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POWER, POLITICS AND PERSONALITIES IN AUSTRALIAN ASTRONOMY: WILLIAM ERNEST COOKE AND THE TRIANGULATION OF THE PACIFIC BY WIRELESS TIME SIGNALS

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Abstract: In 1916 the New South Wales Government Astronomer, Professor Ernest Cooke, proposed the triangulation of the Pacific by wireless time signals, in order to improve mapping. The world was at war, and this scientific advancement was urgently required. The State Government gave Cooke authority to proceed, but later rescinded this decision. It also prevented Cooke from attending the first International Astronomical Union (IAU) General Assembly in Rome in 1919. Although Cooke became Chairman of the Longitude Committee of the Australian National Research Council in 1922, attended the Pan-Pacific Science Association Congress in 1923, joined the IAU's Commission 18 (Longitude by Wireless) in 1925, and continued to promote triangulation of the Pacific by wireless, the Sydney Observatory Board of Visitors, bureaucrats and politicians all continued to block him. This paper examines the interplay between Federal and State politics in international astronomy, using Cooke's triangulation of the Pacific project as a case study.

Keywords: Sydney Observatory, W.E. Cooke, Board of Visitors, triangulation of the Pacific, wireless time signals, State-Federal politics

1 INTRODUCTION

Power, politics and personalities often are intricately intertwined in science, allowing some scientists continuing success and others continual disappointments. Even excellent projects promoted in the public good and proposed at auspicious times—e.g. during wartime—can fail to gain official approval and funding if certain determining factors intervene. This paper is about such a case, Professor William Ernest Cooke's desire to get Sydney Observatory involved in a strategic military project, the triangulation of the Pacific by wireless time signals during World War I (henceforth WWI).

A number of episodes occurred in Australia astronomy at the apex of colonial science in the midst of WWI and its aftermath that are central to our current understanding of the relationship that an Observatory Director, such as Cooke, had with his superiors. The episode being scrutinised here is the 'insufficient authority' of Cooke in internationally managed science that, under the Australian Constitution, should have been a Federal matter.

Firstly, it is noted that Cooke appointed Sydney Observatory's Board of Visitors to support his efforts to triangulate the Pacific by wireless time signals. Cooke had hoped to solicit their combined influence and support to encourage the NSW Government to allow this scientific venture to proceed. The Board, however, had its own agenda and was of no assistance in furthering astronomical interests with this technologically innovative professional.

Secondly, to contrast the original war-time effort, the effects of the 1923 Pan-Pacific Science Association Congress are considered. Cooke presented the same scientific proposal that he had put forward in 1916, although on this occasion he gained the public support of visiting international peers and favourable media attention. Cooke was the President of the Astronomy Section and Chairman of the Longitude Committee for the Australian National Research Council, leading up to and organising the Pan-Pacific Science Association Congress program. This public exposure still proved ineffective in gaining Government support for triangulating the Pacific, although it did cultivate the soil for future efforts.

Thirdly, Cooke's influence in the IAU General Assembly Commission 18: Longitude by Wireless, up until his forced retirement in 1926, is examined. A few months after Cooke's departure, international wireless time signals connected Australia with the rest of the world. However, Cooke's 1926 demise, requires a more comprehensive treatment, which is beyond the scope of this paper.

Fourthly, the manner in which Cooke handed over the international time signal project to his replacement, the former distinguished amateur astronomer and Director General of Technical Education, James Nangle, and William Raymond, the Chief Transit Observer at Sydney Observatory, is detailed.

Finally, it is noted that when authority and funding decisions are placed in the hands of politically motivated individuals rather than scientists, the latter are sometimes unable to pursue their science uninhibited.

Before examining the aforementioned topics in detail we provide background information on Sydney Observatory and a biographical sketch of W.E. Cooke. Australian localities mentioned in

this paper are shown in Figure 1.

1.1 A Brief History of Sydney Observatory, 1858–1912

Sydney Observatory, along with several other colonial observatories, was established in the mid-nineteenth century, as part of the imperial science agenda of the British Government (Haynes et al., 1996: 69–95). In its early years, the primary purpose of Sydney Observatory was to provide a time service for both the shipping and business communities. It also offered meteorological and trigonometric functions to the inhabitants of the colony of New South Wales (henceforth NSW) and conducted astronomical research (Wood, 1958).

In order to understand the relationship between Cooke and Sydney Observatory, it is useful to gain a sense of the history of the Observatory and the impact of its various directors and their research programs, prior to Cooke's time, to appreciate the context in which he operated.

Sydney Observatory (Figure 2) opened in 1858, mainly as a result of several years of relentless lobbying by New South Wales' sole astronomer of that time with any international visibility, Phillip Parker King (1791–1856; Orchiston, 1988a) and Sir William Denison (1804–1871), the new Governor of New South Wales. The inaugural Director was the Reverend William Scott (1825–1917; Orchiston, 1998b), a British academic who was not a professionally trained astronomer. It was not until the new Merz 7.25-in (18.4-cm) refractor was mounted in 1861 that observational astronomy actually commenced (e.g. see Orchiston, 1998b; 2017: 144–156). Scott took a broad approach to astronomy, instigating astronomical and non-astronomical programs. In the astronomical sphere, he made cometary and transit observations, and in 1861 recorded a partial solar eclipse and a transit of Mercury. In other fields, he was responsible for regulating Sydney's time service, making meteorological measurements and recording sea water temperatures. Scott was also involved in the telegraphic determination of the Observatory's longitude, an early antecedent to Cooke's proposal to triangulate the Pacific.

Scott's successor was fellow-Britain George Robarts Smalley (1822–1870), who was Director from 1863 to 1870. During Smalley's time, astronomy deteriorated, as his interests were largely non-astronomical. He focused on meteorological, magnetic and tidal measurements, although he occasionally observed comets (Orchiston, 1988b; Russell, 1871; Wood, 1958).

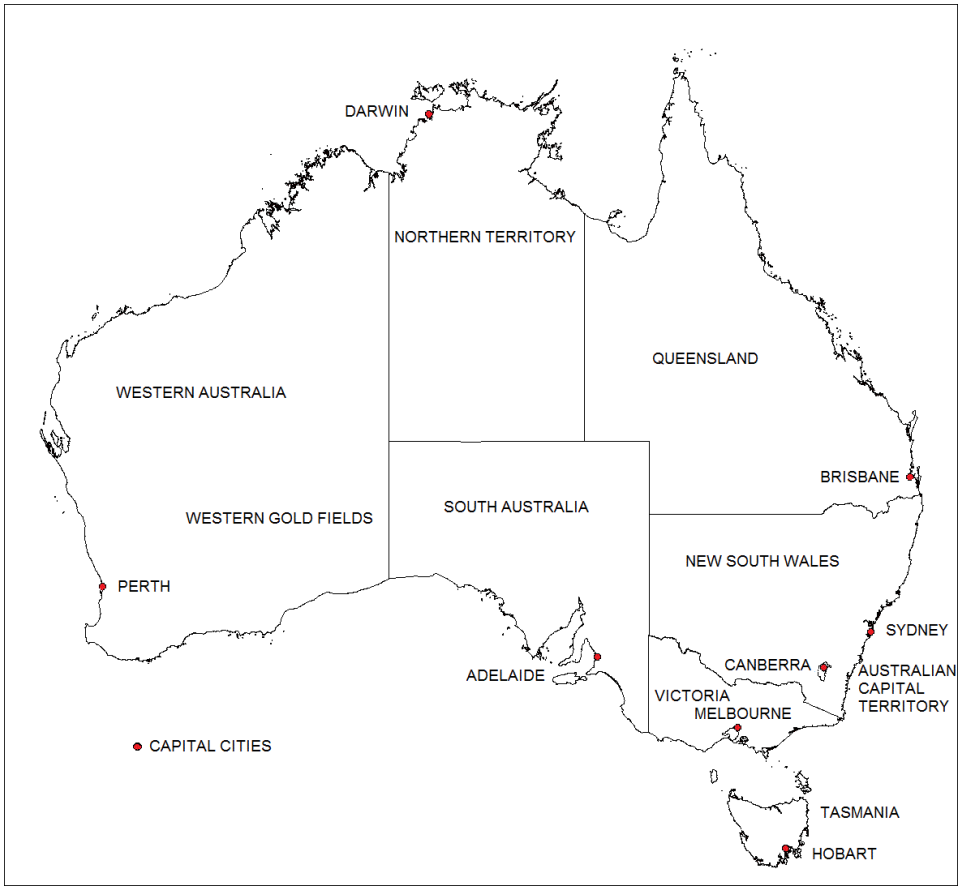

Figure 1: Australian localities mentioned in the text (map: Ian Tasker).

