

Time balls at Greenwich and Adelaide – a direct personal connection

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This article follows extensive research by the authors into time balls,¹ and summarises the contribution of a former member of staff of the Greenwich Observatory, Charles Todd (1826–1910), to the telegraph service in Australia, astronomy, meteorology, and particularly the provision of a time ball for Port Adelaide, South Australia.² The time ball is situated on the coastal side of the Port in a suburb of Adelaide called Semaphore.

Charles Todd started life in Islington and Greenwich, with relatively humble beginnings, eventually achieving great eminence in South Australia. He was knighted and elected a Fellow of the Royal Society while the town Alice Springs in central Australia is named after his wife. Todd's early life and principal telegraphic achievements are explored thoroughly in *An End to Silence* by Peter Taylor, using original sources in South Australia.³ A useful summary is also available in the *Australian*

Dictionary of Biography.⁴ A more personal story is *The Singing Line* by Todd's great-great-granddaughter Alice Thomson. Thomson, a journalist, began to look into her family history, culminating in a trek with her husband to follow the route of the overland telegraph line.⁵

Born in Islington on 7 July 1826, Charles was the third child of a grocer. Shortly after he was born the family moved to Greenwich. He attended the local Church Street School, of which George Biddell Airy, the seventh

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1. Douglas Bateman, 'The time ball at Greenwich and the evolving methods of control – Part 1', *Antiquarian Horology*, 34, (June 2013), 198–218, Parts 2 and 3, 34, (September 2013), 332–346; 34, (December 2013), 471–488; Roger Kinns, 'Time-keeping in the Antipodes: a Critical Comparison of the Sydney and Lyttelton Time Balls', *Journal of Astronomical History and Heritage*, 12(2) (2009), 97–107.

2. Roger Kinns and Lesley Abell, 'The Contribution of Maudslay, Sons & Field to the Development of Time Balls in Australia', *International Journal for the History of Engineering & Technology*, 79 (1), (2009), 59–90; Lesley Abell and Roger Kinns, 'Telegraph Todd and the Semaphore Time Ball', *South Australian Historical Society Journal*, 38 (2010), 42–57.

3. Peter Taylor, *An End to Silence: The Building of the Overland Line from Adelaide to Darwin*, Methuen Australia Pty Ltd, 1980.

4. G. W. Symes, 'Sir Charles Todd (1826–1910)', *Australian Dictionary of Biography*, Volume 6, (MUP), 1975; <http://adb.anu.edu.au/biography/todd-sir-charles-4727>.

5. Alice Thomson, *The Singing Line*, Chatto & Windus, London, 1999. (The title is from the description of the telegraph line by the Aborigines from the wind-generated aeolian tones.)

Astronomer Royal, was a trustee. He proved to be adept at mathematics, and Airy selected the fifteen-year old Todd to be a supernumerary computer at the Observatory. In February 1848 he took up an appointment as Assistant Astronomer at Cambridge University. Soon afterwards, he met his future wife Alice Gillam Bell for the first time. In addition to making astronomical observations he gained important experience in the new science of telegraphy, which included determination of the longitude difference between Greenwich and Cambridge observatories. In May 1854 he returned to Greenwich and was put in charge of the newly formed Galvanic Department. By this time Airy had installed the Shepherd electric clock and the time ball was released electrically by the clock.

Early in 1855 the time ball at Deal, on the east coast of Kent, was commissioned, and, again, electrically released by a signal from Greenwich. In February 1855 the Deal time ball had developed an electrical fault and, to quote from Airy's autobiography

The Time Signal at Deal was brought into regular use at the beginning of the present year (Airy was quoting from annual Board of Visitors Reports). In a short time, however, the action was interrupted, partly by derangement of the apparatus, and partly by severity of the weather, which froze the sulphuric acid to a state of jelly. I sent an assistant and workman to put it in order, and since that time it has generally acted very well.⁶

