

NRAO ONLINE 53

Radio Astronomy by Pawsey and Bracewell, published 1955¹

Paul Wild to Bracewell 11 September 1963- 10 months after Pawsey's death.

However, I still remain vitally interested in the welfare of the second edition [of Pawsey and Bracewell] and will be pleased to do anything possible to help you in the way of gathering information and reading for the solar section.

Introduction

The first comprehensive textbook on radio astronomy was published in 1955: *Radio Astronomy* by Pawsey and Bracewell, Clarendon Press, Oxford, in the series *International Monographs on Radio* with editors Sir Edward Appleton and R.L. Smith-Rose. The book had a major impact on the field since it was written for an advanced audience of radio physicists and engineers as well as astronomers.

The Origin of the Book- 1950

Within a few years after World War II, the concept of an advanced textbook on radio astronomy arose. By 1950, Pawsey was searching for a publisher. During his visit to the UK in 1950 (Chapter 19), he visited at least two publishers in person, Chapman and Hall, and Oxford University Press (Clarendon Press). Pawsey wrote Bowen on 8 September 1950 from London with a report of the reaction of the two publishers. Chapman and Hall already had a series of books under the general editorship of Lovell with the first book to be on radio astronomy by Lovell himself; this book (*Radio Astronomy* in the *Frontiers of Science* series) was subsequently published in 1952 by Chapman and Hall with second author J.A. Clegg.² Thus Oxford University Press remained a choice. Here there was a complication since Appleton, the editor of the series (*International Monographs on Radio*), had assumed that "Stanley Hey might write a book for an

¹ References are NAA C3830 Z3/2/ I, II and III. The 1963 letters were obtained from the Joe and Lenore Pawsey Family Collection, copies of Bracewell-Wild correspondence sent to Mrs Lenore Pawsey after J.L. Pawsey's death on 30 November 1962.

² In 1957 a new book was published by Chapman and Hall by Hanbury Brown and Lovell, *The Exploration of Space by Radio*, subsequently published in the US in 1958 by John Wiley.

Oxford series on ... radio astronomy and they could make no decision until they had discussed this with [the editor].”³

Clearly, this discussion occurred within a short period. Pawsey wrote Appleton on 6 October 1950, shortly before his departure for Australia on 14 October 1950. Pawsey and Appleton had already discussed the matter in mid-September at the URSI conference in Zurich. Pawsey said he “welcomed your encouragement very much and I propose to go ahead and try to write one. I have written to Mr Wood of the Oxford University Press asking if the Press would consider publication of such a book.”

The detailed letter to Wood was also dated 6 October 1950. Pawsey laid out the plan for the book:

I am writing to ask if Oxford University Press would consider publication of a book on Radio Astronomy to be written by myself either as sole author or in collaboration with one of my colleagues in Sydney.

As you may know, a wide variety of investigations in this field has been carried out under my general direction by various members of the Radiophysics Laboratory, Sydney, and if it would be relevant to your consideration of this proposal I could send you a list of our published papers on this subject.

[Pawsey sent an outline of the seven proposed chapters; the published book of 1955 consisted of 12 chapters.] ... [T]he proposal is for a book covering the application of radio techniques to astronomical investigations, including meteors, the moon, sun and galaxy. It is intended to be written for those interested in developments in new branches of physics but with astronomers and radio-physicists in mind as more specialised classes of readers. I should aim at a length of about 300 pages of moderate size ... [The final book was to be 356 pages.]

I think this book could be written in about a year.⁴

Shortly after Pawsey’s return to Australia in late October 1950, he heard from A.M. Wood of the Clarendon Press at Oxford:

³ Cambridge University Press was also mentioned by Pawsey; it is not clear if they were approached. There was a major dilemma as Pawsey wrote Bowen on 8 September 1950: “... it is quite clear that this thing cannot be done without telling people what you are about because the respective publishers immediately refer the matter to technical people such as Appleton, Lovell and Ratcliffe.”

⁴ Pawsey was guilty of misplaced optimism, a common reaction experienced by numerous authors. Including the current three (Goss, Hooker and Ekers)

The Delegates of the Press have now considered your proposal for a book on Radio Astronomy. You will, I am sure, be pleased to know that they have agreed to encourage the project. I can, therefore, propose terms ... If you [would] like to submit a chapter in draft we could perhaps help with comments on it at that stage so that systematic imperfections of presentation could be removed. You may be sure we will help in any way we can.

On 15 December 1950, Appleton, the editor of the series and the Vice-Chancellor of the University of Edinburgh, wrote a glowing letter of congratulations. "I am really delighted about the prospect of this, for you write easily for the reader whatever the cost in blood, tears and sweat."

Writing the Book – 1952

Then there was a silence from Pawsey for well over a year. A full 17 months later on 26 March 1952, he contacted Wood of the Clarendon Press: "The writing has progressed much slower than had hoped, largely owing to my being kept very busy with other work during the greater part of last year, but it is now going ahead." Pawsey also reported he had chosen Ron Bracewell of the RPL as a co-author: "... [W]e have essentially completed a first draft. I am loath to estimate the time necessary to complete the job, but I hope it will not be long and I shall do my utmost to expedite it."