It was not until Henry Chamberlain Russell (1836–1907; Bhathal, 1991) became Director in 1870 that Sydney Observatory came into its own as an astronomical institution (Orchiston, 1988b; Wood, 1958). Russell's impact on Australian astronomy was felt during the last three decades of the nineteenth century, up to his retirement in 1905. Even though he continued the non-astronomical work of his predecessors, it was with the introduction of new instruments, such as a 6-in (15.2-cm) transit telescope, an 11.5-in (29.2-cm) refractor and a 13-in (33-cm) astrograph (Russell, 1892a), that astronomical research flourished. Russell also initiated an important double star project; conducted cometary work (e.g. see Russell, 1881) and meridian observations; led a solar eclipse party to northern Australia (Lomb, 2016); and organised groups to observe the various transits of Mercury and of Venus (e.g. see Lomb, 2011; Russell, 1892b). At Red Hill, away from city lights, he set up a field station of the Observatory for the Sydney section of the International Astrographic Project (Wood, 1858). Significantly, Russell independently invented the horseshoe telescope mounting (Orchiston, 2000), a design that would later benefit international astronomy.

Russell was also a member of the Senate of his *alma mater* at Sydney University for over three decades (Wood, 1958). He was a founder of the Royal Society of New South Wales' Section A (Orchiston and Bhathal, 1991) and of the Australasian Association for the Advancement of Science (MacLeod, 1988), but during the last decade of the nineteenth century became estranged from most of those in the large powerful Sydney-based amateur astronomical community (e.g. see Orchiston, 2017: 393–448; Tebbutt, 1891).

The analysis of Australia's earliest astronomical groups and societies illustrate some of the crucial elements in the development of an emerging discipline (Orchiston, 1998a). Building upon this work, several new elements are introduced and discussed in this paper, including the significance and influence of external stakeholders and their role in Australian astronomy.

At the beginning of the twentieth century, the newly formed Commonwealth Government of Australia assumed responsibility for meteorology, but not astronomy. As a result, Sydney Observatory and the other Australian State observatories lost one of their most public utilities, forecasting the weather (Home and Livingston, 1994).

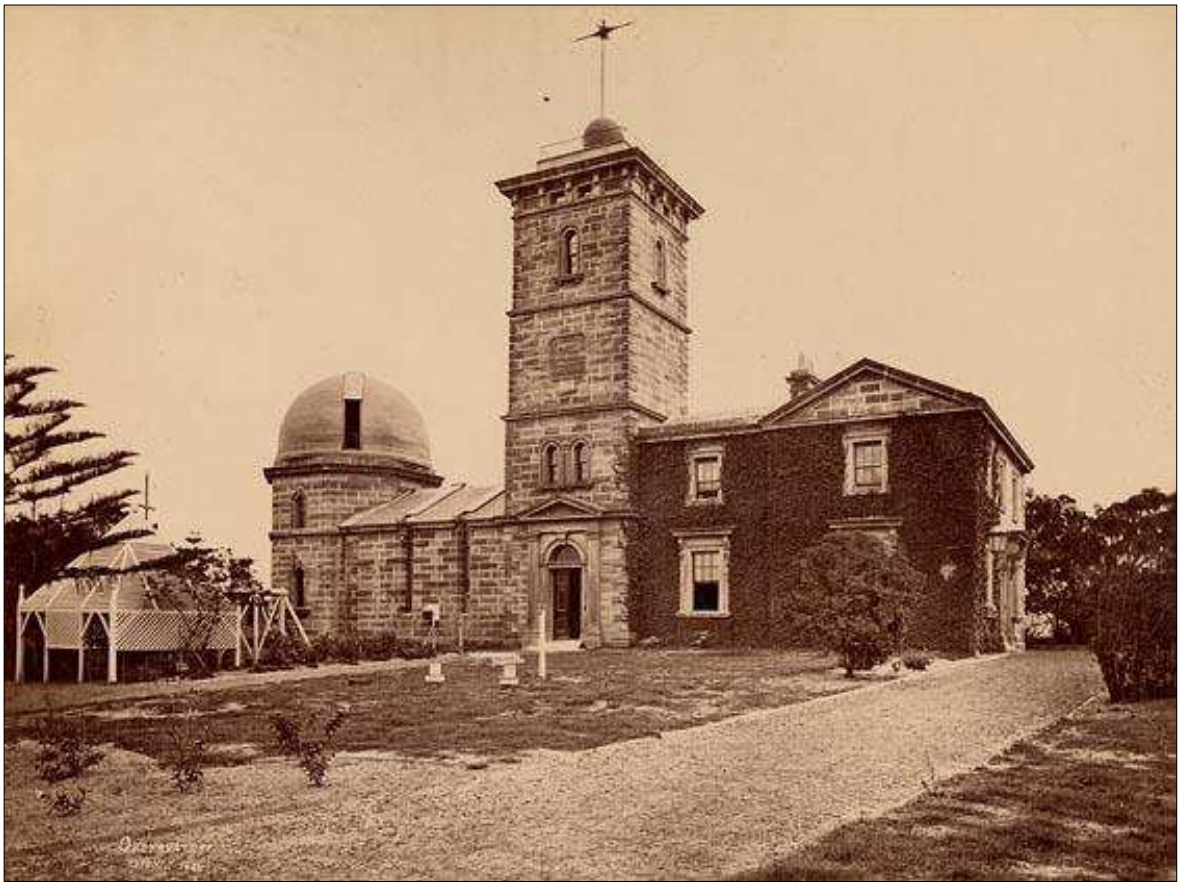

Figure 2: Sydney Observatory in 1874. By the time Cooke began as Government Astronomer of New South Wales the left hand dome housed an 11.5-in (29.2-cm) Schroeder refractor. The section of the building to the right of the time-ball tower was the Government Astronomer's residence (https://en.wikipedia.org/wiki/Sydney_Observatory#/media/File:ObservatorySydney1874.jpg).

In the final period before Cooke's term, 1903 to 1912, Sydney Observatory had two Directors, Henry Lenehan and William Raymond. They continued established programs, including solar eclipse expeditions (see Orchiston, 1988b; Wood, 1958).

It was Cooke's appointment in 1912 as the next Government Astronomer that was to put Sydney Observatory back on the international stage, in a deliberate move by the Public Service Board (*Investigation* …, 1909) to place New South Wales ahead of other Australian State observatories.

1.2 W.E. Cooke: A Biographical Sketch

William Ernest Cooke (1863–1947; Figure 3; Hutchison, 1980; 1981), more commonly known as W. Ernest Cooke or simply Ernest Cooke, was born in Adelaide (South Australia) on 25 July 1863. He excelled at The Collegiate School of St Peter and in 1878 commenced a Civil Service cadetship at Adelaide Observatory under Sir Charles Todd (1826–1910); he was

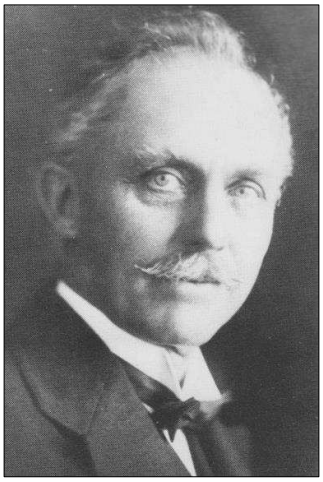

Figure 3: W.E. Cooke (after Hutchison. 1981: 58).

only 15 years old. In 1883 and 1889 Cooke received BA and MA degrees from the University of Adelaide. He then became the founding Director of Perth Observatory in Western Australia, on Todd's recommendation (Utting, 1989), and toured continental cities to study observatory design and to purchase instruments. He arrived back in Perth in 1896, just 33 years old, promoting meteorological, geodesy and wireless innovations.

Cooke produced the first daily weather maps and daily forecasts for Perth, the 'Western Gold Fields' and the State. By around 1900 a general weather report, a special rainfall report, an isobar map and a forecast were produced each morning and posted for viewing in Perth and its port, Fremantle. He also established the first official time service on his arrival in Perth. Using a chronometer and a borrowed theodolite, he determined accurate solar time daily, clear skies permitting, and a time signal was telegraphed to the General Post Office at noon each day (Hutchison, 1980).