Letters from Airy to Todd (the assistant) in early February 1855 showed that Todd had repaired a wiring fault in the telegraphic link via the SE Railway during his visit.⁷ In

fact, the wintry weather must have been quite severe to partially freeze the electrolyte, in, we may assume, a battery of Smee cells that will have been needed to give the power for the electrical release. Alternatively the more common Daniell cell, also with dilute sulphuric acid, could have been used. Both will have been superseded by Leclanché cells and eventually by rechargeable lead-acid 'accumulators'. In 1881 Shepherd himself patented a variation of the Leclanché cell. In fact the Deal time ball tower was recorded as using thirty Leclanché cells in 1884.⁸

It was shortly after this testing experience with the Deal time ball that Airy endorsed Todd's application to travel to Adelaide for a new job. All in all, 1855 was a momentous year for the twenty-eight year old Todd. In February he accepted the position of Government Astronomer and Superintendent of Telegraphs in Adelaide.⁹ Two months later, on the 5th of April, he married eighteen year old Alice Bell. Todd contacted Captain Charles Sturt, who was in England in March 1855, to find out what instruments were available in Adelaide.¹⁰ Sturt, who had led early expeditions into central Australia, told him that there was no transit instrument in Adelaide, but that there was an astronomical clock. Todd commented that as one of his principal duties would 'consist in the accurate determination of time, and probably soon establishing a time ball it will be necessary for me to be furnished with a good Transit.'¹¹ We assume a hectic few weeks acquiring astronomical and telegraph equipment before sailing in June 1855. Todd and his young wife landed at Glenelg on 4 November and arrived in Adelaide on the following day.

Todd's first job was to set up an official telegraph line from Adelaide to the port.

6. Wilfrid Airy (Editor), *Autobiography of Sir George Biddell Airy* (Cambridge University Press, 1896).

7. George Airy to Charles Todd, letters: 3 February 1855, GRG154/24, 139/20, State Records of South Australia (SRSA); 6 February 1855, GRG154/24, 139/22, SRSA.

8. Charles F.C. Beresford and John H Combridge, 'The Deal Time Ball', *Antiquarian Horology*, 19 (Autumn 1990), 33–43.

9. Taylor, *An End to Silence*, p. 20.

10. Charles Todd, Letter to Sturt, 13 March 1855, GRG 154/24/139/27, SRSA.

11. Charles Todd, Letter to Edward Barnett Esq., 26 March 1855, GRG154/24 139/40, SRSA.



Fig. 1. Members of the Overland Telegraph Party at Roper River, 1872. Left to right: J.A.G. Little, R.C. Patterson, Charles Todd and A.J. Mitchell. (Courtesy State Library of South Australia B69996/15.)

This was completed in February 1856 and started to make a profit. The next venture was for a link between Melbourne and Adelaide, proposed in 1856 and completed in July 1858.

The telegraph link to England

The idea of a telegraph connection between England and Australia was already current in 1854 and gained momentum during the 1860s as the reliability of long-distance subsea cables improved. A subsea cable could be taken ashore in Australia and linked to principal locations using an arrangement of inland telegraph lines. In principle, an overland cable across Australia from north to south could be built at a much lower cost per unit distance than an extended subsea cable around Australia, but little was known about the interior of the continent. It appeared that the most

promising plan was to take a cable ashore on the east coast and to route the signal along relatively short telegraph lines to the major cities, but complex negotiations would be needed between the cable provider and various Australian colonies with different objectives. It still seemed to be the solution with lowest risk and it almost won the day for Queensland.

Todd argued in 1859, when various options were under discussion, that the overland route from Darwin (then Palmerston) would ultimately be practicable.¹² Stuart's first south to north crossing in 1862 demonstrated that there was no giant inland sea to form an insuperable obstacle to construction and a route for the telegraph was surveyed at a basic level. One advantage, which was to prove decisive, was that the overland cable would run entirely through land under South Australian control, which

12. Taylor, *An End to Silence*, p. 27.

included the Northern Territory. It was still many years before Todd could convince the South Australian government of the feasibility and affordability of the scheme. In January 1863 Todd addressed the Adelaide Philosophical Society about the possibility of building overland telegraph routes that would link to an overseas cable. In 1868 the direct line between Adelaide and Sydney was completed and used to determine the 141st meridian, the boundary line between South Australia and Victoria. Todd's calculations showed it to be 2¼ miles farther east than had previously been determined. There was growing respect for Todd's ability and perseverance.