Five months later, Pawsey contacted overseas colleagues for advice. After the URSI Conference in Sydney in August 1952⁵, he began with the experts on the optical identification (ID) of radio sources, Walter Baade and Rudolf Minkowski at Mount Wilson and Palomar Observatory. In 1952, the situation with optical identifications was confusing. Few reliable IDs were available; the optical astronomers were frustrated by the poor accuracy of the positions determined by radio astronomers.

In the meantime, Pawsey sent a letter to Wood of Clarendon Press on 16 October 1952 with a number of questions about the figures of the book; the good news was that a first draft was now complete.⁶ Revisions were being carried out. Also at this time, Pawsey sent the solar chapter to Cla Allen at University College London with a request for comments, which he received on 13 November 1952; a similar exchange occurred with Len Huxley at the University

⁵ To Baade, Pawsey wrote: "We have just had a most stimulating, though disruptive, experience in having the URSI Assembly in Sydney. The last visitors are now departing and we hope to settle down to work again."

⁶ Pawsey also reported to Wood: "[At URSI in Sydney] I told Sir Edward Appleton of this [completed draft] ... and he urged us to get on with the job as quickly as possible. We shall do this."

of Adelaide. Huxley sent comments in mid-January 1953 concerning meteor radar; the comments were written by A. Weiss (later at RPL in the solar group), W.G. Elford and D.S. Robertson.

Some months later (14 May 1953), Pawsey wrote Wood with an update on the book. A number of chapters “have now been carried ... into almost final form”. He would send soon Chapter X (Meteors) as an example of a finished chapter, in order to “avoid some possible troubles”. He hoped to receive comments on the presentation from the Press. Immediately, Wood replied (28 May 1953) with a few minor comments.

In a letter from 16 May 1953, Appleton asked Pawsey about the status of the book. Pawsey reported in a letter of 23 July that he had written to Wood a few months earlier that he expected the book to be completed by September 1953. In late July the authors were still on schedule for this goal to be achieved.

During the next months, Pawsey and Bracewell were busy getting permission to use photographs from many colleagues: letters to Lovell for drawings for the proposed “giant Manchester movable paraboloid as an example of the things to come”; a request to Mt Wilson and Palomar for illustrations of galaxies and nebulae; a request to Harvard College Observatory for photographs. Pawsey had also written Alan Shapley of the US Central Radio Propagation Laboratory (National Bureau of Standards) in Washington for information on US contributions to radio astronomy. Shapley referred the letter to John Hagen of the US Naval Research Laboratory. Hagen wrote a long letter on 20 August 1953 with a description of the work of Jansky, Reber, Southworth, Dicke and Beringer, the NRL work, Cornell (Seegar [sic should be Seeger], Williamson and Martha Carpenter), Baade and Minkowski from Pasadena and Ewen and Purcell from Harvard.

On 16 September 1953, Pawsey wrote Wood with an update; the manuscript would be posted by air mail soon. On 2 October 1953, the complete manuscript and figures were posted from Sydney to Oxford. A lengthy letter accompanied this shipment with detailed questions about many issues, such as section numbering, equation numbering, abbreviations, figure captions, section and subsection headings and permissions for figure usage.

Printing of the Book 1954-1955

In early 1954, representatives of the Clarendon Press asked Pawsey for a publicity statement (blurb) that would enhance sales in the US in order “to plan the publicity ... well before [the] appearance [of the book]. [We are] looking to have more detailed information about an

author's contacts with America and the sort of people there that are most likely to be interested in his book. It would help if you could send us information of this sort that we could forward to our New York Branch ...”

On 24 February 1954, Pawsey sent the “blurb” that is shown in Additional Note 1, similar to his statement to Wood at the beginning of the project. In addition, Pawsey wrote the Secretary of the Clarendon Press with a number of details for a US audience. He included the numerous contacts with prominent US scientists in his comprehensive visit to North America in 1947/1949 (see Chapter 17), including Baade, Kuiper, Shapley, Bok, Menzel, Spitzer, Roberts, Friis, Southworth, Goldberg and Burrows. Pawsey commented on the propitious time for this particular book:

I should first point out that the present time is particularly good for some sort of publicity on radio astronomy in the United States because influential scientists are trying to revive radio astronomy there. (It has been at a low ebb). To this end the American Association of the Advancement of Science held a symposium on radio astronomy in Boston in December last [1953], and on January 4th, 5th and 6th of this year [1954] the National Science Foundation, the Carnegie Institution of Washington and the California Institute of Technology jointly organised a radio astronomy conference in Washington which was attended by leading radio astronomers from all over the world as well as numerous Americans. [Chapter 22]