Around 1901, the International Astrographic Congress asked Perth Observatory to collaborate on the international star cataloguing and charting project, the *International Photo-Durchmusterung* or *Cape Photographic Durchmusterung* (*CPD*). Perth Observatory's allocation was 32°–40° south latitudes, and *A Catalogue of 420 Standard Stars* was subsequently published (Cooke, 1907). Cooke produced a critique of the international program, referring to lack of coordination, refinements that he had made in observation methods and suggesting procedures to be used at other sites around the world. As a result, he received wide acclaim from his international peers. The Astronomer Royal of Scotland, Frank Watson Dyson (1868–1939), wrote to the Government Astronomer in Adelaide—where Cooke had undertaken his cadetship with Sir Charles Todd—advising that they were

> … to follow the head of the Perth Observatory implicitly … [and] copy their methods, their catalogues are excellent, and they seem to be able to maintain maximum efficiency with the minimum of energy. (cited in Hutchison, 1981: 67).

Here is seen an example of where the student had become the teacher.

During his time in Western Australia Cooke was the founding Chairman of the Civil Service Association (in 1902), and he also served as the Government Meteorologist until 1908 (Hutchison, 1980).

Cooke later attended the International Astrographic Conference in Paris in 1909, now aged 46, and he presented his ideas before the Congress (see Cooke, 1911). Cooke joined their ranks as one of the 18 members of the Permanent Committee of the Congress. Six volumes of meridian observations were published by 1913 as part of the Astrographic Catalogue (henceforth AC) (Utting, 1989; White, 1988). These were based on photographs taken and measured at Perth Observatory under Cooke's direction, and contained the positions of about 9,000 reference stars between declinations –31° and –41°.

Cooke was then enticed by the NSW Government to accept a dual role as NSW Government Astronomer and Professor of Astronomy at Sydney University, and was promised another investigative world tour, a dark sky site for the Observatory and the latest astronomical equipment (Cooke, 1913).

Cooke's success at Perth Observatory part-

ly stemmed from the childhood influence in Adelaide of his father Ebenezer Cooke (1832–1907; Hawker, 2006), who was the perfect role model. Cooke Senior was possibly the most influential South Australian public servant of his time, in his position as the Commissioner of Audit. Cooke Senior advised the Government on a wide range of matters, in addition to book-keeping and auditing procedures. He played a valuable role in revealing financial swindles connected with the system of tenders for Government contracts. Cooke Senior also served as Chairman of several interdepartmental committees and supported the formation of the Public Service Association in 1884, serving as its inaugural President and as a member of its governing Council for five years (ibid.). While Ernest Cooke shared many of his father's attributes, these would not be enough to bring him the success he anticipated when he chose to accept the Sydney appointment in 1912—as the events portrayed in this paper will reveal.

2 COOKE'S FAILED ATTEMPT IN 1916 TO TRIANGULATE THE PACIFIC BY WIRELESS TIME SIGNALS

The problematic relationship that Professor Cooke had with his superiors provides critical insights into the man and those who governed him. Their assistance, once given, was condiional and could be withdrawn. In the end, Cooke's superiors were prepared to sacrifice him for political expediency. This paper focusses on the 'insufficient authority' of a State Observatory Director in internationally managed science, in this case the triangulation of the Pacific by wireless time signals. Cooke had much to contribute to the international war effort but was hampered by the political impediments placed in his path.

Triangulation is a process of measuring the time difference between several stations that are looking at the same star as it passes overhead, with the first station recording its passage and transmitting this to the second station, which then confirms when the star crosses their zenith. Probable errors are reduced, and the accuracy in determining the location of each observatory improves, as more stations are connected around the globe.

When Cooke was the NSW Government Astronomer, he requested that the Sydney Observatory Board of Visitors be reformed, and he nominated its members. He aimed to gain their considerable combined influence and political astuteness, to encourage the Government to let him proceed with experiments and fulfil the Government's initial promises that secured his employment in 1912. The Board's minutes and official correspondence, as primary sources, provide a fascinating insight into their charged interplay, for matters did not play out as Cooke had anticipated.

Cooke's peers, Australian university academics, were distinguishing themselves abroad in their wartime service, while Australia made only limited contributions to the fields of science and technology during that period. There are many examples of their contributions (e.g. see Endacott, 2014; Hartcup, 1988). Professor Sir William Bragg focussed on problems of submarine detection. His son, also a Professor and Knight, led a team that designed a method of sound-ranging enemy artillery batteries. Professor Sir Richard Threlfall was engaged in research on tracer ammunition and phosphorus in smoke screens. Professor Sir Edgeworth David led the mining corps. Professors Hubert Whitfield and Norman Wilsmore worked with British munitions producers. Honorary Lieutenant-Colonel Sir Samuel Barraclough led the Australian Munitions Workers in England and France. Professor Major James Pollock, a physicist, created a geotelephone for underground listening.

Cooke's 'limited authority' to carry out a triangulation of the Pacific proved futile, even though the results would have contributed to the war effort. Throughout the 1916 negotiations, Cooke's proposal remained unactioned, as the NSW Government rescinded the authority to proceed that it had initially granted him. What follows is an account of the minutia of the requests for authorisation that Cooke was forced to make from numerous parties, and whether this authority was ever granted or not.

In a casual conversation, the Chairman of the NSW Public Service Board, John Taylor, suggested to Cooke that he might be able to make good use of Henry Spendlove Hawkins. Hawkins (1824–1888) was the former Head of the Fieldwork of the Trigonometrical Survey of NSW, with unique qualifications (Cooke, 1916q: 397; Government Gazette, 1880: 5; Hawkins, 1876; 1881; Orchiston, 1987; 2017: 154). The NSW Surveyor General, Frederick Poate (1855–1935; Figure 4), proposed, partly in the interests of economy, to discontinue the geodetic survey for a couple of years or so as the fieldwork component of the survey had run considerably ahead of computations (Cooke, 1916b: 280). This freed up Hawkins, who could now work on other Government projects.

Cooke followed up on Taylor's lead when he wrote to Poate on the 8 June 1916 and then to the Under Secretary for Education on the 15 June (ibid.; Cooke, 1916e: 288). Poate was a Fellow of both the Royal Society (from 1881) and the Royal Astronomical Society (from 1912). Poate was at that time a PSB Actuary, Director of Trigonometric Surveys and Metropolitan District Surveyor with the NSW Department of Lands,

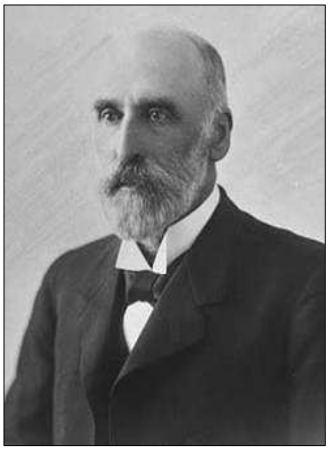

Figure 4: Frederick Poate in 1916, recorded by an unknown photographer (courtesy: State Library of New South Wales, FL1864557).

as well as a Lecturer in Geodesy and Astronomy at the University of Sydney (Atchison, 1988). At the same time, Cooke, also a FRAS, was the Foundation Professor of Astronomy at the University of Sydney.

Cooke's appeal for funding considered the fact that, in May 1912, Poate had attended a conference with the Commonwealth Directors of Lands and Survey and the Survey Generals of the Australian states, and taken an active part at that meeting. This conference decided that the compilation of the map of the world would probably be done in NSW (Kass, 2008: 275).

Poate's reply (see *Simple Practical Astronomy*, 1940: 19) informed Cooke that the Minister for Lands, (William Ashford) was sympathetic to the proposition to triangulate the Pacific and would support it to the extent of £750[1] per annum, provided the Observatory could raise a further £400 per annum. Poate was about to retire and wished that the work would commence within his last three months of work, adding that it would be a "… crowning jewel to his career."

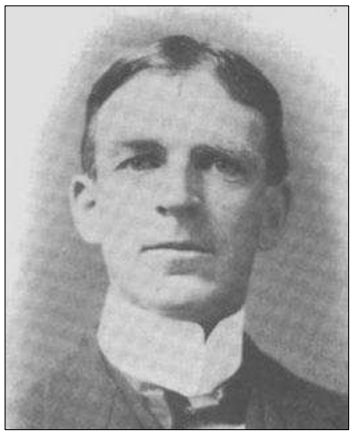

Figure 5: W.W. Campbell (after Macpherson, 1905: facing 240).

Cooke then wrote to the Marconi Wireless Telegraph Company of America. Marconi was in charge of the radio station at Honolulu. Hawaii and Fiji were to be the intermediates between America and Australia with New Zealand (henceforth NZ). Cooke began proceedings before Poate's retirement, with the provision that he had

> … to secure the assistance of several gentlemen, and may encounter a fatal obstacle since a three-month time limit had been assigned to commence this project. (Cooke, 1916d: 292).

Likewise, Cooke contacted Professor William Wallace Campbell (1862–1938; Figure 5), Director of Lick Observatory in California. He noted that, as

> … before completing any arrangements as I shall have to secure assistance in various quarters, I may experience a check, but at present, the way seems, so far, open. (Cooke, 1916c: 294).