A detailed account of the arguments that led to selection of the overland route is given by Taylor.¹³ A contract for construction of the north-south telegraph line over a distance of 3,000 km was signed in June 1870 and the line was completed in August 1872. A huge number of management and other challenges had to be addressed by Todd during construction, when failure would have meant financial disaster.¹⁴ The subsea cable had been brought ashore at Darwin in November 1871, but it failed in June 1872. The complete connection between Adelaide and London was finally established in October 1872. The time to transmit messages between England and Australia had been cut from months to hours and Adelaide had become a focus for communication with other Australian colonies. It was a remarkable achievement and a political triumph for South Australia. After completion Todd and his family were fêted, and congratulatory messages were received from dignitaries around the world. Thomson even mentions a message from his brother Henry, then working at the Greenwich Observatory, whom he had not

seen for nearly twenty years.¹⁵ One descendant of the family living in Sydney, Barry Todd, remarked to Alice Thompson that he thought Charles Todd was a far greater hero, at least in Australia, than Scott of the Antarctic.¹⁶

The time ball at Semaphore

Todd's duties included astronomy and meteorology, as well as the development of telegraphic communications in South Australia, but he had not lost sight of the need for a time ball. He tried time and time again to obtain the necessary funds. Alice Thomson wrote: 'Perhaps in recognition of the challenge that won him the right to come to Australia, Todd spent hours on the ball'.¹⁷

In his official report to Parliament for the Meteorological Department in 1862, Todd pressed the Government for a time ball and suggested ways in which the cost could be reduced:

A time ball, at Le Fevre's Peninsula, is an urgent want for the convenience of shipping. The one mounted at Sydney, made by Messrs. Maudsly [sic], Field, & Co., Engineers, London, cost nearly five hundred pounds (£500) when landed, exclusive of mounting; but a much cheaper one made of Indian rattan, strengthened with spring steel binding rods, would, no doubt, answer our purpose. These, I understand, are now adopted in Victoria, and cost with shaft and hoisting gear about one hundred pounds (£100). I propose that the ball should be erected at the Peninsula Telegraph Office, sufficiently high to be seen at the Port, and to be dropped by a voltaic current from the Observatory at 1h. p.m.¹⁸

13. Taylor, *An End to Silence*, pp. 35–42.

14. Taylor, *An End to Silence*, pp. 43–157 and Thomson, *The Singing Line* (interspersed with the story of her personal journey).

15. Thomson, *The Singing Line*, p. 234.

16. Thomson, *The Singing Line*, p. 173.

17. Thomson, *The Singing Line*, p. 260.

18. Charles Todd, 'Meteorological Department', Appendix to Report on Public Works 1862, South Australian Parliamentary Papers, Vol.1, 1863 Paper No.19, p.vi.

Despite indications that the Government supported the idea in principle, no funds were forthcoming. Todd continued to persevere and built a working model of a time ball mechanism during the 1860s:

The frequent complaints of shipmasters relative to the absence of a time ball will no longer be applicable, seeing that Mr. Todd has all the gear in a forward state. On Tuesday he courteously afforded us an inspection of a working model of the whole machinery, which is remarkable in its simplicity, and the effectual mode in which the objects are attained. It is suggested that instead of multiplying the number of flagstaves on the beach, the time ball might, with propriety and economy, be attached to one at present existing, so as to slide on the lower mast. There is one strong enough to support a ball of sufficient size to be seen from vessels in the roadstead.¹⁹

Funds for the project were at last voted in 1871. It was now Todd's turn to come under pressure, notwithstanding his required focus on construction of the overland telegraph between Adelaide and Darwin. Completion of the link to London in October 1872 made Adelaide the hub for onward communications to the other Australian colonies, causing a substantial increase in local shipping movements. The lack of a time ball was now an embarrassment to the Colony. Todd was forced to emphasize his lack of staff in January 1874:

I quite concur with the Hon. the Chief Secy. that it is a disgrace to our port that we should still have no Time Ball and if my request for an assistant for the Observatory can be acceded I would

recommend that the Time Ball should at once be erected. I have a small working model which with some modifications might be adapted, and I should be happy to afford every information to the Department. The Time Ball will be dropped by voltaic current from the Obsy. at 1pm.²⁰

