Rivett (Melbourne), 4 August 1941 and response Rivett to Madsen Document No. 35 on 8 September 1941.

well as others, although on matters of his own research he is held in the highest possible esteem.

During the discussions with Madsen, Oliphant was concerned by four main problems: (1) Australian liaison staff not paying enough attention to UK RDF research compared to attempting to obtain supplies, (2) services of able men such as Leslie Martin and Eric Burhop in Melbourne not being used to “best advantage”, (3) in Australia too much attention to reproducing British designs and (4) the Australians not “making any proper effort in the direction of research”. Madsen was defensive in his response: earlier he had told his Australian colleague in London, Burgmann, to contact workers in micro-wave areas in the UK. Regarding item 2, Madsen had made efforts to get L.H. Martin to join RPL and also possibly go to London to learn the trade. Madsen explained to Oliphant the remarkable success Pawsey had “in regard to the common aerial for transmission and reception which is only now being taken up serious [in the UK], but upon which we have based the whole of our design”³. Also, Madsen had described Piddingtons’s work on the accurate time base for RDF transmission as well as the work of Myers on plotting machines for plotting locations based on accurate ranges and bearings from shore defence sets. Madsen continued in a defensive manner:

I then suggested that he [Oliphant] himself might be able to provide us with some suggestions as to further lines of research, and he immediately suggested the necessity of taking up a thorough investigation of the reception of ultra-short waves. I then asked for further suggestions but received none. At this point Oliphant expressed himself as very well satisfied with our research programme, and withdrew any reflections which he might have cast upon our methods of handling research.

Madsen summarised his impressions of Oliphant:

I found him quite interesting and full of enthusiasm and his lab [Birmingham physics] is turning out some excellent work, restricting itself to fundamental issues and passing over applications completely to other bodies. He now has well in sight the production of a megawatt magnetron ... [The magnetron] has brought about a completely new form of technique as compared with radiation at lower frequencies ...

Rivett wrote back to Madsen a month later on 8 September 1941:

It was amusing to find that Oliphant was surprised at his rather heavy charges being taken seriously; but they gave such evidence of misunderstanding and, as I suspected, of

³ Madsen pointed out that Oliphant had met Pawsey in the UK in the years prior to 1939. Oliphant “expressed considerable interest in Pawsey” and Madsen hoped that Oliphant would meet him again during the short overlap in the US during Pawsey’s visit to North America in July to October 1941. From the archive we have no indication that they did meet in 1941. In the following year, these two were closely associated during the Oliphant visit in 1942 to Australia (below).

misinformation from certain individuals⁴ here, that I am sure it was wise to come down hard at once on a possible source of future trouble. You seem to have cleared up the whole thing with complete satisfaction ...

Apparently Oliphant is likely to be able to give us a good deal of help in the short wave work and this will be most welcome.

Thus from the Australian point of view, a 1942 visit made sense; he would provide first-hand advice about the 10 cm radar systems.

As 1941 progressed, Oliphant was more and more frustrated by the research with his group in Birmingham⁵: "The work was no longer at the front line of battle." Although the power of the magnetron was a major success, Oliphant saw that many of the challenges lay in research by the British Services as this generator of micro-waves was perfected and enhanced. Oliphant needed a new challenge.

This new challenge arrived in an unexpected manner on 15 February 1942 with the fall of Singapore and Malaya; roughly 130,000 British, Indian and Australians became prisoners of war from the two campaigns.⁶ In addition, the Australian 8th Army division was lost. Oliphant feared for the security of his homeland and sent an immediate cable to John Curtin, Prime Minister of Australia: "Offer services defence Australia stop. Will seek release Admiralty [his service employer] and fly immediately if real job offered stop. Australia best hope conservation forces by new methods."

The cable was shown to Madsen with an immediate letter to Rivett. Both Madsen and Rivett were enthusiastic about the new possibilities of micro-wave radar; Pawsey had only returned a few months earlier from his trip to Canada and the US where he learned about the new high frequency radars (Chapter 9). Madsen told Rivett: "[This] would be an inspiration as it would save considerable time in putting new methods into application in Australia." On 21 February 1942, the Australian High Commission, whose resolve had been reinforced by the terrible raids against Darwin on 19 February, started to organise Oliphant's trip to Australia. Another reason for Oliphant to return to Australia was that his family had evacuated to Australia from Birmingham in mid-1940; his wife Rosa, son Michael, age six (in 1942) and daughter Vivian, age four, had settled back in Adelaide.