For this particular section, Cooke's official correspondence is cited so that the reader may hear his voice, to gain a feel for the man and his plight.

Cooke, after a conversation with Layton, an Associate of the Sydney Town Clerk, then asked the Town Clerk to obtain permission to extend their wireless aerial and fasten the ends of two of them to two Moreton Bay Fig trees just outside the southern fence of the Observatory (Cooke, 1916f: 306). Nearly four months earlier, Cooke (1916a: 131) had informed the Town Clerk that

> … our wireless house has not been used since the commencement of the war, owing to instructions received from the Defence Department to disconnect our instruments.

Despite this instruction, Cooke (1916ae: 15) had previously informed the Under Secretary for Education, when he submitted the Sydney Observatory's report for 1915, that:

> Owing to the war no further developments in connection with wireless time signalling were possible on account of military regulations, but a fair amount of experimental work has been carried out.

At the beginning of July, Cooke (1916j: 309) asked the Under Secretary for Education for authority, along with a letter of introduction from the Premier of NSW, to visit Lieutenant William Rooke Creswell (1852–1933) in Melbourne, the naval head of all wireless operations in Australian waters, to obtain his consent and cooperation.

Cooke then began engaging with NZ and Fijian authorities. He wrote to John Strauchon (1848–1934), NZ Surveyor General, and Timothy Buckley, Chief Electrician of the NZ Post and

Telegraph Department, along with Cecil Charles Fisk Monckton (b. 1867), Superintendent of Telegraphs for Fiji. He echoed that

> … provided I can put this scheme into operation within the next three months or so … [but] I have yet to obtain the consent of several people ... so there is not at present any certainty of the proposition being carried out. (Cooke, 1916i: 321).

Finally, he announced that

> The N.S.W. Government has now authorised me to proceed … [and] It happens to be essential for me to start very soon, if at all, as my opportunity will slip and may not easily recur. (Cooke, 1916g: 322–323).

He added:

> I'm afraid the matter is very urgent. That is to say; I shall lose the opportunity unless I can get started within a month or two at the outside. (Cooke, 1916h: 325).

So authorised to undertake this international collaboration, Cooke still had to ask the Under Secretary to kindly issue him a first-class return railway pass from Sydney to Melbourne, and two sleeping berths, to attend to matters relating to the proposed longitude determination work (Cooke, 1916j: 326). Cooke may or may not have made his way to Victoria, but what is evident is that Governmental structures were quite centralised at the time.

After Cooke met with Lieutenant Creswell, who was visiting Sydney, he wrote to the Naval Secretary in Melbourne, apprising him of the Premier's instructions, leading to the following appeal:

> I have been instructed by the Premier of N.S.W. to undertake a determination of the difference of longitude between Sydney and an America Observatory (probably Lick) by means of wireless time signals across the Pacific. For this purpose, I shall require your consent, and I hope also to enlist your sympathy and co-operation. (Cooke, 1916l: 344).

Separately, Cooke also asked the Naval Secretary to give his consent to the carrying out of experiments with his two sons' invention that, if successful, would be offered to the British Military authorities. He gave no further details on what the invention entailed, as was proper during wartime, other than that the designs had been been submitted to the Chief Electrical Engineer of the NSW Railway Department, who had approved trials. As part of this work, it would be necessary to erect a couple of small aerials to perform a few simple wireless experiments (Cooke, 1916l: 346). Cooke secured the Naval Secretary's consent to perform the said experiments, and the Town Clerk's permission to attach wires to the fig trees was thus forthcoming (Cooke, 1916n: 366).

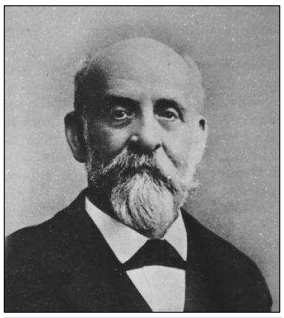

Figure 6: Dr C.E. Adams, New Zealand's first Government Astronomer (Orchiston Collection).

Cooke also extended his invitations to participate in the project to other Government Astronomers: Dr Charles Edward Adams (1870–1945; Figure 6) in New Zealand, Dr Joseph Mason Baldwin (1878–1945) in Victoria, and George Frederick Dodwell (1879–1963; Figure 7) in South Australia, reiterating that:

> Owing to readjustments in the Lands dept., I have been offered the services of a small well-equipped field party for an indefinite period, provided I can take it up almost immediately. (Cooke, 1916k: 348).

In early July, Frank Basil Cooke (1892–1967), Professor Cooke's son, who had been at Sydney Observatory for nearly three years, finally received notification of his appointment as Junior Assistant. Nevertheless, an appropriate increase of salary was not forthcoming. The file dealing with this matter is missing.

Cooke Junior was 23 at the time and received £60 per annum (Cooke, 1916j: 327). As a professional astronomer, Cooke Junior, with his advanced skill set, was poorly compensated. In Victoria, in 1910, the average yearly factory worker's wage for a male was £157 16s 8d and a female £70 17s 5d. In 1920, on average a man was earning £204 15s 9d per annum and a woman £99 1s 6d (State Library Victoria, 2017).

Figure 7: Adelaide Observatory Director G.F. Dodwell in about 1926 (https://de.wikipedia. org/wiki/George_F_Dodwell#/media/File:G_F_Dodwell_1926.png).

By mid-July, Cooke wrote to the Under Secretary for Public Instruction.[2] The Under Secretary, who Cooke never names, reported to the Minister of Education, who at the time was Arthur Hill Griffith (1861–1946). Cooke (1916m: 358) stated:

> I wish to appoint the assistant at once. I propose that the salary be £200 with a £50 allowance. That will leave £150 of the £400 authorised by the Premier for the necessary travelling and incidental expenses. Will you kindly authorise the appointment to be placed in the hands of the Public Service Board immediately

Cooke (1916q: 398) informed John M. Taylor, Chairman of the PSB and inaugural President of the Wireless Institute, when

> … deprecating any further delay in connection with the proposed wireless longitude and latitude work … [that] my son, who I suppose will be the assistant from the Observatory side. Cooke Junior has been most enthusiastically developing the technical part of the work.

Incidentally, this would have meant an increase in salary for Cooke's son from £60 per annum to £200, which was more than a threefold increase, plus a £50 expense account.[3]

Cooke Junior was the only viable contender in Australia for the Assistant's role, as there were no other applicants. However, the PSB responded by sidestepping Cooke Junior's appointment. Instead, they perpetuated the unresolved Constitutional debate regarding the Federal Government's responsibility to manage international research efforts such as astronomy. This was despite the fact that there was no central astronomical agency in place at the time and this particular collaboration was trigonometrical. It has always been a State obligation to establish its borders even if this required linking them to an international trigonometrical effort, as evidenced in *The States of a Nation: The Politics and Surveys of the Australian State Borders* (Taylor, 2006).

Furthermore, Cooke reinforced the fact that the original concept of triangulating the Pacific stemmed from a conversation he and Taylor had. The point was also made that

> … the question of referring it to the Commonwealth Government has already [been] raised and disposed of before authority was granted. (Cooke, 1916r: 407).

Cooke (1916q: 399) reported that "… the newspaper reporters have got on to the project, and it has been made known practically throughout the world."

Cooke (ibid.) closed the correspondence:

> My strong contention is that it is now too late to reconsider the matter of carrying out the scheme. The receipt of the cable from the Marconi Co. this morning practically assures the success of the undertaking, and if it were dropped, except for some new and overwhelming objection, I could never have the assurance to request outside assistance for any future undertaking. It would make the Observatory and myself a laughing stock and cause deep humiliation (after what I have already told you I think you will understand that it would be about the last straw).

The situation, about which Cooke had already told the Under Secretary for Education, was a singular exception in Cooke's manner, at least on record, dated 31 July 1916, in which he was uncharacteristically personal:

> My present position is considerably worse, financially than the one I resigned. In addition, I have lived a dog's life. All interests have been taken away. My tremendous enthusiasm for my work has been slowly strangled, and I have aged 20 years in the last 4. My wife has become a chronic invalid, and my daughter is just drifting about without any chance of domestic pleasures or the usual accomplishments that a young lady expects. She has, in fact, become a household drudge. These are cold facts, not in the least exaggerated. (Cooke, 1916o: 377–378).
>
> For four solid years which ought to have been the best four of my life, I have been wearing out my brains and nerves – not in the work for which I was appointed – but in chasing official papers from pillar to post, begging and imploring those who had the say to fulfil the promises under which I was appointed [*sic*] induced to leave my former life. And now after all this wear and tear, I have brought the undertaking to the present point. The plans are at last prepared. They have been approved from dot to finish by various officials at various times. Authority to go ahead has been given by the Minister of Education, the Premier, and the Minister of Works; and the Premier has provided £3,500 for a start (up to June 30th 1916). Any hitch now will be fatal as far as I am concerned. This is absolutely my last effort. I am utterly down-hearted and cannot make a fresh commencement. Nothing in the world can compensate me for the last four years, but at least I expect some recognition of the promises that lured me here and even belated ratification of them.
>
> My personal honor [*sic*] and that of the State is at stake. A quarter of a century ago Sydney undertook a share in the great International Photo-Durchmusterung; and so far, owing mainly to the want of a suitable site and instruments, the work has been already done, at a total cost of many thousand pounds and a whole generation of workers, has been wasted. (Cooke, 1916q: 378).

