NRAO ONLINE 8 Mills Cross versus Parkes Dish- Publication March 1962

Australian Publication in *The Bulletin* of 31 March 1962 associated with Chapter 40

**The article from 31 March 1962**

The controversial article "Mills Cross versus Parkes Dish"[1] was published in the Australian news publication *The Bulletin* [2] on 31 March 1962, five months after the GRT opening on 31 October 1961. The University of Sydney and the National Science Foundation announced on 25 March 1962 that the NSF would provide roughly US $746,000[3] over a five-year period for the construction of the Super-Cross (Mills Cross); the initial grant was $149,000 in 1962. *The Bulletin* article stirred up controversy and was shown to Pawsey at the Washington Hospital Center by Bill Hartley of ASLO on 13 April 1962.

The article began with the assertion that the award signified two aspects: (1) Since the end of WWII, "Australia has emerged as perhaps the world's leading nation in the new science of radio astronomy"; (2) "And it underlines the fact that radio-astronomy efforts in Australia are now split into distinct groups: the Federal Government's own CSIRO [with the GRT, Parkes] and Sydney University's Radio-astronomy Centre group which receives no financial support from the Australian Government but whose Mills Cross project at Canberra is being funded almost entirely by the American Government."[4]

The controversial claim was made:

> The split [between the Sydney University groups and the CSIRO group] is so marked that there have indeed been efforts to influence the US National Science Foundation against funding the Mills Cross Project and rather devote funds to the CSIRO group. Scientifically this split is most unfortunate as there are many aspects in which the two sides should

[1] Authored by "Our Scientific Correspondent"
[2] *The Bulletin* was a Sydney news magazine that ceased publication in 2008 after 129 years.
[3] Later followed by an additional grant of $107,500 (in 1964), McCaughan, 1987 *The Messel Era*, ed D.D. Millar
[4] Also with substantial financial support initially by the Sydney University Nuclear Research Foundation (1954-1967), later the Science Foundation for Physics. McAdam (2008) had pointed out that the NSF grant was the first, and perhaps only, large foreign grant awarded by the US agency, National Science Foundation.

> complement each other and it is hoped that eventually a measure of co-operation and collaboration will develop between them.
>
> However, this split may also be seen as further evidence of the vitality of Australian radio-astronomy. Indeed the science of radio-astronomy was virtually unknown until Australians started to develop it after the war in conjunction with groups at Manchester and Cambridge universities.

The concluding sentence of the article was certain to have raised eyebrows:

> Each arm [of the new Super-Cross] collects radio signals and focuses them on a central aerial along the entire arm. In this way the Mills Cross can pinpoint the location of distant radio sources as accurately as a dish-type radio-telescope of a diameter almost equal to the length of one of the arms. It thus achieves one of the main objectives of radio astronomy at a fraction of the cost of the corresponding dish, such as the Parkes telescope.

Not surprisingly Bowen was upset. On 13 April 1962[5] (just after the CSIRO had begun to hear about Pawsey's illness), he wrote Bill Hartley at the Australian Embassy in Washington (ASLO-Australian Scientific Liaison Office) about Pawsey's illness. At the time the seriousness of Pawsey's condition was not appreciated. "We are extremely sorry to hear of his illness and are glad to know he is making progress. It is comforting to know he is in such good hands [including Merle Tuve and his wife – see Chapter 40]. We are in touch with [Pawsey's] wife … [She is] in good heart …"

Surprisingly Bowen thought there was only <u>one</u> major problem at this time (Bowen to Hartley):

> There is only one blot on the landscape--a smouldering fire of innuendo and half-truth in the press which seems to come from the local School of Physics. A recent example is attached [*The Bulletin* article of 31 March 1962]- one is a straight copy, the other has comments attached [this version was not located in the archives]. The first two paragraphs taken together give entirely the wrong impression. The last paragraph [quoted above] contains a profound untruth.[6] We do not propose to do anything about this and I would certainly not suggest you do either. However, due to the NSF interests, at least you should be aware of these unfortunate things.