I should also mention that my own position as (1) Assistant Chief of the Radiophysics Laboratory, and in charge of Radio Astronomy since the work began in 1945, and (2) President of the Radio Astronomy Commission of the International Astronomical Union, might be of some use from a publicity angle.⁷

When he travelled to the UK in 1954 (see Chapter 24), Pawsey visited Oxford and the Clarendon Press. They discussed the next steps in a letter to Bracewell on 19 August 1954: Bracewell was to produce the index immediately after the first proofs were available in the coming months. A complication arose at this period as Bracewell was to move to Berkeley on 7 September 1954 for a one-year assignment to the University of California, the visit organised by Otto Struve, the

⁷ Pawsey also mentioned to the Clarendon Press that he had been in touch with the American John Pfeiffer who was to write a popular book about radio astronomy, eventually published in 1956: *The Changing Universe, The Story of the New Astronomy*. The book contains remarkably little about the Australian efforts, influenced by the fact that Pfeiffer was unable to visit Australia; he had written to Bowen and Pawsey in Sydney and met Mills during his visit to the US in 1954-1955. His visits to the UK, the Netherlands and Canada led to more details about scientific results of these three nations.

chair of astronomy. By 16 September 1954, Bracewell and his family were in Berkeley. The proofs were being sent to both Sydney and Berkeley. Since Pawsey was still traveling (arrived back in Sydney 21 October 1954), the communications were complex. At this stage (3 September 1954), Bracewell expected that the book would be published at Christmas 1954.

The correction of the proofs was a slow process. Pawsey wrote Bracewell on 9 December that he had not “done anything useful at all ... I am assuming that you have received all this and that you will do what is necessary.” Bracewell did all the proofreading and reported on 13 December that the proofs had all been returned with corrections to the Press: “You will be pleased to hear that the last of the revised proofs have reached me and been duly returned to the Press. They have been coming in at intervals ever since I arrived here and it is a pleasure to have dealt with the last.”

By 21 February 1955, Wood reported that “the book is passed for press”.

On 11 May 1955, Bracewell wrote Pawsey from Berkeley that the book would be published on 16 June 1955, to be sold at a price of 55/- sterling (£2 15/8). Pawsey wrote Bracewell on 19 May 1955 from Sydney. He was disappointed: “It is depressing that the thing has been delayed so long, but we have to accept it.” Bracewell wrote back on 23 May 1955 with a generally favourable report on the appearance of the book. He was not pleased that all the “decorative” images from Mt Wilson had been lumped together at the end of the book, leading to a loss of impact.

In EM_26.11, the table of contents of the book is listed.

Reviews of *Radio Astronomy* – 1955-1956

A number of colleagues were sent complementary copies. Hanbury Brown (29 June 1955) at Jodrell Bank replied that he looked forward to using the book in his lecture courses.⁹ Oort (30 June 1955) from Leiden was effusive in his gratitude: “I must confess that I feel a little embarrassed by this beautiful gift, which I have so little deserved. But I want to thank you most heartily for it. It is certain that I shall use it frequently and to great advantage.” C.W. “Cla” Allen (16 November 1955) reported on his successful use of the book in a 12-lecture course at University of London Observatory. He did point out some omissions in the book which he had

⁸ The cost of the book in the US was \$8.80. In the modern era the cost would be about US\$100.00.

⁹ By a remarkable coincidence, W.M. Goss may have this copy. In 2007 Stuart Pawsey of Berkeley, California, (the son of J.L. Pawsey) gave Goss one of his copies of his father’s book. Stuart had bought this on eBay. The book has the signature of Robert Hanbury Brown.

added in his lectures, such as Stokes parameters (polarisation), the Nyquist theorem, special relativity and the Kramers theory of free-free emission.

At least six reviews of the book appeared from December 1955 to June 1956, most by well-known radio astronomers. The opinions expressed were all generally favourable. The first review was by Bok in the 23 December 1955 issue of *Science*. Bok was the most critical of all the reviewers. He started with a positive note:

Radio astronomy is by now more than 20 years old, but until the appearance of the present volume [by Pawsey and Bracewell] there existed only a single semitechnical work on the subject, the book by Lovell and Clegg (1952) ... The Pawsey-Bracewell is our first textbook and a good one it is ...

Then Bok pointed out the major flaw of the book, its datedness.

The ... chapter on cosmic radio waves is, alas, a little on the brief side, and here the book suffers markedly from a delay in prompt publication: whole sections are more or less out of date, in part because of more recent work by the authors and their associates. It is difficult to avoid this in a field that is still developing as rapidly as radio astronomy is. To take one glaring example of rapid “aging”, there is no reference in the sections dealing with 21 centimetre [HI] research to the recent spectacular results on the spiral structure of the galaxy, to the absorption features observed in the profiles of some discrete sources, or to studies relating optical and 21 centimetre features of details in the interstellar medium. In other words, the eager student of the subject will perforce have to depend on recent summarising articles or volumes like the forthcoming results from the August 1955 symposium held at Jodrell Bank, if he wishes to be up to date in the field. The same criticism applies to problems related to the radio continuum or the identification of discrete radio sources ... Let us hope that the first edition may soon be sold out, that the authors may be persuaded to prepare an up-to-date second edition. And that the publishers will bring the next edition out with minimum delay.