During my research I found no evidence of either

a reply or a reaction to Cooke's emotional outpouring, and it appears to have been ignored.

Cooke was not above asking for advice from his international peers, such as those at the Naval Observatory in Washington, who had connected Washington with Paris with wireless time signals (see Renan, 1916; Rines, 1916; Home and Watanabe, 1990):

> I should, in any case, be grateful for any information or hints you may be able to give as a result of your experience in the work. (Cooke, 1916p: 383).

Notwithstanding the technical inexperience of Lick Observatory's Professor W.W. Campbell, Cooke hoped he would join him in triangulating the Pacific, using the same technology used in connecting Paris and Washington:

> Whether you eventually co-operate or not I should greatly value your candid (brutal if you like) criticism of my proposed methods. (Cooke, 1916s: 446).

On 16 August 1916, the day the Sydney Observatory Board of Visitors was to have its first meeting, Cooke wrote to the Premier urging him to consider reinstating his previous decision supporting the trigonometric survey. The PSB's principal objection was that they thought the scientific effort was a Commonwealth responsibility (Cooke, 1916r: 407). This position, however, did not take into account that it was up to each State to determine its borders, and the Commonwealth had no resources to undertake the work as only Cooke Junior and Hawkins possessed the skills to do this work—as previously mentioned.

Cooke (1916r: 410) listed eight reasons for continuing the trigonometric project:

> I contend Sir that it is altogether too late to withdraw. I did not move a finger in the matter until it was officially requested of me by one minister and sanctioned by the Premier. Surely this constitutes sufficient authority? If not – then there is no finality at all. Nothing further can ever be undertaken for I shall always have the feeling that after having deeply committed myself the authority will be withdrawn. That would constitute utter demoralisation and prevent any further initiative.

In the light of the evidence provided earlier, Cooke's statement that he "… did not move a finger …" is somewhat questionable. Cooke had asked for authority in July and then immediately contacted NZ and Fijian authorities.

At the Board's first meeting

> The Government Astronomer outlined the steps he had taken concerning a determination of the longitude of Sydney by means of wireless communication. He regretted that the Public Service Board had raised objections to the carry out this work, and he informed the Board that it would involve only a temporary appointment of a Junior member of the staff in this connection. (Sydney Observatory Board of Visitors, 1916: 3).

As noted earlier, the PSB objected because they saw this as a Commonwealth matter, even though it had always been a State obligation to establish its borders. However, the original project sponsor, Fredrick Poate, had now retired, and John Broughton (1857–1925) had replaced him, not only as Surveyor General but also as a member of the Sydney Observatory Board.

In stark contrast to Poate's industriousness, Broughton invested some of his wife's money in shares in the Royal Sydney Golf Club and NSW Tennis Ltd., clubs of which he was a member (Kass, 2008: 281). Broughton held vastly different interests from those of his predecessor, and Cooke thought of him as a 'dilettante'.

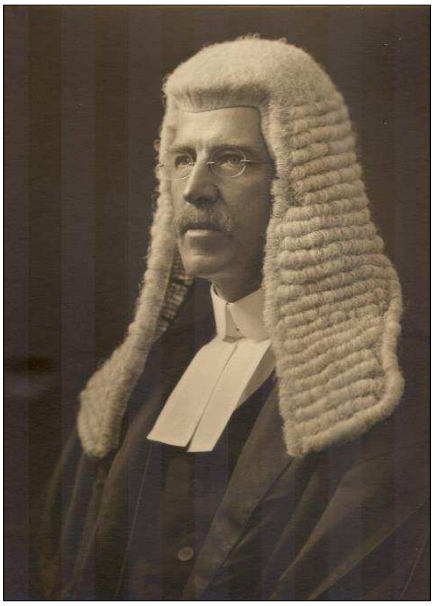

Figure 8: Frank Leverrier in 1900 (courtesy: University of Sydney Archives, G3/224/ 2039).

The Observatory's Board never recommended or supported the triangulation of the Pacific, even though sitting as their Chairman was the lawyer Francis Hewitt (Frank) Leverrier (1863–1940; Figure 8), who also was the President of the Wireless Institute of NSW and therefore would have been aware of the proposal. The Board subsequently held several meetings at the University of Sydney, deliberately excluding Cooke. Eventually, it was decided to refer the matter to the Astronomer Royal (Sydney Observatory Board of Visitors, 1916: 1, 3–4, 6, 8).

When Cooke (1916s: 444) wrote to Professor Campbell at Lick Observatory in September of that year, he not only bemoaned his Government but also forthrightly named his adversary, John Broughton:

> ... but I am afraid that I have lost the opportunity – not in any way through your inability to meet me with an immediate response – but owing to the usual departmental delays which seem to cripple all one's efforts. I have always understood, though without being definitely informed, that the necessity for haste was largely due to the resignation of our late Surveyor General, Mr Poate. It was he who offered me the field party, and who urged an immediate commencement. Both Premier and Minister for Lands were very sympathetic and authorised the necessary expenditure, and I pushed my head as hard as I could against the old stone wall, but it would not budge in time. Now I am finding quite unexpected obstacles, and fear that these indicate a difference of opinion on the part of the new Surveyor General. Just at present I do not know how the matter stands, but believe the Premier still wishes the work to proceed.

Throughout Cooke's correspondence about the scheme, he consistently reiterated that it had to be up and running before Poate's retirement. Cooke never expected to gain Broughton's support. Dr Harley Wood, a later Director of Sydney Observatory, tells a different story, that appears to diverge from the evidence. Financial aid had already been committed by the Minister for Lands to the extent of £750 per annum. The Premier, who at the time was the Acting Head of the Education Department, had approved a further £400 per annum (Cooke, 1916e: 289; 1916q: 397). Wood (1958: 21) states that "For want of financial support, Cooke was compelled to drop an extensive plan to determine longitudes in the Pacific in 1916."

Cooke, however, did not miss a stride as he corresponded with George Dodwell, the Government Astronomer of South Australia on 20 September regarding the difference in longitude between Sydney and Adelaide:

> Thanks for the clock errors. I have taken your signals on several evenings and worked out the diff. of long. between Sydney and Adelaide. It is of course a very rough test because we have taken your clock errors as the errors of the signals at emission, have had no determination of personal equation, have determined our own clock error by a complete novice using a new impersonal micrometer, and have discovered that the head of the moving wire was loose.
>
> Moreover, we did not get good sets of stars at both ends. Notwithstanding all these drawbacks the results do not come out badly. (Cooke, 1916t: 455).

Cooke found that the mean difference between Sydney and Adelaide was 50 minutes, 29 seconds and 19 tenths of a second. Thus, Cooke wrote as a postscript to his letter that he would like to arrange for a more rigorous determination of the difference.

A couple of days later, on 22 September 1916, Cooke wrote again to the Premier via the Under Secretary for Education. The Secretary of the PSB had informed Cooke that the matter of wireless longitude signals between Sydney and America was back on the Premier's desk. Cooke included with his letter a dispatch just received from the Director of Lick Observatory. It showed much sympathy for this proposed work, and such a willingness to assist as even to the installation of a wireless, equipment and the training of a member of the Sydney Observatory staff. Cooke (1916u: 461) thought that the Government ought to be ashamed to back out given that matters had progressed so far.

On 6 October Cooke wrote confidentially to the Under Secretary for Education, for transmission to the Premier. This was Cooke's final appeal for 1916, and he explained that the Commonwealth Department (which he does not name) was keeping quiet on war-time progress in wireless research that Cooke felt ought to be encouraged as reflecting credit upon the State of New South Wales. He concluded that the key people were Hawkins and his son Basil:

> In Messrs' Sawkins [*sic*] and Cooke we have two ideal people to carry out the scheme successfully, Mr Sawkins [*sic*] with his experience of astronomical field work, and Mr Cooke with his knowledge of and enthusiasm for all sorts of wireless research. The expense will not be great, and the undertaking will reflect credit upon the State. Please authorise me to go straight ahead. (Cooke, 1916v: 480).