---

[5] NAA, C3830, Z1/52.

[6] The new Mills Cross did achieve the angular resolution of a single dish with a diameter of roughly one mile, but at only a single frequency with no facility for detailed spectroscopy.

In mid-April, Hartley passed *The Bulletin* article to Pawsey in the Washington Hospital Center. "I would be interested to hear your comments on this! I hope to get in to see you over the weekend. William".

On 27 April 1962[7], Hartley replied to Bowen with an update concerning Pawsey and also his concerns about *The Bulletin* article:

> The news about Joe Pawsey is very good indeed. He has just phoned me to say that he will be leaving the hospital on [29 April- Sunday see Chapter 40] and his brother-in-law [Ted Nicoll] will be taking him by car to Princeton …
>
> … [In regards to the article about the Mills Cross], I must admit I was quite appalled when reading this article at the various innuendoes contained in it. As you point out, it is obviously inspired [by the School of Physics of Sydney University] and I certain agree that this apparent or real conflict of interests between scientific bodies in Australia is very serious. I am of course doubly concerned about the possible reactions of people in America, not only in relation to grants for radio astronomy work, but also because of their possible implications in other fields (our emphasis) … If nothing is done [he suggested coordination with the Australian Academy of Science] I fear that sooner or later there will be a 'bust up' which will be disastrous for the whole future of American research grants.

In Additional Note 1 (end of this text) we summarise a follow-up publication (14 months after the *Bulletin* publication of 31 March 1962) that described a continuation of the controversy of the Super-Cross controversy. An article in an Australian publication *Nation* on 1 June 1963 was titled "Men Following Machines: the CSIRO and Rival Claimants for the Scientific Man". The text contains a number of confusing assertions.

**Controversy between CSIRO and the University of Sydney, contacts with the US National Science Foundation 1959-1962**

At the time of *The Bulletin* article, the rumour in Sydney was that the CSIRO had indeed tried to influence the NSF (McAdam, 2008[8]). In July 2014, Goss found the evidence in the National Archives of Australia, C3830 in an uncatalogued series (Z1/20, E.G. Bowen, Personal Files- Mills Super-Cross from 10 October 1959 to 31 October 1962). Bowen wrote a letter to Alan T.

[7] NAA, C3830, Z1/52.

[8] "Molonglo Observatory: Building the Cross and MOST" in *Journal of Astronomical History and Heritage*, vol 11 (1), p 63, 2008.

Waterman[9], the inaugural Director of the NSF in Washington. The letter was written on 5 October 1961, including an invitation to attend the opening ceremony of the Parkes telescope on 31 October:

> A week or two ago we had the opportunity of discussion with Earl Droessler [Program Director Atmospheric Sciences NSF] that the NSF might support the building of a Mills Cross in Professor Messel's Department at the University of Sydney. I thought I would take this opportunity of pointing out to you one or two factors in this proposal which may not have been previously brought to your attention.
>
> Let me say that the technical proposals for a Giant Cross are absolutely first-rate and have the support of all of us. As you know, the first three Crosses were built in this Division, they are now being copied in various parts of the world and it is only natural that we should be heartily in favour.
>
> However, there are political and other implications surrounding Messel's project which the NSF should be aware of. To put the matter quite explicitly, Radio Astronomy in Australia was pioneered and built up in this Division of CSIRO. Messel has no previous experience in this branch of science, neither does he have facilities for the constructional and field work involved. But he has stated his intention of taking over a large part of our galactic activity and he has begun by taking some of our staff by a process which need not concern us here.
>
> From time to time he has expressed similar desires, for example in relation to nuclear energy and computers, and on at least one occasion he has advocated taking over the whole of CSIRO by the universities. [10]
>
> In these views he does not get much support from the rest of the scientific community in Australia. I do not think I need to say more to emphasise that if the NSF were to make a grant to Messel's group, it would be entering very controversial territory.
>
> I would suggest that you do not accept my judgement on this. It is clear that I am an interested party and therefore very much biased on the whole question, but I do

---

[9] The first NSF Director from 1950 to 1963. Bowen also had hoped that Waterman, Randal Robertson and Geoffrey Keller would attend the opening of the Parkes telescope on 31 October 1961; only Keller planned to attend but had to cancel at the last moment.