Two reviews followed in February 1956 in *Nature* by J. Stanley Hey (the ground breaking radio astronomer in the UK) and *Sky and Telescope* by Philip Newman (a space scientist) of the Air Force Cambridge Research Centre. Newman cited a relevant quote from the book: “[They] must cater to those who know astronomy but not radio, and also for those who know radio but not astronomy”. The authors tried to make the material “readable by anyone with a background of

physics". Newman wrote: "The result is indeed a well-turned-out book." Hey does point out in passing the dated aspect of some material in the book.¹⁰

Graham-Smith wrote a thoughtful review (June 1956) in the journal started by Appleton as the founding editor of *Journal of Atmospheric and Terrestrial Physics* in 1950 (*Journal of Atmospheric and Solar-Terrestrial Physics* since 1997). Smith's review was upbeat:

The last years have seen the phenomenal growth of radio astronomy from a collection of odd publications by communications engineers to a subject which opens up wide new fields of astronomical knowledge. The spectrum of electromagnetic radiation available to observation has been dramatically increased, making possible the study [parts] of the universe which were previously invisible or perhaps covered by obscuring clouds. The rapid growth of a very few radio-astronomical observatories, of which the Radio-physics Laboratory in Sydney is one of the most outstanding, is now being matched by an increasing interest on the part of many older observatories and other institutions, and correspondingly the need has become obvious for a comprehensive account of the new subject. Dr Pawsey and Dr Bracewell are exceptionally well qualified for the task, since they have been, for many years, closely associated with radio astronomy in Sydney and elsewhere.

Graham-Smith pointed out that the material covered in the book was only up to date in mid-1952, three years before publication. He recommended the book for every physics library.

Apparently, Pawsey only replied to one reviewer, Graham-Smith. On 12 December 1956, he thanked Smith and emphasised to him that, "I entirely agree with your comments." The reasons were summarised by Pawsey as he recapped the "break-down of the elapsed time". The closing date for the manuscript was mid-1952; the complete manuscript was posted to Oxford in October 1953. Then the publication of the book was in June 1955, a delay of three years. Many readers did not see the book until mid-1956, a delay of four years. Pawsey remarked to Smith: "[The delay] gave me a surprise."

Prospective Second Edition of Radio Astronomy – Discussions 1956-1963

¹⁰ A Soviet review was published in April 1956 by V. Vitkevitch. An additional review was prepared by John Kraus for *Proceedings of the Institute of Radio Engineers* in 1957. The author is said to be J.D KRAUSE (sic not KRAUS); thus, the on-line IEEE index does not locate the review as the name KRAUS is entered. The Kraus review began with a stirring introduction: "Astronomy may be divided into three epochs: the pre-telescopic before Galileo, the telescopic from Galileo to the present and the radio-electronic epoch which we are now entering."

Already on 17 April 1956, Pawsey had implied to Wood of the Clarendon Press that a second edition might be desirable. He mentioned that much of the material was “already a bit out of date. This is inevitable in a fast growing field, but we can still claim that defects are defects of omission rather than false statements.” On 12 October 1956, Pawsey asked about the sale of the book. If the supply of first edition books should dwindle to a low level, there would be a strong incentive to publish a second edition: “I am interested not only in the financial end but also in the perspective as to a second edition. The reviews seem generally favourable and I am looking forward to hearing how sales have gone. The timing for the US market appears to have been good- radio astronomy is booming there.”

On 12 December 1956, Pawsey was quite direct as he broached the topic again with Wood. Pawsey had been informed that sales up to end March-1956 had been 1159 volumes.

I am writing to ask you again about this question of a second edition. Bracewell has gone to live in California and it would require some looking ahead for us to get together. [A visit in 1957 might in fact be possible.] On the other hand, there is no good doing anything unless the published factors favour it. The dominant factor is presumably the sales, and you must interpret this. Technically there have been, since writing, important **advances in certain aspects which make parts of the book obsolete**. [our emphasis] My guess is that the main part of the text could stand with minor revisions, a few sections should be added or deleted and certain chapters, notably Chapter VII [“Cosmic Radio Waves”, with synchrotron emission and the HI spiral structure] should be completely re-written and expanded.

Wood responded on 31 December 1956. Since 1 April 1956 about 500 additional books had been sold, implying that the stock of books would last for 18 to 24 months only. Wood wrote:

My own personal feeling is that we should encourage you to plan to write it and that if you started in about a year that would be a reasonable time ... Would it be reasonable to suppose that if you went to the US in about a year's time you and Bracewell would have completed the new manuscript of the new edition by July 1958?