It is plausible that Wood may have concluded that the triangulation of the Pacific did not go ahead due to the financial consideration alluded to above, but funds had by then been allocated. However, the project became convoluted when authority was sought to appoint Cooke Junior.

On 17 October Cooke wrote to Dr Adams, the Government Astronomer in NZ, and subtly disposed of Broughton, writing him out of the proposal and replacing him quietly with Frederick Slade Drake-Brockman (1857–1917), the Surveyor General of Western Australia, whereby

> From present appearances I am afraid it looks as if the Government at the last moment has decided not to go ahead with this work, but nothing is yet settled. If we do carry it out, I am hoping to act in conjunction with a small committee formed of the Government Astronomers of N.Z., Victoria, S. Australia and the Surveyor General of W. Australia. Will let you know as soon as something definite is settled. (Cooke, 1916w: 493).

In the same post, Cooke (1916x: 494) wrote to Adelaide Observatory Director G.F. Dodwell:

> Just at present we have no wireless station

> as the Commonwealth people who have become rather interested in the whole matter are making certain alterations with a view to greater aerial efficiency.

The on 14 November Cooke (1916y: 541) queried if Dodwell had tried the Audion receiver:

> These are made by an American inventor, who is not yet bringing them forward in a large commercial sense because the De Forrest company threatens an action for infringement of the patent. It is therefore difficult to procure them, but they are coming into order in small driblets, and I think it would be possible to procure one or two of the bulbs, at 25/- each.

Towards the end of Cooke's effort to get this project off the ground, on 29 November 1916 he submitted a paper to the President of the Royal Society of New South Wales, Thomas Harry Houghton (1857–1924). He also forwarded a slightly revised version to the Astronomer Royal Sir Frank Watson Dyson (1868–1939: Figure 9), whom he first met in Sydney in 1914 during the meeting of the British Association for the Advancement of Science (see Orchiston, 2017: 498–499):

> Herewith I am sending you a paper on some suggested improvements in accurate time signalling, having in view longitude work in particular. The main principle seems so remarkably simple that one feels it must have been tried, but we have seen no reference to it: and it appears to be remarkably effective. We do not like to enthuse in a paper such as this, but we are tremendously in love with the audion we possess, and with the little we have experienced with arc work. (Cooke, 1916z: 572).

The papers were published by both Societies (Cooke, 1916af; Cooke and Cooke, 1917), even though the triangulation of the Pacific project appeared to be a dismal failure as a result of a lack of political support at the State level.

Then on 6 December 1916 Cooke submitted a paper to Sir Frank Dyson on a proposed method of differential star corrections, and this also was published in *Monthly Notices of the Royal Astronomical Society* (Cooke, 1917b). These publications are evidence that work was proceeding at Sydney Observatory on several fronts simultaneously—despite the aborted triangulation project—and Cooke knew that his international peers engaged in this effort would appreciate his suggestions, as they had in the past:

> There are, or will be, a number of observers working in zones of 2° in connection with the meridian scheme of the 1909 Astrographic Conference, and they will, I feel sure, find this proposed method a considerable simplification. I think it will also be suitable for those who are taking the intermediates, and in fact for all except fundamental observers. (Cooke, 1916aa: 582).

Cooke also wrote to the Under Secretary for Education on the same day that he received a communication from Adelaide's G.F. Dodwell who was engaged in geodetic work in connection with the Military Topographical Survey. Dodwell was using a wireless method for the determination of longitudes. At the time Dodwell and Cooke Junior were the only two people in Australia who knew much about this new astronomical development, and Cooke's (1916ab) opinion was that it was an opportune time to meet for a dicussion.

Cooke informed Dodwell on the 14 December 1916 that he was waiting for the authority to send Cooke Junior across to Adelaide Observatory. Meanwhile, Cooke sent a copy of a paper that he and his son had presented to the local Royal Society a few nights earlier, and recommended that Dodwell try their new method of determining coincidences (Cooke, 1916ac: 593).

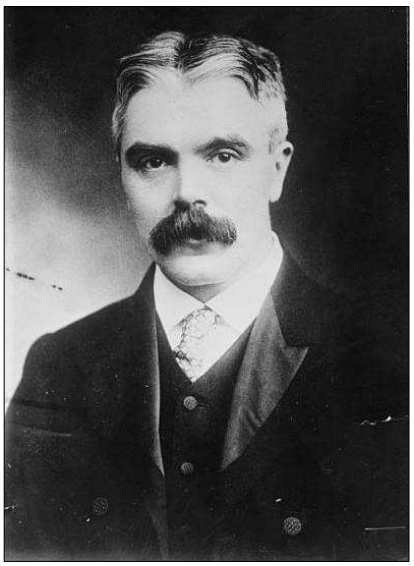

Figure 9: An undated photograph of Sir Frank Dyson (https://upload.wikimedia.org/wikipedia/commons/c/cd/Frank_Watson_Dyson.jpg).

On 22 December Cooke (1916ad: 599) wrote to the Under Secretary for Education regarding the official visit by Cooke Junior to Adelaide, asking him to kindly issue the necessary return railway pass for the journey on 24 December. However, there is no evidence that Cooke Junior ever made the trip.

On 20 March 1917, Cooke reluctantly wrote to the Under Secretary for Education recommending the acceptance of his son's resignation. Cooke (1917b: 24) suggested that

> I think the attention of the Public Service Board ought to be directed to this or any typical case which indicates a fault of some kind in the present organisation. Meanwhile will you kindly indicate your acceptance of

> Mr Cooke's resignation at once, as he wishes to start fresh University course and the term has already commenced.

The matter concluded on 2 May 1917 when Cooke wrote to the Under Secretary for Education that items under Observatory contingencies such as the 'Longitude Operations' would be eliminated (Cooke, 1917c: 765). After all this, the PSB finally replied:

> The Board are unable to understand why wire-less apparatus has been erected at the Observatory. So far as can be seen it has no connection with the ordinary functions of an Observatory. (Gilfillan, 1917).

Cooke entered the field of astronomy when great Australian professional astronomers like Henry Chamberlain Russell (Bhathal, 1991), Robert Lewis John Ellery (1827–1908; Gascoigne, 1992) and Sir Charles Todd (Edwards, 1993) reigned supreme. He served his apprenticeship under Todd in Adelaide, before accepting the Directorship of Perth Observatory. However, by mid-WWI Cooke could no longer work amiably alongside the likes of the retiring NSW Surveyor General, Frederick Poate, but instead had to contend with his replacement, the 'socialite' John Broughton. However, a more severe roadblock to realising the triangulation of the Pacific by wireless time signals was most likely the proposed appointment of Cooke's son Basil as Hawkin's Assistant in 1916. A threefold increase in Cooke Junior's salary, supplemented with an expense account, was possibly too lavish for the PSB to authorise, and an alternative approach was employed that distracted the politicians with State versus Federal responsibilities. Yet despite these setbacks, Cooke and his son still managed to publish several research papers that year. It is also significant that the Chairman of the Sydney Observatory Board of Visitors, Frank Leverrier, was also the President of the Wireless Institute of New South Wales, yet he and the Board refused to support Cooke's triangulation proposal. Had they done so, this would have led to a convergence of astronomy, geodesy and wireless, with astronomy taking the leading role in supporting the war effort.

3 THE SECOND PAN-PACIFIC SCIENCE CONGRESS

Cooke was not granted permission to attend the inaugural IAU General Assembly in Rome, so he had to wait until colleagues from abroad visited Australia to once again apply pressure on the NSW Government and further his quest to link the Pacific by wireless time signals. However, this strategy also was ineffectual, although it did set the stage for later efforts by others.

Cooke was President of the Astronomy Section of the Australian National Research Council, and he chaired the committee that organised the second Pan-Pacific Science Association (henceforth PSA) Congress in 1923 in regards to Section VIb: Pacific Radiotelegraphy and Longitude by Wireless. In these roles, he was positioned to exert his influence and set the programme.

The second PSA Congress was held in Melbourne (13–22 August) and in Sydney (23 August–3 September). The Congress aimed to advance scientific understanding across the Pacific region, including the development of institutions and organisations to encourage and support scientific research. The Congress was a multidisciplinary gathering, and the attendance of many international, as well as prominent Australian scientists, generated real interest in the development and importance of Australian science (see Conway and Philp, 2008).

The PSA was the first Asia-Pacific regional inter-disciplinary science association, and was dedicated to the furthering of science in the Pacific. The PSA has been an influential organisation in the region throughout its eight-decade history (Ward and Lewis, 2009).