[10] In Figure 1, we show an article that had appeared five months earlier in the *Sydney Morning Herald* of 4 May 1961- "Universities Should Take Over CSIRO". The article This controversial article was a call to arms by Messel as he suggested that the Australian universities take over the CSIRO "lock, stock and barrel". Messel asserted that the universities would do "what CSIRO does and better." He ended his article: "This would be the most important and profitable takeover in the history of Australian people…"

> suggest that before a commitment is finally made, the NSF consult with some of the higher responsible agencies in Australia on this matter. It would clearly be better to do this on a person-to-person basis rather than by correspondence.[11]
>
> I have marked this letter "Personal and Confidential" so that you can use it or ignore it at your discretion, but I would strongly urge that you seek more than the usual amount of advice on this particular project.

The proposal for NSF funding for the new Super-Cross (with 19 copies) from Sydney University had been sent on 5 June 1961 to Keller of the NSF in Washington[12]; the proposal was evaluated in record time. For example, within 10 days on 16 June 1961, Pawsey was asked for an evaluation in a letter from Washington. He replied before leaving for the US the following month (July) with a succinct report: "This is an exceedingly important proposal." The covering letter repeated this statement and added: "Mills's proposal is a curly [Australian slang meaning "difficult to counter or answer"] one for me and I should much prefer it if I could discuss it personally with you [at the IAU Symposium in Santa Barbara of the IAU in Berkeley in August 1961]. (Both Keller and Pawsey were present at these events, see Chapter 38.).

By 8 August 1961[13], Ron Bracewell wrote Messel with good news:

> The Mills proposal has been rated very highly by a large number of distinguished referees, with the result that the astronomy office is asking the National Science Board [NSB] at its meeting of September 1 to authorize support, without further discussion.

On 4 October 1961, Messel was informed that the NSB had approved.

After the receipt of the Bowen letter of 5 October (above)[14], Waterman was likely concerned by the controversial environment described and decided that a visit by Keller (soon to be an assistant director of the National Science Foundation) was required, a fact-finding mission. On 18 October, he announced to Messel that he was coming to the opening of the Parkes telescope, to arrive on 29 October 1961 (to be met by Bowen). He hoped that he could visit the

---

[11] Bowen suggested that Waterman contact the Australian Academy of Science, the Universities Grants Commission (Sir Leslie Martin) or the Prime Minister's Department in Canberra for opinions about the Cross Project.

[12] University of Sydney Archives. G047. The Program Director for Astronomy; Keller was to be promoted on 13 November 1961 to Assistant Director for MPE (Mathematics, Physics and Engineering). His successor at the NSF was Gerard F.W. Mulders. During 1961, Keller assisted Rabi in the recruitment of Pawsey to the NRAO Directorship.

[13] University of Sydney Archives. G047. Bracewell was to arrive in Sydney for his sabbatical, 10 September 1961 to 27 June 1962.

[14] All of the correspondence between Australia and the NSF until the end of 1961: University of Sydney Archive, G047.

Sydney University radio astronomy group on 30 October, the day before the Parkes opening. On 26 October 1961, he announced by telegram that he would not attend due to the unexpected death of his mother.