The trip to Australia in the spring of 1942 was a disaster subject to long delays. Oliphant had expected to travel by air but instead was assigned on a slow troopship to Cape Town, leaving Glasgow on 20 March 1942, arriving in Cape Town on 22 April. He was discouraged and could

⁴ Both Madsen and Rivett provided subtle hints that the sources of the rumours were Laby and Kerr Grant.

⁵ Cockburn and Ellyard (1981), p. 90-91.

⁶ About 15,000 Australians became prisoners in Singapore alone.

see that the total trip might take ten weeks. He asked the High Commissioner of Australia in London to organise an immediate return trip to London. Rivett was informed and discussed the situation with Fred White. Cockburn and Ellyard (page 91): “White favoured Oliphant’s going back to Britain. He had at first been keen for him to come but had since recruited Leslie Martin and Eric Burhop from the University of Melbourne to work on microwaves. Oliphant’s service no longer seemed so essential.” But the Australian High Commission was upset by this discussion and insisted that Oliphant fulfill his commitment to continue to Australia. (Cockburn and Ellyard, page 92). The trip to Australia took more than an additional month. He arrived in Fremantle, WA, on 27 May 1942. Oliphant flew from Perth to Adelaide where he had a short reunion with his family. He arrived in Sydney at RPL on 30 May. Oliphant later suspected that Madsen had deliberately kept him from travelling by plane: “So he had endured 2.5 wasted months at sea.”

After arrival in Sydney, the Australian perceptions of Oliphant’s role in radar research were confused. Cockburn and Ellyard (1981, p. 92) have pointed out that Oliphant’s enthusiasm in the UK in February had landed him in a troubled situation. His status was not at all clear; neither White nor Madsen seemed to have a role for him at RPL. “... [W]ithin six weeks of arrival he found himself excluded from any considerations of policy, even those concerning microwaves. He became convinced that Madsen resented his presence, seeing him as a threat to existing policies and patterns of work. Madsen’s change of heart baffled him.” Perhaps a part of the confusion was due to the major transition occurring in Madsen’s role in the RAB; already by the 19th meeting of the RAB on 2 April, discussions of the abolition of the RAB were raised as well as a possible resignation of Madsen as Chairman. Clearly, this impacted Madsen. In Chapter 9, ESM_9.4 and NRAO ONLINE 15, details of Madsen’s resignation on 14 July 1942 are summarised.

On the other hand, MacLeod (1999, p. 413) emphasised the positive outcome of Oliphant’s visit:

But his visit, during the battles of the Coral Sea and Midway, proved influential. Oliphant argued that the Allies would need radars for the coming counteroffensive, and particularly in amphibious landings. Such radars would have to be easily transported, quick to put into operation, self-contained, and built so as to survive humid tropical conditions.

The most positive assessment of Oliphant’s visit are comments made by A.G. Pither, who was associated with Oliphant at RPL during a number of meetings of the RAB. Pither wrote in his

1946 document *An Account of the Development and Use of Radar in the Royal Australian Air Force*, p 34 and Appendix C – “Visits by Overseas Scientists”) see NRAO ONLINE 10:

[Pither]: Progress of centimetre radar was given a tremendous boost by the visit of Prof M.L. Oliphant to this country in June 1942. Fresh from the latest information in England he was able to point the way developments were likely to go, and Australia owes much to the far-sighted picture which he painted.

Professor Oliphant arrived here when things were at their worst in mid-1942 [looming military disasters in PNG and the LW/AW still being developed.] He brought a breath of hope from overseas and helped us, at a time when we were completely smothered by local problems, to get a glimpse of the future. He told of the developments on centimetre radar and forecast its use in specialised operations such as landings where it would be used to direct the landing force from the control ship and beach control parties ashore. Such techniques were eventually seen in action in Leyte in the Philippines in 1944 ...