Todd's request for an assistant at the Observatory was granted and tenders for a new tower were called in July 1874.²¹ The work still failed to progress smoothly. In March 1875, the *South Australian Register* recorded ongoing procrastination and printed a long rhyme making fun of the project and the length of time it had already taken. Verse 6 started with the lines:

When I was young – long years ago
There came a man of power,
Who bore a model small to show
How they must build the tower.²²

The 'man of power' and 'model small' mentioned in the rhyme were almost certainly Todd and the model he showed publicly during the late 1860s.

The Semaphore time ball tower was at last erected in 1875 next to the Signal Station. This was reported in parliamentary papers under the heading 'Semaphore Time Ball Tower'.²³ In fact the town of Semaphore is named after its role as the signal station heralding the arrival of shipping to Port Adelaide. It grew to be the most important marine communication station in South Australia during the period from 1860 to 1880. Semaphore is located about 15 km NW of Adelaide city centre, on the west side of Le Fevre's Peninsular; Port Adelaide harbour is on the opposite side, about 5 km away.

19. *South Australian Register*, 13 January 1869, p.2e.

20. Marine Board Minute, 19 January 1874, p. 668.

21. *SA Government Gazette*, 9 July 1874, p. 1315.

22. *South Australian Register*, poem headed 'The Tale of the Time-Ball Tower. A Legend of the Semaphore', with introductory paragraph, 30 March 1875 p. 5f.

23. 'Government Architect's Report', Public Works Report, South Australian Parliamentary Papers, 1874–5, No 34, p. 31.