By 17 November, Keller announced that he now would be visiting in December 1961. On being asked by Messel whether the "Mills Cross Grant" was likely to be announced, Keller responded by telegram on 25 November 1961: "Regret that political complications make final decision unlikely before January 1962 …" At this point, it was clear to the University of Sydney personnel that Bowen was trying to "poison the well"[15] for the new Mills Cross. There is no evidence that they had seen a copy of the 5 October 1961 Bowen letter; clearly, they were nervous. Letters from Sydney University were sent to prominent individuals who would be asked about the suitability of Sydney University to undertake the new Mills Cross project: Prof Lennard Huxley, Vice-Chancellor of ANU, Fred White, Chair of CSIRO and Sir Leslie Martin, Chair of the Australian Universities Commission (latter was mentioned by Bowen in the 5 October 1961 letter). The Bowen comments were not mentioned. Mills on the other hand was upfront with his disdain with the Bowen criticism. In his letter to Sir Leslie Martin he wrote on 5 December 1961:

> This grant was in fact approved by the National Science Board of the National Science Foundation last October and I have been led to believe that the delay in finalizing the grant and the reason for Dr Keller's visit may be connected with some objections from CSIRO, principally on the basis that the magnitude of the project has been underestimated and our facilities are inadequate. [In fact the CSIRO criticism was more severe, "Messel has no previous experience in this branch of science"… with no mention of the vast experience of Mills, Christiansen and others in the Sydney University group.]

On 13 December 1961[16] Mills wrote Keller in Washington:

> As I understand that there have been some definite criticisms expressed by Dr Bowen concerning our estimates of the ultimate cost of the structural part of our radio telescope, I am enclosing some correspondence and reports about this aspect of the design.

[15] McAdam (2008).

[16] The date of the letter was three days after Keller's arrival in Sydney. Either he received the letter after arrival at the NSF in mid-December or more likely he was given a copy when he met the Sydney University group on 10 December 1961.

He enclosed two independent estimates of the costs, showing that the costs were consistent with the amounts described in the NSF proposal. Mills also pointed out a critical fall-back position:

> If, by some mischance, costs should be appreciably higher than anticipated [e.g. a long delay in starting the project] there is a great deal of flexibility; an instrument with considerably shorter arms, or with the lower frequency [110.5 MHz in addition to 408 MHz] absent, is possible and I am confident that it could eventually be completed without further call on the NSF for assistance … I hope that this information will help you evaluate the practicability of our instrument. It could, of course, be constructed much more easily with assistance from CSIRO, but the fine support given by local industry has already ensured its success.

As pointed out by Bruce McAdam (2008), Bart Bok (Director of Mt Stromlo Observatory from 1957-1966) was to play a major role in the next few weeks. On 27 November 1961, Bok wrote Messel with the details of the upcoming Keller visit, which Bok would coordinate. "Geoff Keller… expects to be in Australia from December 10$^{th}$ to 14$^{th}$. He asked me to prepare a tentative schedule of visits for him. [He included a list of people he wanted to see] ... I understand [that] the primary purpose of his visit is to check finally upon certain aspects of the grant to be made to Bernard Mills [and Christiansen] for the Cross." He would start off Monday morning at 09:30 am 11 December 1961 at the School of Physics meeting with Mills and Messel. Then at 2:30 pm, Keller would go to the RP Lab close to the School of Physics (now the Madsen Building on the Sydney University campus) where he would meet Bok, Bowen and Pawsey. Keller indicated he would also like to visit Bracewell, the School of Physics, and also have a "leisurely" meeting with Mills. Likely he would also have met Pawsey on a one-on-one discussion of the status of NRAO as Pawsey was to move in 1962 to Green Bank (West Virginia, USA) as the new Director of the National Radio Astronomy Observatory, funded by the National Science Foundation.

On Tuesday 12 December, Keller went to Melbourne to meet White. White wrote the Vice Chancellor of Sydney University (S.H. Roberts) the following day with an answer to Roberts's letter of 8 December 1961 asking for support for the Mills Cross project:

> I was very glad to hear from him [Keller] of the interest of [the NSF] in the project being put forward by the University of Sydney. Radio astronomical research in Australia has been, up to the present, a very successful venture. I hope to see this success continue, particularly now that your University is to make a substantial contribution to this scheme.