This plan would mean that there would only be a small gap between the stock of the first edition and the new edition. The press would be happy to accept the new manuscript any time after the middle of 1958, subject to the approval of Appleton as editor of the series. Wood was in the process of informing Appleton.

On 6 February 1957, Wood wrote back to Pawsey with a new aspect of the collaboration. Lovell had been contacted by Appleton with a request: Lovell was willing to help with the Meteor Chapter (X). It is not at all clear from the correspondence whether Pawsey had ever asked for assistance. This chapter did not require major revisions. Pawsey wrote Lovell (18 February 1957) with an expression of thanks. He did not want Lovell's assistance at this time in early 1957. He outlined the plans that Bracewell and he had for the second edition; the major goal was "nice timing and no delay once under way." Pawsey was again optimistic: the second edition could be ready by 1959; thus, the completion date had already slipped within a few months by about a year! Lovell replied immediately on 27 February 1957. He had been surprised a new edition was to be completed so quickly; but now he realised that the time scale was a bit longer. "I feel certain that you will have a much better chance of making a satisfactory job when some of the major uncertainties have been removed from the extragalactic studies."¹¹

In the meantime, Pawsey and Bracewell were beginning to make concrete plans for the major re-writes required for the second edition. They would meet in the US in the northern summer of 1957 (letter from Pawsey to Bracewell on 18 February 1957). Pawsey was determined to make the process work smoothly for this edition: "... [W]hen we do decide to go properly, we must put in a concerted effort and get it finished quickly so that it all relates to the same date of closing [of the writing of the manuscript]."

The correspondence with the Clarendon Press continued on 2 April 1957. Wood wrote that sales of the first edition continued at a reasonable pace with a half year's stock remaining, "... [Y]ou may wish to do extensive revision even at this stage. I should be glad if you could let me know immediately whether you feel you must prepare a completely new edition, or whether minimal corrections at this stage will give us a breathing space of another three or four years before a new edition is required. If a corrected impression can be done this time I shall be glad to have the corrections soon, so we can get started. I am glad the book is going well." Thus for the first time, a "quick and dirty" revision was suggested, in reality a "facelift".

On 30 April 1958, Pawsey had just returned from the US, having visited Bracewell at Stanford from 17 to 23 April 1958. He wrote Wood (a letter sent via Bracewell so Ron could add his comments for Wood). Clearly a major effort on the second edition had not been carried out at

¹¹ Pawsey wrote Lovell on 24 July 1957 as they discussed the problems of collaboration with Soviet colleagues. Pawsey reported that in Shklovskii's book of *Cosmic Radio Waves* (original edition 1956) many figures were taken from Pawsey and Bracewell with no attribution. Also, many of the equations such as 2-18 to 2-23 were taken from Pawsey and Bracewell's book with no reference. The Harvard University Press translation of 1960 contained references to the 1955 Pawsey and Bracewell book.

this time They had decided to postpone a “serious start” yet again. They would wait until after the Paris Symposium in 1958 “at which it will be possible for us to become reasonably up-to-date on the subject”. Pawsey rejected a piecemeal correction in order to gain a few years’ breathing space. “Several of the most important chapters are now seriously out of date, and I feel that a revision is due. My rough estimate of the time we should take to do this is about 12 months from next December, i.e. completion about December 1959.” Thus, the time estimate was roughly consistent with the estimate made in February 1958. Bracewell added a letter to Wood on 6 May 1958. He was also optimistic and reported that the “book had stood the test of time fairly well” according to an informal poll of US radio astronomers. The book continued to be valuable to newcomers to the field.

However, Bracewell made a counter proposal that was a surprise, the letter from him enclosed in the same letter to Wood: “I therefore feel that it would be unwise to let it go out of print and would propose incorporating minor corrections.” [Thus, a facelift or even a “quick and dirty” repair!]

Bracewell continued, suggesting that the developments since 1954 would require extensive additions to the chapters on cosmic radio waves and lunar thermal radiation and a revision of the extra-terrestrial radio echoes chapter. Already the widely different opinions of the two co-authors were apparent. Bracewell continued: “The time scale estimated by Pawsey seems realistic to me, but does not fit in very well with the idea of a corrected impression [the facelift] which would have a currency of three or four years. An alternative which Pawsey might like to consider is replacing part of Chapter VII [Cosmic Radio Waves] with new material covering the new development (hydrogen line emission), and leaving the extensive revision for four years.” We can imagine the confusion experienced by Wood after receiving the letters of 30 April and 6 May from the two authors simultaneously.

Pawsey picked up this thread immediately as he tried damage control after reading Bracewell’s surprising and confusing letter. Pawsey wrote Wood on 20 May 1958 as he tried to mediate: “You will gather from Bracewell’s letter to you ... that he and I are suffering from our geographical inability to talk things over with respect to the proposed minor modifications of our new edition of *Radio Astronomy*.”