Oliphant emphasised that if the service member told the scientist what his problem was in the field, the solution would be more efficient. This method was to be preferred compared to the situation where the service member would specify the nature of the equipment that was required. Thus, Pither suggested that the Military would specify the **need** not the **solution**. Also, he suggested that frequent exchanges of information between the RPL and the services should occur. “This advice was followed for a time in that conferences took place between RP and RAAF Command on several occasions but owing to various difficulties [not specified] they were discontinued.”⁷

Proposed “Dictator of Radar”

In mid-July 1942, Oliphant made a successful visit to the radar groups in New Zealand where he was given a warmer welcome than he had received in Australia. On the return to Sydney, he worked on the problem of securing increased supplies of valves such as magnetrons that were essential to the operation of all radar equipments. Given the unpredictable nature of suppliers in the US and the UK, more self-sufficiency in Australian sources was required.

As the nature of the problems of the complex management of radar design, prototyping, manufacturing, testing, full scale operations and then improvements became more acute, the

⁷ Pither Account, Appendix C, p 2.

coordination of the various players became more severe – CSIR RPL, PMG, Department of Munitions, external firms such as AWA, HVM etc, Navy, Army and Air Force. Time and time again, the boundaries between the various organisations were ill defined. Conflict was inevitable. Oliphant pointed out that each of the services did not have their own development laboratory as was the case in the UK; e.g. the RAF had the TRE labs for much of their development chores.

Oliphant wrote on 9 July 1942 to Rivett:

... I believe that which is required is not so much a Director of Development ... but a supreme Controller of RDF development and production as a whole. The task of such a man would be broadly to see that there was a continual flow from research and overseas information through development and so to production. Such a flow can be assured only through a unified general control, with research, as such, left as free from interference as possible ... The Laboratory has been in existence for about two years [really close to three] and it was its failure to appreciate the trend of events and the backwardness of its own policy, as well as the Services, which lead to a condition of affairs where its whole effort had to be devoted to the satisfaction of urgent and immediate needs. The fact of the matter is that the Laboratory has never occupied its rightful place as an advisory body on RDF, but had been content to work on known Service needs, following a policy that it was not, as it undoubtedly should be, one of its chief functions to tell the Services what they required ...

It is unlikely that even [General Douglas] McArthur himself could or would have assumed the dictatorial functions which Oliphant was stipulating. The Board was only “Advisory” and there had at no stage been any intention that more over-riding powers should be delegated to it. The Board itself would have rejected any suggestion that its responsibility should be augmented.⁸

Perhaps Oliphant and Pawsey had discussed this problem of diffuse management. Pawsey wrote Rivett (from his home address, out of official channels on 5 September 1942) an equally strong letter with a similar plea to appoint a strong leader for radar:

I am writing you on the subject of endeavouring to retain the services of Prof Oliphant in the hope that [my own] opinion, from one of the research staff of RPL added to those you have already heard from, those in control, may help you in reaching a best decision.

⁸ Madsen had only five days before his resignation as Chairman of the RAB, which itself was to see a major re-organisation as McVey took over the RAB and the Technical Committee (White Chairman) increased its presence.

I understand that it is now accepted that the Lab should act as a research establishment as opposed to functioning primarily as a prototype production centre ... I believe that the maintenance of a strong research section in Australia is most desirable. To mention only one aspect, a proper research section can [create major] reductions in the work of production by simplification of design ... [At present], the RPL, because of the diversion of effort to production, is not a fully efficient research organisation. [However, it is one] which could be transformed into a [efficient research lab].

In order to make it fully efficient it requires two things: (1) effective coordination with the whole of the RDF effort in Australia and (2) inspiring leadership. The former seems to me to best be realizable through the appointment of a sort of **dictator** [our emphasis] of RDF in all aspects for Australia, a project which scarcely appears realizable because of the difficulty of arranging such an appointment. [Pawsey was asserting that it would be valuable if CSIR could persuade Oliphant to become the “dictator”, but the Services and or the Government would likely not agree.] But the latter could be achieved if Oliphant could be induced to still further extend his stay in Australia.

Oliphant is one of the leading physicists in the world engaged in this type of work. His power lies in his well-balanced appreciation of the operational problems involved in the application of scientific equipment to war, his very brilliant qualities as an experimental physicist, and his ability to inspire his subordinates. Further, I think he would have the courage to persist with ideas he considered valuable for simplification or improvement despite strenuous opposition from official quarters. In all these respects, I think he is outstanding among the men available in Australia today.