> One of the principal difficulties in such projects is that of estimating accurately the amount of money that might be involved. I was therefore particularly pleased that the NSF asked Dr Keller to visit Australia so that the Foundation will itself be familiar at first hand with the nature of the project. I hope, therefore, as a result of his visit this matter will go forward successfully from your point of view.

Messel was a little guarded as he wrote Keller on 15 December. "I would like to say how very nice it was to be able to see you [in Australia] even though it was only for a short time. As I mentioned to you yesterday we hope we have the pleasure of seeing you here again and under happier circumstances[17]. Still all is well that ends well!"

In the new year of 1962[18], Messel and Mills received no answer from the NSF concerning the start date of the grant. In mid-February 1962, Gerard F.W. Mulders (new Program Director for Astronomy, originally from Utrecht, the Netherlands) replied to an impatient telegram from Messel. Mulders said that "action on the proposal would be rushed as fast as possible." Finally on 3 March 1962, Waterman sent the formal acknowledgement that the sum of $149,000 (the first year) was granted for the Mills Cross Radio Telescope. A discussion between the NSF and the University of Sydney then occurred about issuing a joint press release about the project-NSF grant number G20038. In spite of this agreement, the Sydney press received a slightly different version[19]. The Sydney version contained additional material about another new astronomical instrument of Sydney University, the stellar intensity interferometer at Narrabri under the leadership of "one of the world's leading radio astronomers, Professor Hanbury-Brown, FRS." The public announcement was made at the 8th annual dinner of the Nuclear Research Foundation on 23 March 1962, with the Prime Minister Sir Robert Menzies in attendance. This occasion was the first time in Australia that a major research project in radio astronomy outside CSIRO was announced. Within a few weeks (26 March 1962), J.L. Pawsey

---

[17] Clearly referring to the controversy initiated by Bowen.

[18] Also on 8 February 1962, White wrote Bowen in Washington (during Bowen's complex overseas trip to the US, Europe and Chile from January to mid -March 1962) with a question about the Mills proposal (C3830, Z1/9 1962): "I do not know whether you heard anything in the States about the proposed grant from the NSF to Mills. My information is that they are proposing to make a much smaller grant initially to allow studies of the project, presumably with the promise that it will be extended later when [the proof of concept has been demonstrated]." Bowen replied on 2 March 1962 that he had been "careful to keep right off the Mills business, but I believe your summary ... is correct. I hope that as a result of Keller's visit NSF know where in Australia to get advice on any problems of this kind which may crop up in the future". White's negative assessment turned out to be unfounded.

[19] Both versions of the press release did mention Pawsey's recent appointment at Green Bank: "On Dec. 18, 1961, the Foundation announced the appointment of another prominent Australian, Dr. Joseph L. Pawsey, as new Director of the National Radio Astronomy Observatory at Green Bank, West Virginia. The NSF grant to Sydney will help maintain cordial and mutually beneficial relationships between US and Australian scientists."

sent a letter of congratulations to Messel from Green Bank, NRAO. This date coincides with the period when Pawsey's paralysis was first evident (see Chapter 40): "A few days ago I saw an announcement from the NSF that they are giving support to your Mills Cross project. I am writing to say that I am delighted to hear the news, and I wish you and Bernard every success with the project." (The signature "Joe" is clearly written in his handwriting. The letter was typed by the well-known NRAO personality and Director's secretary for many years Phyllis Jackson.

The Sydney University astronomers still had to "jump through a final hoop" before the funds could be released. On 26 March 1962, Keller wrote Mills:

> As a necessary concession to various people inside and outside the government who have criticised us (with some justification) for not having taken every reasonable precaution with respect to our commitments on large experimental construction programs [perhaps the 140-foot telescope at Green Bank], we have agreed that we will review your estimates before funding major construction.
>
> It seems to me that this might best be done by some knowledgeable radio astronomers who are in a position to review your estimates on the spot in Sydney … We would naturally like these to be individuals who are reasonably disinterested and have a certain obligation to the NSF to do the job.
>
> Would you be receptive to the idea of our asking Joe Pawsey and Ron Bracewell to represent us? Joe as Director of NRAO will have other major responsibilities in advising us on large telescopes, and Ron is a member of our Advisory Panel for Astronomy.