Pawsey thus offered two options: (1) Let the book go out of print¹² or (2) produce a modified “facelift” as Bracewell suggested. Later the second edition would be required¹³; Pawsey then proposed a new deadline, end of 1960! Pawsey realised that the “triangular” correspondence

¹² Apparently Wood had suggested this in a letter (not present in the archive) of 7 May 1958.

¹³ Pawsey was particularly afraid that a book dated 1958 would have the perspective of 1953.

was almost hopeless. He had recently written a letter to Bracewell but requested that he hold his reply until Wood had answered. The confusion of a three-way conversation was complete.

A decisive letter that attempted to bring some closure was written by Pawsey to Bracewell on 20 May 1958 with numerous suggestions. Bracewell characterised his plan as a “slight re-vamping” and then a new edition in four years. Pawsey had looked at the entire book and found many shortcomings:

- omissions such as 2-dimensional Fourier transforms in the observational technique chapter, and synchrotron emission theory in the chapter on radio waves in ionised media
- major revisions in the cosmic radio wave chapter (the Crab Nebula and synchrotron emission, galactic corona, absorption in HII regions and many HI topics and Faraday effect in the chapter on radar from the moon, meteors etc.)

Pawsey continued with his old theme but added a new idea that seemed promising: “I am also uncertain about how long it would take to rewrite the book properly. I think my estimate of one year is a minimum. The 8000-mile separation is no mean handicap. Should I see if Paul Wild is interested in collaborating? I think he is the best writer among us.”

Pawsey ended his letter with a frustrated paragraph. He did not like the details of Bracewell’s facelift proposal but he was “sympathetic to the idea of a patched-up version.” Pawsey hoped to stop the cycle of misunderstandings that were being perpetuated in the triangular correspondence.¹⁴

Fortunately for Pawsey and Bracewell, Wood broke the log-jam in a letter to Pawsey on 28 May 1958. He did not want to just print a new version of the first edition. And he opposed a “minor-facelift”: “I do not think it would be at all easy to do, and I doubt it would make sufficient impression on the sales curve to avoid uneasiness about when we would clear out stocks.” He was in favour of incorporating the results of the Paris Symposium from August 1958. He ended his letter with a clarion call to action: “Let us then plan to have copy for the new edition at some time that suits you. We will then make strong endeavours to produce it in a reasonable time. I am sure this is the best course.”

¹⁴ A number of factors had contributed to this tortured history in mid-1958. The “face-lift” versus complete revision discussion had been confusing. Now there was a new element: adding potential authors. And as we will show, the internal infighting at RPL (the growing schism with Christiansen and Mils) that accelerated in 1959-1960 (Chapters 30 and 31) was an additional and possibly an additional factor in the upcoming failure to provide a new edition.

On 3 June 1960, Bracewell responded to Pawsey with a report on the two competing radio astronomy textbooks: Steinberg and Lequeux (*Radioastronomie* in French from 1960¹⁵, publisher Dunod) and Hanbury Brown and Lovell (*The Exploration of Space by Radio* in 1957). Bracewell's assessment was: "The former is the more substantial and is two or three years more up-to-date than Brown and Lovell." Then he asked the key question: "Have you taken up the question of joint authorship with Paul Wild again lately?"¹⁶ Bracewell was still keen on the piecemeal revision. "I feel it is unfortunate that the book is out of print merely through datedness, because it is still in demand."

Pawsey's response was a sombre letter written from his home in Vaucluse¹⁷ to Bracewell on 16 July 1960. As we have described in the Chapter 30, Pawsey's position was being undermined by Bowen already in 1960, as the plans to bring Bolton back to Parkes developed. This fact and the loss of Mills and Christiansen to Sydney University had become a major distraction for Pawsey. In addition he was exhausted by the problems of the review paper being prepared with Eric Hill for *Reports on Progress in Physics* ("Cosmic Radio Waves and Their Interpretation" published in 1961; see Chapter 46).

Pawsey explained to Bracewell (16 July 1960):

I got your letter about a new edition a few weeks ago and have been turning it over in my mind since. I am torn between two urges. The few new facts are these (a) I have had a talk with Wild and he feels that he is too full up [likely with planning for the new instrument that would be opened in 1967 at Culgoora] to attempt to write a book. I concur with this opinion. Therefore, if we want a new collaborator it has to be someone other than Paul. And there is no one in the whole wide world to compare. (b) I have been sweating my guts out for the past couple of months writing a review article ... [with Eric Hill]. The result is that I have accumulated a certain fund of knowledge in this field and I have also a feeling of being overwhelmed (incidentally largely by attempts at undue condensation). Any way my present feeling is that **a book would kill me** [our emphasis]. This feeling may fade in due course when the manuscript is safely away. (c) There is a rumour that you are planning to come out here for a sabbatical [from

¹⁵ This book would be translated by Bracewell and published in 1963 *Radio Astronomy*, publisher McGraw-Hill. In July 1960, Bracewell wrote Pawsey: "[The book] ought to be available in English and in correspondence with Steinberg I have offered to assist ... Steinberg is of the opinion that the book is written for the public at large and does not compete with Pawsey and Bracewell."