This regional focus was in contrast to the earlier wartime focus. WW1 had been a crucial event in this earlier period for many and obvious reasons, and it both reinforced nationalism and at the same time signalled the need for more internationalism, not only in political but also in economic and intellectual terms. Technological changes and scientific discoveries were accelerating towards what would now be called globalisation (ibid.).

The 1923 Congress, however, was a determining moment for the PSA. In contrast to the Australian meeting of the British Association for the Advancement of Science (BAAS), held in 1914, this first post-war congress signalled the emergence of a new scientific nationalism in Australia. A new scientific relationship was developed between Australia and its great and powerful friend across the Pacific, the United States of America (MacLeod and Rehbock, 2000).

The PSA Congress was also pivotal in recognition of science as an instrument of Australian regional, national and international policy (MacLeod and Rehbock, 2000). It assisted in the creation of committees for Pacific investigation, linked through the International Research Council (henceforth IRC). The IRC was established in Brussels in 1919 by wartime neutral and allied nations, led by America, Britain and France, to replace Germany's pre-war hegemony in the organisation of international science. Each member country was required to create a national academy or research council as an 'adhering body' to the IRC (ibid.).

The role of host fell to the Australian National

Research Council (henceforth ANRC), a 'quasi-academy' of scientists from all six Australian States, which was founded in 1920 as Australia's adhering body to the IRC. The ANRC became the principal medium through which the country's small scientific community presented itself to the public. In 1922, however, the ANRC was just one year old. Its functions, as spelled out in its charter, were both broad and specific: to represent Australia in international science; to promote scientific research through its 18 discipline panels; and to serve as Australia's *de facto* National Academy of Science. It aimed to bring research problems to the attention of the universities and the Commonwealth Institute of Science and Industry, which later would become the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (ibid.).

Dominating the list of topics at the PSA Congress were questions of geology, notably Alfred Wegener's hypothesis of continental drift, which the Dutch proposed to test by taking measurements at 5-year intervals. Wegener wanted to determine whether Pacific islands were moving about the surrounding seafloor (ibid). This proposal foreshadowed the development of technology that would become Global Positioning Systems (GPS) later in the twentieth century.

International speakers at the PSA received favourable publicity. Extensive daily newspaper and radio coverage brought the Congress to a broader audience than science had enjoyed in Australia since the 1914 BAAS Congress (ibid.).

Questions of political economies, such as the establishment of international standards for radio, the future of aviation, and the prospect of tropical settlement, were featured prominently by leading Sydney writers (ibid; see also Practical science, 1923).

Sir George Knibbs (1858–1929), amateur astronomer and Director of the Commonwealth Institute of Science and Industry, believed that the Congress was more than a meeting of scientists: it was "… an event of great national and international importance." (Australia science, 1923; cf. MacLeod and Rehbock, 2000: 219).

One of the striking elements of the Congress was the sizable American presence at the Congress. As one of its instigators, Gregory, had correctly foretold, a relatively small investment produced substantial diplomatic returns. The Congress lent a new dimension to American-Pacific relations, at a significant moment in international scientific affairs. By sending a strong delegation, larger even than that of Britain, America signalled an increasing interest in the region. Notwithstanding its many attachments to Europe, American science was here-after to enjoy higher visibility and prominence in the Pacific, on both sides of the equator (MacLeod and Rehbock, 2000; Tasker, 2012).

Even beyond its importance to the Pacific, the Congress of 1923 is of particular importance to Australia. Quite apart from bringing many colleagues to Australian shores, the Congress was a massive triumph for the protagonists of Federal science. The Congress gave the ANRC its first public platform and its first significant opportunity to speak to Government with an assembled voice. It also showed the Australian public that Australian science held a respected place in the world. In 1914, in welcoming the BAAS, Australia was a loyal member of the Empire. By 1923, Australians, although not turning away from Britain, began to look toward America, and even inwardly, into the heart of their vast continent, which was still such a mystery. As such, the Congress stressed the urgency of Federal assistance to scientific enquiries that Australian scientists had been advocating since the 1870s (MacLeod, 1988; cf. MacLeod and Rehbock, 2000).

The Geodesy and Geophysics Section at the 1923 Congress urged the Commonwealth, "… no longer a colony … take up her fair share …" of the world's work in terrestrial magnetism and geophysics, from "… both economic and defence points of view." (Rivett, 1923: 636). The same Section called for the establishment of a Geodetic Survey of Australia and a Commonwealth Solar Observatory, both of which eventually came into being (re the latter, see Love, 1985).

From its highly individual beginnings in Honolulu in 1920 to its more common manifestation in Melbourne and Sydney in 1923, the Pan-Pacific movement in science gathered momentum and achieved recognition. For those who saught to cultivate a Pacific sense among nations, like geologists, Gregory from America and Andrews from NSW, the Australian Congress of 1923 was a forerunner of things to come. It gave evidence of a more precise Pacific dimension emerging in American science. It displayed and encouraged European science in the region. It heralded a strategic, federal vision for science in Australia. Above all, it "… was destined to rank as a remarkable achievement in the international cooperation of science." (Elkin, 1967: 25).

For the next 80 years, successive PSA Congresses would strive to achieve a similar combination of commitment to both national goals and internationalist ideals. The theme of unity and the dedication to the Pacific sense would be played out time and again, in the interests of peace and prosperity and the service of science and humanity (MacLeod and Rehbock, 2000).

Of particular interest at the 1923 Congres was the section relating to Pacific Radiotele-

graphy and Longitude by Wireless, hosted in Sydney. The participants read like a 'Who's Who' in this field, and their topics provide a snapshot of the technology and issues of the time:

- "Australian wireless longitude determinations" (G.F. Dodwell, B.A., FRAS, Australia)
- "Application and development of wireless in Australia" (E.T. Fisk, Australia)
- "Organisation of wireless time signals in the Pacific and adjoining countries" (Professor W.E. Cooke, M.A., FRAS, Australia—see Cooke, 1924)
- "Observations of static in the Pacific" (Rev. M. Selga S.J., Philippines)
- "Aerial sciences and their possibilities in the Pacific" (Captain G.A. Taylor, Australia).
- The social and commercial possibilities of wireless communications in the Pacific" (E.T. Fisk, Australia)
- "Determination of longitude by wireless at Batavia" (Dr C. Braak, Dutch East Indies)
- "Encouragement of invention and its bearing upon the peace of the world" (Captain G.A. Taylor, Australia)
- "A few suggestions for discussion in connection with radio telegraphy" (Father E. Gherzi SJ, Hong Kong)
- "Theory of electricity as syntonic vibration" (Commander F.G. Cresswell, Australia)
- "Reception of Bordeaux and Honolulu wireless time signals" (Dr C.E. Adams, New Zealand)
- "The time service in the Philippine Islands" (Rev. M. Selga SJ, Philippines)

The *Sydney Morning Herald* ran an article on the influential radio pioneer and businessman Ernest Fisk (1886–1965), who was Managing Director of Amalgamated Wireless Australasia (AWA). This company was formed in 1913 by an amalgamation of Marconi's Wireless Telegraph Co. Ltd and the Australian Wireless Company. On 28 August 1923 Fisk was quoted as saying: "Australia was one of the few countries that had solved the problem of government control and development of the science …", although this was said somewhat 'tongue in cheek'. Cooke's attempts to conduct wireless experiments during 1916, which required permission from different levels of Government, clearly indicate that Australia had not solved this problem.

Cooke also received some favourable free press for his proposal:

> Wireless Time Signals, W.E. Cooke M.A.
>
> In the radio telegraphy section, attention was given to the proposal of Professor W.E. Cooke that there should be an organisation of wireless time signals in the Pacific and adjoining countries. There are already wireless time signals, but they are mainly in the northern hemisphere. A separate series is necessary for astronomers and geodesists in countries bordering the Pacific. They should be sent from Honolulu since the astronomers who would be in that series would be interested only in the fractional part of a second. There would be no necessity for any zero points. A long dash at the commencement and end would be a luxury, but not a necessity – a fact which wireless experimenters may understand and appreciate. The dots should be started at an assigned moment of Greenwich Mean Time and be continued without a break for about five minutes. Greenwich, 1 a.m., would be the best, and that would be approximate! 11 a.m. in Sydney and Melbourne. (Wireless time signals, 1923; cf. Editor, 1923: 9).

Cooke's proposal above reflects his 1916 plan to triangulate the Pacific by wireless time signals (and was further consolidated when he joined IAU Commission 18 (Longitude by Wireless) in 1925).