On 4 April 1962, Mills wrote back agreeing to the concept: "Such an independent check would be an excellent protection against the sort of thing that happened before. The only difficulty is that Ron is likely to be leaving [mid-year 1962- 27 June] before we obtain all our final tenders." Mulders replied from the NSF on 18 April 1962. He pointed out that if Ron Bracewell should have left "before sufficient information is available, I propose Bart Bok as an alternate to represent us in a local review of the cost estimates." He had feared that he would need to find a substitute for Pawsey "who has been in the hospital for three weeks now with an undiagnosed disorder affecting his left arm and leg. However, he is now improving to the extent that he can move his left arm again and it is our fervent hope that he will soon make a good recovery. In any case, for the present I am still counting on him." (As we have seen in Chapter 40, this optimism was misplaced. Pawsey was to be taken to MGH in Boston in a few weeks, 6 May 1962.)

Mills replied on 28 May. Many of the decisions on the construction could not be made before Bracewell's departure to return to Stanford on 27 June 1962. At this date, the news about Pawsey was also quite discouraging. His operation in Boston for a glioblastoma multi-form had

occurred on 16 May. Thus, it appeared that Bart Bok would be needed for this appraisal; "naturally we would object to Bowen and it would place anyone else in Radiophysics in a difficult position to be asked."

On 1 June 1962, Mulders agreed and asked that Bracewell evaluate the bids for the site works, antenna foundations and the superstructure if the bids arrived before his departure. If not, then Bok would do so. The finances would arrive about a month later. From the archival record, it is not at all clear if Bracewell was in fact involved in the approval process. The approval, likely by Bok, was clearly in place by 31 July 1962 when Mulders agreed that the steel superstructure contract be placed with Tubewrights Ltd. (A£ 120,000, or roughly US$ 288,000 )

> Construction on the new Cross began by the end of September 1962, with rapid progress. The opening of the Molonglo Cross was held on 19 November 1965 in the presence of the Prime Minister, Sir Robert Menzies (who had not been at the GRT opening in October 1961) and numerous US dignitaries, including the Ambassador to Australia, the Texan (and friend of Lyndon Johnson) Ed Clark. Several representatives from Cornell (the Cornell- Sydney University Astronomy Centre) were also present.

**Additional Note 1: 1 June 1963: "Men Following Machines: the CSIRO and Rival Claimants for the Scientific Man" in the Australian publication *Nation***

*:*

On 1 June 1963 the Australian publication *Nation* published an article, providing a more nuanced report on the CSIRO/Mills NSF proposal conflict of the previous year: "Men Following Machines: the CSIRO and Rival Claimants for the Scientific Man". The report was mainly concerned with conflicts between the CSIRO and Australian universities concerning the funding for a series of large main-frame computers. In addition, a related issue was the conflict of the previous year between the University of Sydney and CSIRO over the NSF proposal of Messel/Mills. (The assertion in the article that Pawsey did not share "the preference for the sun project at Narrabri" was inaccurate; as we have seen he was the main proponent of the "Paul Wild project" and worked with Wild to support the project both in Australia and with the Ford Foundation in the US.) The authors of the *Nation* article were, however, well aware of the conflicts of late 1961 as the NSF seemed to delay their decision about funding the Super-Cross proposal. The article continued:

> [At the end of 1961] delays began to supervene as well as some speculation about the delays. The ascertainable facts about those delays are few: the suspicions voiced and

the denials of those suspicions are many. [Keller of the NSF] arrived in Australia [in December 1961]. This was something slightly out of the ordinary. [Keller then interviewed] everybody with knowledge in the field, including [Bowen, Mills and Bok] … Keller went back to the United States, and in March 1962, a grant for the full sum that Dr Mills had applied for was officially announced … Unfortunately this story with a happy ending had other moments, at least in the belief of some scientists. It is beyond doubt that at some stage of the Americans' study [of the proposal], Mills's former employers had to be asked for an opinion. They were the most distinguished radioastronomical team in the southern hemisphere, and one of the three or four leading establishments in the world. Their answer, however, objective, had presumably to account for the fact that they [in fact Bowen and White] had chosen other projects [the GRT] in preference to the Cross proposed by Mills. Under the hustling Professor Messel, the university school of physics was becoming a next-door competitor in radio-astronomy, not only with the proposed Cross but with other projects like the Narrabri interferometer [of Hanbury-Brown]. Had there not been a body organised like the NSF with permanent, impartial administrators, and a wide body of referees [like Pawsey], its decisions would have left a taste of bitterness in its wake, a taste far more intense than the rumours that did in fact surround the enquires made by Keller in Australia. That our rival scientific elites will inevitably raise such problems for governments is now an established fact; that the rivalry will be intense when the competitors are themselves men of world reputations is understandable; that they may also be equally intense when the contenders are younger and yet not so well-established needs perhaps bringing home. For scientists who, compared to business executives, are still satisfied with comparatively low salaries, prestige and the facilities for research are major considerations. If one accepts all this, one can see the sources of dissatisfaction with what had gone on [as described in the preceding text about the 1963 conflicts over the national computer plan].

Figure 1 Article by Prof Harry Messel in the *Sydney Morning Herald* of 4 May 1961, "Universities Should Take Cver CSIRO".

Sydney Morning Herald 4/5/61

# 'UNIVERSITIES SHOULD TAKE OVER C.S.I.R.O.'

SMH 4/5/61

By PROFESSOR H. MESSEL

**IN spite of the increasing aid being provided by both State and Federal Governments, the universities and institutes of learning in Australia are facing a major staffing crisis to which there appears at first sight to be no solution.**

The crisis is immediate and will deteriorate even further during the next five years.

According to figures published by the Australian Universities Commission, there are close to 60,000 students in Australian universities at present and this number will reach about 95,000 in 1966. Due to the unavailability of suitable staff and severe financial shortages, the universities are not able to cope properly with the present student numbers, let alone some additional 35,000 students in five years' time.

The heart of the problem revolves around two directly related points — the availability of first-class staff, and adequate post-graduate research facilities.

At present there are some 3,500 academic members of staff in the universities to cope with 60,000 students, including part-time students. Already with these figures, the student-staff ratio is one of the worst in the world. Even to maintain this deplorable ratio, more than 3,600 new academic members of staff must be appointed by 1966. Where are they to come from?

## Position Overseas

As has been pointed out repeatedly by many people, there is no hope of recruiting this additional staff from overseas where serious staff shortages, caused by increasing student numbers, also exists. In fact, because of the seriousness of the situation in Australia, it is likely that during the next five years we will lose more staff to overseas countries, such as England, Canada and the U.S.A., than we will gain from these countries.

The Universities Commission and many other people have pointed out that there appears to be little choice but for the universities to train their own high quality youth to the standard where they are fit for academic staff appointments. As our future staff must come largely from within Australia itself, thousands of students must be trained to at least a Ph.D. or post-Ph.D. standard. This means post-graduate training on a scale never envisaged before in this country.

But to train research students to Ph.D. standard automatically requires post-graduate research facilities and equipment within the universities, for these provide the essential basis for such training. In other words, post-graduate research must be built up to a very high level in the universities—only then will we be able to train our own post-graduate students and thus help provide future staff for the universities.

In spite of being aware of this fact and mentioning it on several occasions, the Universities Commission has made little provision for the support of research within the universities during the next three years. It is almost beyond imagination that the commission did not face up to this fundamental issue—for here lies the clue to the long-term staffing problems of the universities.