[Then in spite of his pessimism that the Government would reject a “dictator”] I believe the appointment of Oliphant to a position giving him control of RDF research in Australia would be of very great value in increasing the effectiveness of the whole RDF program.

Unfortunately, we do not have a response from Rivett to Pawsey’s letter. Both Oliphant’s and Pawsey’s concerns⁹ and suggestions for a “radar dictator” were similar to the proposal made by General Whitelaw and Commander Buchanan reported by Evans (1970, p. 120) in a letter of 9 July 1942 from White to Rivett. They described their modified suggestion that a Directorate of RDF Production be established within the Ministry of Munitions (after their harsh statements of

⁹ Both were aware of the major deficiencies in the management structure of radar research, production and operation in Australia in 1942.

3 July – see below). This Directorate was never established¹⁰; if this had occurred the Director of RDF Production would have fulfilled the position suggested by Oliphant and Pawsey.

Oliphant's interactions with the RAB 1942

Mark Oliphant did have an impact on the RAB during the 5 months he was in Sydney during 1942. He attended the 20th, 22th and 23th meetings (3 July, 24 September and 15 October, respectively). He missed the momentous 21th meeting on 14 July 1942 when Sir John Madsen submitted his resignation as Chair of the RAB; perhaps the topic was too confidential or controversial for an outsider such as Oliphant.

At the first RAB meeting attended by Oliphant on 3 July 1942 (Pither was also present for the first time), a summary of the discussion of the previous week was presented. Oliphant made a number of statements: on liaison abroad he suggested that the best policy was “to arrange for a shuttle service of Australian scientific liaison officers to and from the US”. Long term visitors from the US would not be optimal since “such a man would be out of date in a few months.” Thus frequent short term visits to Australia from staff stationed in London, Ottawa and Washington (or Boston). Oliphant thought such officers should not be away from Australia for less than 6 months. Not surprisingly, Oliphant was asked to investigate the fact that “production of valves in Australia was very difficult.” A special problem was the supply of tungsten wire for filaments (for the valves). “It was finally agreed that Professor Oliphant would look into the whole position [of valve production] and then report on it to the Ministry of Munitions.”

On 24 September 1942, McVey was the chairman for the first time, having replaced Madsen (NRAO ONLINE 15); Pither was also present, as well as Madsen. Oliphant was an active participant in the discussion (initiated by the Navy) about a “live” full-time Service liaison officer at RPL. He mentioned that this problem had been faced in the UK (TRE- Telecommunications Research Establishment) and the US (MIT, RL, Massachusetts Institute of Technology, Radiation Laboratory). Instead of a Service liaison officer, “it was generally agreed by the meeting that the engineering of a set for production to the approved Service specification and design was a matter for the Department of Munitions [personnel] which, in turn would enlist the assistance of PMG [or contractors] [i.e. the better choice would be that the liaison would be a representation of the Department of Munitions] ... The idea was to design short wavelength

¹⁰ However, in 1942 the Directorate of Radio and Signal Supplies (in the Ministry of Munitions) under the leadership of Lt-Col S.O. Jones was established; Jones coordinated production but would not have been regarded as a “radar dictator.”

valves, to improve existing valves and to develop new types. “The work would enable Australia to undertake at an early stage the production of new types of RDF equipment ... Unless the country attained such a position, it would need [to copy UK prototypes] which would mean that it would always lag behind the latest practices elsewhere.” The new laboratory would only build prototypes and then pass on the techniques to outside firms.

The famous Time-Life photographer Fritz Goro was in Australia preparing for a *Life* magazine article that appeared a year later on 17 November 1952¹¹, “Radio Astronomy, Celestial Sounds Reveal Invisible Stars and New Facts about the Sun”. Goro is not named in the article. Goro had been in Australia in March 1951. His photos were taken at Dover Heights, Potts Hill, Dover Heights and Mt Stromlo.