¹⁶ The first reference to Wild as a co-author had been two years earlier in May 1958. The implication in the June 1960 letter is that the question of Wild's participation was uncertain, but unlikely.

¹⁷ It is possible that Pawsey did not want Bowen and his personal assistant Sally Atkinson to see the contents of the letter.

Stanford] in the near future. If so, when? Another intangible is my general feeling of unrest. A year ago we had what I was sufficiently egotistical to consider the outstanding radio astronomy group in the world. Now Alex Shain is dead [since 11 February 1960 at age 38], and Chris [Christiansen] and Bernie [Mills] gone [to Sydney University]. I no longer see the future clearly.¹⁸

I have had a look at the various new books. Shklovsky's book which I have seen unofficially [the translation published by Harvard University Press in 1960] in the manuscript state through Bart Bok is thoroughly interesting but is not a direct rival. Steinberg and Lequeux is excellent but is in French [soon to be translated by Bracewell!, published in 1963 by McGraw-Hill]. There is still room for an up-to-date version of [our book]. But it has to be a good one and this involves a heck of a lot of work. I could do the cosmic side reasonably easily now, assuming I do recover, but the solar side is a major one and the instrumental side is also tough, and this is not counting the odds and sods. Incidentally my paper [with Hill] includes a section on synchrotron radiation for beginners. What do you think of it all? I need to sit on the fence and recover for a few weeks before committing myself.

Thus, Paul Wild had finally withdrawn as a possible author. In addition the collaboration with Eric Hill had been disappointing, leading to an exhausting experience for Pawsey.

On 27 July 1960, Ron Bracewell wrote a long letter of response to Pawsey. As reported in Chapter 30, he was "puzzled as to the future in Sydney, and it often is discussed [among colleagues in the US]. The fragmentation that has taken place is an inevitable concomitant of maturity. I look forward to a rearrangement of the pieces that will favour continued successful development of radio astronomy in Australia and send my best personal wishes for your part in it."

Bracewell continued his campaign for a piecewise revision of the book, "even if it takes over a year." His proposal to Pawsey seemed complex and likely implausible: "The out-of-datedness is not the crucial thing, as is obvious from the fact that it would still be enjoying a good sale to newcomers in the field if it were still available. Hence we should revise the chapters as of various epochs, acting separately, and only meet at a later stage for final touching up."

Bracewell was quite uncertain of his sabbatical in Sydney; he suggested that this might occur with an opportunity to work on the second edition. In fact, Bracewell did spend six months in

¹⁸see Chapter 30

1962 at the University of Sydney on a short sabbatical. Apparently, Bracewell did not work on the second edition during this period.

In the 27 July 1960 letter, Bracewell made the obvious suggestion to Pawsey to turn the *Reports on Progress in Physics* article into a replacement for the first edition chapter VII (“Cosmic Radio Waves”). He suggested that he would write the new chapter II (observation techniques). As a last ditch attempt to involve Paul Wild he made an unrealistic suggestion: “Maybe Paul could still be prevailed upon to do Chapter V (solar) if we break away from the original position that all the authors had to be responsible for all the book. We could accept some discontinuities in style and content as the price for appearance rather than non-appearance.”

In August 1960, Pawsey tried to find another collaborator after Paul Wild withdrew as author. Pawsey made a futile attempt to bring Jim Roberts into the second edition project. He wrote Roberts at Caltech on 6 August: “Ron Bracewell and I have been considering a new edition of [Pawsey and Bracewell] for some years and have not yet got to the necessary courage. We tried to get Paul to do the solar chapter, but he is too busy, he says. What would your reaction be to coming in as a co-author?”

From Pasadena, Jim Roberts wrote (12 August 1960) a rambling response as he turned down this suggestion. He had made the decision to leave solar radio astronomy. He had committed to working at the Parkes radio telescope, which opened in October 1961. He returned to Sydney from Caltech in March 1961.¹⁹

Roberts turned down the offer:

Thank you for considering me ... I guess I have mixed feelings. But really if I'm to go on with radio astronomy I think I need a more active job with a compelling interest. I'm finding it ever harder to sit down and think and write or do theoretical work. Perhaps I just don't like hard work? There is no doubt that your book is the only one on radio astronomy that can claim to be a text book, and it is a great shame it is out of print.

Thus, Roberts was not interested in the project.

At this point (August 1960) there was no discussion about the second edition again for another two years. Pawsey was fully occupied in 1961 and early 1962 organising his departure from RPL.

¹⁹ Roberts took early retirement in 1987, after a remarkable career. During his second period at RPL from 1961- 1987, he experienced three long-term, successful visits to the University of Toronto, the Arecibo Observatory and the University of California-Berkeley.