International astronomers present at the 1923 PSA Congress included Bernard Benfield (Astronomical Society of the Pacific), Alfred Moore (Director, Smithsonian Solar Observatory) and Dr Wait (Carnegie Institute, and Watheroo Magnetic Observatory—in Western Australia), all from the USA. Astronomers from Japan included Dr Shizo Shinjo (1873–1938, Professor of Astronomy at the Imperial University Kyoto), while from the Netherlands was Dr C. Braak (Director, of the Royal Magnetic and Meteorological Observatory, Dutch East Indies).

The PSA Congress proposed that accurate determination of latitude and longitude should be carried out every five years to ascertain what horizontal movement might be involved in such areas of instability throughout the Pacific by their Geology section. Unfortunately, Wegener's proposal proved to be way ahead of the technology of the day, and he would not live to see his Plate Tectonics Theory proved.

4 THE SECOND IAU GENERAL ASSEMBLY

Professor Sir Thomas Lyle FRS (1860–1944) represented Australia at the second IAU General Assembly at Cambridge, England in July 1925, only because he was in England at that time (Australian National Research Council, 1925: 8). Lyle was a retired Professor of Natural Philosophy (Physics) at the University of Melbourne University from 1889 to 1914, Chairman of the ANRC, a member of the Gravity Survey and Solar Physics Committees, and on the Board of Visitors of Melbourne Observatory. No Australian State Government astronomers had the opportunity to attend this second General Assembly, not even those who had missed the first General Assembly.

By 1925, two Australian astronomers had joined IAU Commissions (International Research Council, 1925: 28, 34, 129, 192, 273). Dr Walter Geoffrey Duffield FRAS (1879–1929), who joined C12 (Solar Physics), had also taken up a new post as the inaugural Director of the Commonwealth Solar Observatory at Mt Stromlo, near Canberra (Love, 1985), while Cooke joined C18 (Longitude by Wireless), where he was once more able to promote the triangulation of the Pacific by wireless signals.

Meanwhile, Dodwell (*Bulletin Géodésique*, 1923) had by now become a member of the International Geodesy and Geophysics Union's Longitude Committee, and he was applying the wireless longitude method to confirm State borders—with Cooke's technical assistance (Dodwell, 1921; International Research Council, 1922: 280, 287; Taylor, 2006).

5 COOKE HANDS OVER THE INTERNATIONAL TIME SIGNAL PROJECT

Before his forced retirement, Cooke wrote to the Chair of the National Committee for Astronomy on 19 May 1926, regarding the proposal by Yale Observatory for the co-operation of the Australia Observatories in the investigation of variations of latitude. Cooke had hoped that Melbourne Observatory's Dr J.M. Baldwin would be able to undertake this collaboration. Although Cooke sympathised with Dr Duffield's views that this kind of work was more suitable for a State observatory than the Federal one, he felt that it was futile to ask any State Government for additional astronomical research funding as matters stood (Cooke, 1926b).

On 23 June 1926, Cooke wrote to the French radio pioneer General Gustave-Auguste Ferié (1868–1932), informing him that Sydney Observatory was abolished as such and that it would be maintained only as a time service station. William Edward Raymond FRAS (1871–1937), Chief Transit Observer, was to remain as the sole salaried officer, and James Nangle (1868–1941), Superintendent of Technical Education and an accomplished amateur astronomer, was residing at the Observatory. Cooke suggested that, as Nangle was interested in wireless time signals and Raymond was fully capable of determining the time, the Observatory might still participate in some work. Cooke (1926c) further suggested that Ferié write to Nangle.

On 28 June Cooke also wrote to Professor Robert Meldrum Stewart (1878–1954), Director of the Dominion Observatory in Canada, thanking him for the reminder of 19 April regarding the Honolulu signals. Cooke informed Stewart that Sydney Observatory had, unfortunately, practically ceased to function, that the staff were being transferred, that he, Cooke, had been instructed to retire, but one Assistant would remain to carry on the time service. Cooke (1926a) reported that the NSW Government had taken this action in the interests of economy. However, in the end not all was lost, and Sydney Observatory would remain operational as a research facility until 1983 (State Records Archives Investigator, 1999).

6 CONCLUDING REMARKS

This paper addresses the dynamic of insufficient authority and resources that the NSW Government Astronomer Professor W.E. Cooke had to contend with in his attempt to pursue the triangulation of the Pacific using wireless time signals and establish Sydney Observatory as the the Australian prime meridian. The triangulation of the Atlantic had already been completed between France and America, and triangulation of the Pacific would close the chain, improve global accuracy, and assist military logistics.

When Cooke first proposed this project in 1916 WWI was raging, and refined maps of the Pacific region were urgently needed. This project therefore should have taken precedence over of all other astronomical endeavours at Sydney Observatory. Cooke therefore urged the NSW Government to take the lead in this important international scientific endeavour, but his relationship with his superiors proved that no amount of coercion was going to sway the bureaucracy and gain support for his project.

In 1916 Cooke strategically appointed an influential and politically astute Board of Visitors, in the belief that they would pressure the NSW State Government into delivering on its prior commitment to fund the Pacific triangulation project. It was Cooke's role as the Government Astronomer to set Sydney Observatory's research direction, but the Board wanted him to focus on other matters that they, as science administrators, determined were more important than the war effort. They went so far as to write directly to the Astronomer Royal in England seeking his support, but this back-fired when Sir Frank Dyson backed Cooke.

In the longer term what were required were national (as opposed to State) facilities, though in 1916 these were beyond the still-weak Federal system and would only come into being long after the war, with the benefit of returning expertise. Cooke therefore remained without the authority or means to undertake a project that would have benefitted Australia at State *and* Federal levels, and would also have contributed to the international scientific community.

Cooke's position as a Section President and Committee Chairperson in the Australian National Research Council meant he could take ad-

vantage of the 1923 PSA Congress—which was held in Australia—and re-activate his plan to triangulate the Pacific through wireless signals. The media received him well and Cooke's international peers respected him for publishing both methods and procedures to improve efficiency in the performance of data collection, yet once again the Sydney Observatory Board of Visitors prevented his efforts from bearing fruit.

Cooke also could promote his Pacific triangulation project through Commission 18 of the International Astronomical Union, but he never was able to attend a General Assembly and had to rely on corresponding with other members of the Commission. Strategically, Cooke supported his protégé G.F. Dodwell, the South Australian Government Astronomer, who approached the issue of State boundaries within Australia but from a different perspective: through the Longitude Committee of the International Geodesy and Geophysics Union, and by using wireless time signals from around the globe. Notwithstanding his influence, publications and politicking, Cooke still could not convince his Board or the NSW Government to fund his Pacific triangulation project.

Over the years, the Sydney Observatory Board could have offered Cooke much in the way of assistance and influence, but it did not help or support him, right up to his forced early retirement. In 1926 Cooke tried to re-activate the long-planned move of Sydney Observatory from central Sydney to a 'dark sky' site beyond the city limits, and the Government responded to this by deciding to close down the Observatory. As Malin et al. (1986: 66) poignantly observe, Cooke

> … became a scapegoat He was placed on a month's notice and finally left the observatory in August 1926 … [he was] a broken man … [Because] the university refused to pay his pension … He retired in poverty to eke out a living by conducting classes in contract bridge … before returning to his home city of Adelaide, where he died in 1947.

What this paper draws out is that personal and emotive issues, such as jealousy, turf wars, political infighting, lack of vision and national insularity (the tyranny of distance), had the potential to impede the advance of Australian science. In this instance, the triangulation of the Pacific was delayed by a decade, but more importantly, Australia lost its prominent position on the world stage in the fields of astronomy, geodesy and wireless.

More than one hundred official documents were examined in the course of the research for this paper, and Cooke remained the consummate professional throughout. Only once did he pour out his soul to those who blocked him at every turn when he reported the effect that this had on him, his wife and his daughter. Haynes et al. (ibid.) note that "… despite his very considerable abilities, Cook was not destined to have an easy time in New South Wales." Viewed solely in the light of his Pacific triangulation project, this is surely an understatement!

7 NOTES

1 For those wondering what £750 or £400 mean, prior to the introduction of decimal currency on 14 February 1966, Australia used pounds (£), shillings (s) and pence (d). There were 20 shillings in a pound, and 12 pennies or pence in a shilling. Thus, a salary of £157 16s 8d (mentioned on the following page of this paper) is 157 pounds, 16 shillings and 8 pence. Another way of expressing this is: £157/16/8. Similarly, often shillings and pence would be listed say as 16/8 (i.e. 16 shillings and 8 pence) or 16/- (16 shillings exactly).

2 Although the Department of Public Instruction (1880–1915) was renamed the Department of Education in 1915, the former title persisted.

3 The expense account amounted to 83% of his original £60 salary package.

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