In the publication, only photos from Dover Heights and Potts Hill were published, with Bolton in one from the former site and Pawsey in the latter (both unidentified). No photos from Mt Stromlo were used. The Stromlo photos include David Martyn (NRAO ONLINE 24) and Mark Oliphant, both unidentified on the web site. The Oliphant photo is shown below as Fig 1.¹² See NRAO ONLINE 23, Additional Note 1 for details about Goro.

Oliphant –II. November 1942 “The Physical Sciences in Australia in War and Peace”. - Precursor to the post-1945 evolution of science¹³

Mark Oliphant wrote a lengthy document during the long sea voyage¹⁴ to South Africa, 26 October 1942 from Melbourne to end November in Cape Town, South Africa (final arrival in the UK on 1 March 1943). The 10-page document, “The Physical Sciences in Australia in War and in Peace” (dated November 1942), is fascinating, filled with innovative proposals, but verbose and repetitive. The emphasis on the impact of WWII and the evolution of post-war Australian science is remarkable text, written when the outcome of WWII was far from certain.¹⁵ For

¹¹ The cover of *Life* shows the newly elected President Dwight Eisenhower and his wife.

¹² The published *Life* magazine article also includes images at Harvard with visiting Australian E.G. Bowen, Edward M. Purcell (just awarded the Nobel Prize in Physics in early November 1952) and H.I. Ewen, Martin Ryle of Cambridge and Hendrik van de Hulst of Leiden. Probably the images at Harvard were taken in October 1951. See Fig 20.1

¹³ Evans, 1970, Supplementary Documents, No. 36, p1-10.

¹⁴ Oliphant vented some frustration with the remarkably inefficient 11-month absence from the UK with more than half of the time spent on travel. The travel time by sea was about two months to Australia and four months for the return trip. He arrived back in the UK (Glasgow) on 1 March 1943.

¹⁵ The second battle of El Alamein was occurring exactly at this period and the Battle of Stalingrad was to end with a massive German defeat in early February 1943; the French North Africa invasion by the US and UK troops as well as the US, Australian victories at Guadalcanal also occurred in this period. The tide was turning against the Axis powers.

example, Oliphant predicted that Australia would begin awarding science graduate degrees and at the same time develop closer association with the international community in the post-war era.

The following observations are made not with the object of criticising destructively Australia's utilisation of science and of scientists in the war effort, but in order to record some of my impressions of the working of the existing machinery and to suggest where my own native country can make better use of some of her technical man-power. It is not possible to do this without at the same time discussing the use of science in Australia's secondary industries [turning raw materials into manufactured goods- eg electronics, etc.], particularly in the period of stabilization and development which must follow the unbalanced growth in war-time.

In Oliphant's opinion, MANPOWER was a major issue. Most people who had studied physics in Australia went into secondary school teaching. "Those who are ambitious, or who are ready to sacrifice present security for scientific adventure, manage to leave Australia for countries where scientific opportunities are more abundant. For these reasons those relatively few good scientists ... must at all costs be used to the very best advantage in the war effort."

SELECTION OF PROBLEMS: "A careful selection must be made of those problems of the greatest urgency or of the greatest promise from the point of view of the war in the Pacific."

CONTACT BETWEEN SCIENTISTS and TECHNICAL or PRODUCTION ASPECTS of WAR: "It is impossible to have the complete help of the technical man without giving him as complete as possible a picture of the conditions under which new weapons or counter-weapons are to be used." The scientists must have contact with production and operational tactics.

PRODUCTION BASED on MOST MODERN ADVANCES: "Australia is passing from the phase of her war effort which was devoted to the rapid expansion of her secondary industry to a state where it is realized that it is more important to produce the right weapons and to utilize them correctly than to make vast quantities of inferior or of superseded types ... [It is essential that] there exist side by side with production those stages of scientific investigations which precede manufacture." After all, the enemy possessed excellent weapons, e.g. the Japanese fighter aircraft and German radar and counter-measures.

BE FLEXIBLE: Too much personal ego was involved in Australian science effort. Science in Australia had to learn to be flexible and give up ideas that were no longer relevant. There was in Australia "far too much consideration of the individual and not a great enough appreciation of the importance of directing work into the right channels regardless of vested personal interests in any particular problem ... Many scientific [projects have exhibited bad judgement] and continued effort without results is very demoralizing."