By March 1962, Pawsey was in the hospital in Washington, DC, gravely ill with glioblastoma (brain tumour). (see Chapter 40) On 30 April 1962, Pawsey dictated a letter from the hospital to Bracewell, at the University of Sydney during his sabbatical:

The outstanding question is the future of the book. I just can't see how I can be much more useful at this stage because I must take things easy for some time and there may be quite a lot to do in getting away from Sydney in the next few months. [Pawsey expected that he would soon return by air to Sydney for a recuperation. Pawsey died end November 1962.] I have no bright ideas on how to continue co-operation in writing the book. If you have any ideas, you could let me know. I don't suppose you have had any luck in getting Paul as a co-author. If he would do so, I, of course, would be heartily in favour, but I think I had better leave any suggestion to you. [Clearly, Pawsey had given up any expectation that a second edition would occur.]

Clearly, Wild had remained steadfast in his refusal to collaborate ever since July 1960. However, Bracewell wrote back to Pawsey in Boston at Massachusetts General Hospital on 6 June 1962. There had been a break-through. Paul Wild had changed his mind and had agreed again to participate as a co-author!

I spoke to Paul again [Bracewell was still in Sydney] after receiving your letter [30 April 1962] and he agreed to discuss the matter of co-authorship. We had one or two technical talks that seemed promising ... I know you will be pleased that Paul has joined us and I think we can confidently look forward to the new book holding a leading place for some years to come.

Bracewell described the arrangement for all three of the authors to sign the new contract sent by Wood of the Clarendon Press. On 25 June 1962, Pawsey signed his copy of the agreement and sent it to Bracewell, still on sabbatical at the University of Sydney. He congratulated Bracewell on "getting Paul into taking this on." In a separate letter to Paul Wild, Pawsey wrote that he was pleased that Paul was participating. "I [also] sincerely hope that the work will not cut across your other plans."

After the death of Pawsey on 30 November 1962, Paul Wild and Ron Bracewell continued their discussions about the ill-fated second edition. Clearly, the new circumstances lead to a completely new evaluation for the future. By this point, the discussions of the second edition had dragged on since 1955; all enthusiasm had dissipated. In the end very little, if any, serious efforts had been expended in doing the re-writing while many letters were written to

colleagues and the publisher about the desirability of completing the second edition. On 31 May 1963, Paul decided for the second time that he would not participate.

In summary, the ill-fated second edition was a victim of many factors. The break-up of the team of senior radio astronomers at RPL in 1960-1962 contributed. But the death of the “Grand-Old-Man” of Australian radio astronomy in late November 1962 was the final straw for this precarious project. Bracewell and Wild lost momentum and motivation in the post-Pawsey era.

EPILOGUE

The major handicap for this book, as recognised immediately by the authors, was the dated nature of the material in the book. The material in the book was closed in mid-1952 and the complete manuscript was submitted in October 1953. Publication was in June 1955, leading to many readers only receiving the book in the course of 1956. Immediately in mid-1955, Pawsey was aware of the “datedness” of the book, especially at the meagre treatment of the spiral structure of the Milky Way as determined by HI studies, which had only become available in 1954 and 1955 by the groups in Leiden and Sydney. In addition, Pawsey was especially concerned by the failure to describe all the new results in Chapter VII, “Cosmic Radio Waves” (which included the short chapter of only five pages on the new HI line at 21 cm). Another problem was the omission of any discussion of synchrotron emission, again a topic that had been described in the early to mid-1950s by Ginzburg and later Shklovsky (see Chapter 34). Edge and Mulkay (1976, p. 444) have highlighted this omission: “The synchrotron theory, incidentally, is *not* referred to by Pawsey and Bracewell in their textbook on *Radio Astronomy*, published in 1955.”

As observed from a perspective of 65 years, the impact of the Pawsey-Bracewell text book of 1955 was a success. However, the “rapid aging” described above was a major flaw. The tragedy was that Pawsey, Bracewell and Wild could not agree on an efficient plan to correct these flaws.

Additional Note 1 : The publicity “blurb” written by Pawsey Feb. 1954, for an American audience

Descriptive Note “Radio Astronomy” – Pawsey and Bracewell.

Astronomy is now bringing into use a radically new medium for observations: radio waves are now supplementing light. Using radio waves, we “see” new aspects of the heavens. We can “see” the vast interstellar clouds of ground-state hydrogen which are invisible optically, the mysterious “radio stars”, of which the second brightest is a pair of galaxies in collision 100 million light years away, and the tenuous solar corona unhampered by the dazzling photosphere. The exacting requirements for equipment have been met by extraordinary refinements in radio techniques: by the development of receivers which are so sensitive that they can detect thermal radiation from a body at a temperature of a fraction of one degree Kelvin, of aeriels which direction-find to an accuracy of a minute of arc, and of methods for determining the distribution of radiation over a source only a minute of arc in extent.

This book is a balanced, comprehensive account of the new science of radio astronomy written from one of the laboratories most active in its development and containing the necessary background of astronomy and radio techniques for non-specialist readers. It is a book written by physicists for readers, scientists, engineers, students, etc., who have a general training in physics.