If research is to be pursued by the universities at all at present, then it still must be done on a shoe-string budget as previously, or funds must be collected from various private sources in Australia and overseas. The commission either missed the fundamental aspect of this whole problem or gave up in despair due to the financial problems involved.

In the scientific fields practically all of the Commonwealth Government's funds for research have been, and are being, channelled into their own research agencies such as C.S.I.R.O. (the largest), the Atomic Energy Commission, and so forth—but not into the universities.

## Largest Body

Consider the largest scientific body in Australia—the C.S.I.R.O. with some 2,000 scientists, engineers and technicians, many of them of the highest calibre. They perform good work, in both the basic and applied fields, with the excellent and generous research facilities at their disposal. These facilities have been provided largely by the Commonwealth Government. Now that this same Government is also providing an increasing amount of funds for the universities, it is only natural that there is and will be, increasing competition for research funds between the universities on the one hand and C.S.I.R.O. on the other.

Furthermore, C.S.I.R.O. is also short of staff and competing with the universities in this field. In many instances, C.S.I.R.O. is able to offer higher salaries than the universities and usually much better research facilities and conditions of work.

## Solve Problem

I now wish to make a suggestion which could largely solve the problem of scientific, engineering and technical staff and research facilities for the universities and for C.S.I.R.O. The problem of scientific staff for teaching the undergraduate students would be solved as well. The solution I propose has one further great merit—it would not involve the provision of further large sums of finance by the Government immediately.

My suggestion is that the universities take over C.S.I.R.O. lock, stock and barrel (exceptions might be its standards activities and developmental work). Yes, I said the universities take over C.S.I.R.O., and not vice versa; for C.S.I.R.O. could never do what the universities do, whereas the universities can do, in most instances, what C.S.I.R.O. does—and better. This would also put a halt to the present encroachment by C.S.I.R.O. into more and more of the work traditionally carried out by universities. In fact, it should be pointed out that the scientific and engineering staffing crisis now faced by the universities can in a large measure be traced back to the establishment of C.S.I.R.O.

The proposal would—

- Immediately provide the universities with the necessary additional scientific and engineering and technical staffs for teaching at all levels, both undergraduate and post-graduate;
- Provide the universities with a considerable portion of the necessary scientific and engineering research facilities;
- Help to provide the necessary additional first-class staff and facilities for the training of postgraduate students and overcome the staffing difficulties of former C.S.I.R.O. projects by the continued flow of highly trained students;
- Stimulate the present C.S.I.R.O. staff to perform even better research work, since they would be carrying this work out in its traditional home—the universities—with the youthful and enterprising research worker. The overall calibre and amount of the research work performed on a national basis would then be increased to a level much higher than is being achieved at present by C.S.I.R.O.;
- Stop the competition for funds between universities and C.S.I.R.O. The staffs of the universities and C.S.I.R.O. have been on good terms for years, but increasing friction is arising as C.S.I.R.O. encroaches on the universities more and more;
- Not entail any substantial additional cost to the people of Australia; and
- Since many of the main divisions of C.S.I.R.O. are already on the university campuses, they could be easily taken over, the applied divisions going to technological institutes, the more basic to the universities.

PROF. MESSEL

Naturally these suggestions may not be received favourably by certain people. However, in my opinion, this is **the only solution** to the scientific and engineering staffing crisis in the Australian universities. No other feasible solution, to my knowledge, has been put forward. Furthermore, it would rectify a major error made years ago—the establishment of C.S.I.R.O. itself.

The Australian taxpayer simply cannot afford to ignore it. My suggestion is, therefore, that the Australian universities make a "takeover" bid for C.S.I.R.O. This would be the most important and profitable takeover in the history of the Australian people and would solve a large portion of the Australian universities' problems. After all, both the universities and C.S.I.R.O. belong to the Australian taxpayer. The nation has everything to gain and nothing to lose. The alternative is the debarring of thousands of students from entering the universities.