FILTERING of TECHNICAL PROBLEMS: an important aspect was "... the setting up of a 'filter' which would endeavour to sort out the problems arising and allow an attack only on those of the most important nature". It was important to not just attack urgent short-term problems but "rather that the scientific war effort be viewed with as great a degree of prevision as possible, and that those advances be encouraged which are most likely to affect favourably the future course of the war, either by the prevision of new weapons or counter-weapons, or by revolutionary processes."

AN AUSTRALIAN WAR RESEARCH COUNCIL: Oliphant raised again the idea of an overall war research council. This suggestion was related to his idea of a "radar czar" (main text). This council would incorporate the three fighting Services as well as CSIR, the PMG, the Department of Munitions etc. All scientists working on war effort would be incorporated into this new department. "The work of every individual scientist would be reviewed, whether he is employed by one of the services, ministries or by private undertakings, and whether his work is at present war-work or directed to some other end." Oliphant suggested that the Director of Scientific Research would in effect be the dictator of all war related science activities in Australia.

In regards to the timing of this unification, Oliphant emphasised that this was a good idea in late 1942 due to the post-war expectations. "I will endeavour to show later that the whole of Australia's future as an industrial nation is bound up with the correct use of her technical resources during the unparalleled opportunity offered by the pooling of information during the war."

RELATION BETWEEN WAR RESEARCH and DEVELOPMENT and INDUSTRIAL DEVELOPMENT after the WAR: Due to the great strides made by Australia in the industrial sphere so far in WWII, it was now clear that Australia could not continue to thrive economically by primary industry (mining and agriculture). Fewer and fewer people would be needed in agriculture due to mechanisation.

To secure stability for the community a balanced population must be built up which will consume a great deal of the produce of the country inside its own boundaries. [The] population must grow to eat the products of the land and to produce much of the manufactured material at present imported from abroad. A healthy manufacturing country possesses a power of bargaining with other countries which no purely primary producing country can ever attain ... It is good that Australia should have developed the industrial system to a degree where she can supply some at least of her own needs; it would be great if she could contribute to the development of industry itself through

scientific enquiry and experiment, and build up manufactures which are as peculiarly hers, as the wool of the Merino sheep.

TECHNICAL GENIUS AUSTRALIANS:

Apathy and the “great national inferiority complex” have combined to prevent the utilisation within Australia of the natural inventive genius which is being exploited all over the world in the persons of technicians and scientists driven abroad by lack of opportunity. Australian scientific men have proved their worth in competition with the best in any country. The young and vigorous industries which inventive aptitude produces could do more than any others to make Australia a power in the world.

UNIVERSITIES: Oliphant was also critical of engineering departments in Australia, as well as physics and chemistry.

These have tended to become glorified technical school departments, teaching established practice in a [frequently] indifferent manner and contributing little or nothing to the advancement of the subjects. The exceptions have arisen from the great drive and energy of talented individuals who have refused to accept the present standards of apathy towards research ... Engineering and science studies need drastic revision if they are to meet the needs of the growing industries which will surely develop after the war.

CSIR ROLE: Much of the reformation in the quality of science could be done by CSIR, but the major role was to be the universities, as they developed a research spirit that would be required in the post-war era.

OPPORTUNITIES AFFORDED BY WAR-TIME DEVELOPMENT: Oliphant saw the possibility of using the war-time experience of secondary industry formation to lead to peace time spin-offs, using the

background of scientific investigation. Many of the projects of the war period, undertaken for reasons of offence and defence alone, can become of the greatest national importance after the war. Thus RDF, in a country like Australia whose whole future is bound up with air travel, can revolutionise the safety of aircraft under every condition of weather or darkness.

But Australia could only take the industrial development fostered by war-time urgency and develop the peace time spin-offs if Australia “lays down now the necessary specific background while all essential information is pooled by the Allies, and if she arranges to carry on with her own investigations and development when access to that information is cut off.”

In summary, Oliphant saw the opportunity for Australia to create a “research spirit” based on the war experiences and to carry this forward in the post-war years. In 1942, he could not have imagined that this major challenge would face the CSIR and Australian universities in only three years. In 1950, he returned to Australia as the first Director of the Research School of Physical Sciences and Engineering at the Australian National University in Canberra.