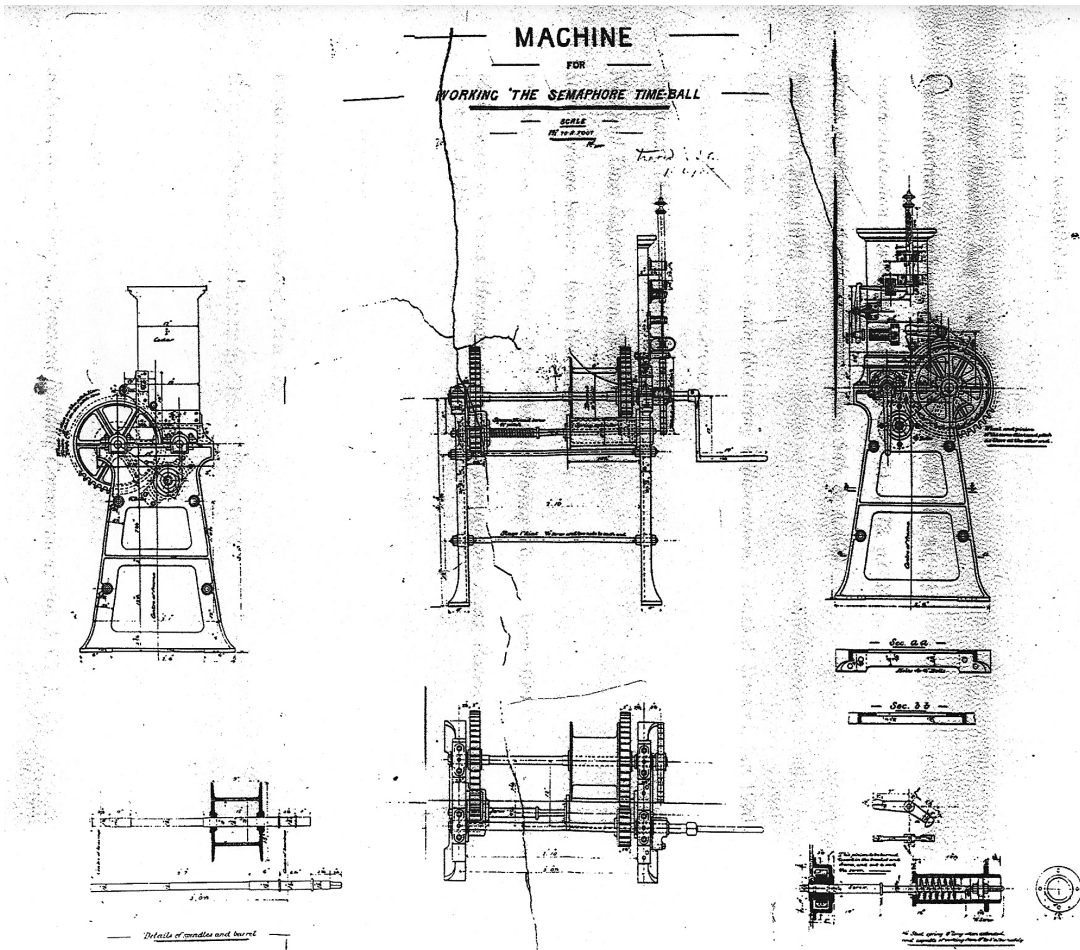


Fig. 2. Semaphore time ball mechanism 1875 (G.T. Light, Architect-in-Chief's Office, 1874, supplied by McDougall and Vines, Norwood, S.A.)

The Semaphore machinery

Separate tenders were called for the time ball machinery, via an advertisement in the *SA Government Gazette* of 5 November 1874.²⁴ The short timescale for tender response, an eight-week allowance for manufacture after contract signature and severe penalties for late delivery, would have precluded supply from England. The tender document appears to have been written by an individual having experience of time ball mechanisms, with a view to local manufacture. That individual is likely to have been Charles Todd. Although the tender documents required provision of a

new tower and heavy-duty equipment, the design of the time ball apparatus was almost certainly based on Todd's design and the model that he prepared during the 1860s. Figure 2 is a copy of the mechanism drawing.

Todd is likely to have designed the mechanism personally to be simple, cheap and effective. Sadly, the original machinery has been lost. The original specification for the ball itself appears to be for a sphere with metal ribs, but a novel design using six iron flanges arranged at 60° intervals around the mast was used instead to give the appearance of a ball from a distance.

24. *SA Government Gazette*, 5 November 1874, p. 2224. Tender calling notice for the 'Time Ball Tower Le Fevre's Peninsular', issued by G. T. Light, Architect from the Architect's Office, Adelaide on 4 November 1874.



Fig. 3. Signal station, Semaphore, around 1877. Time Ball Tower (left), Signal Mast (right) (Courtesy SLSA B2408)

Successful completion of the project was reported in 1876 under the heading 'Semaphore Time Ball':

The machinery of this time ball has been constructed and completed on a very simple and effective principle, so that the ball drops from the top of the mast at the instant of its being released at the hour of one o'clock, p.m. It was used for the first time on the 2nd day of August, 1875 – the electric key being manipulated by the Chief Secretary. Since the above date the working of the machinery has proved highly satisfactory.²⁵

Figure 3 shows an early photograph of the Semaphore tower with its flanged 'ball'.

Todd's time ball came into operation on 2 August 1875, almost twenty years after he arrived in Adelaide. Time ball operation was interrupted between the end of

December 1891 and the middle of January 1892, following a fire in the tower. Apart from that short period, it was operational for nearly fifty-seven years.

The restored Semaphore tower

The tower was restored to a limited extent in about 1960 and the original time ball mechanism was probably removed at that time. Various works, including painting of the exterior using acrylic paint, were undertaken during 1975 and 1976. A detailed conservation plan for the tower was prepared in 1990, but the original mechanism had been lost. The tower was restored in 1992 with a new mechanism that allows the time ball to be operated by electric motor. The observatory telegraph links that were such an important feature of original operation no longer exist. Figure 4 shows the tower in 2006, with the flanged ball in its raised position.

25. 'Government Architect's Report', Public Works Report, South Australian Parliamentary Papers, 1876, No.62, p. 29. Also reported in the *South Australian Register*, 12 August 1875, p. 15a.



Fig. 4. The Semaphore time ball tower in November 2006 (courtesy Marion Kinns).

Todd celebrated in Australia and Great Britain

Todd's place in history was assured by completion of the telegraph links that facilitated fast communication between Great Britain and the Australian colonies in 1872. He was appointed CMG (Commander in the Order of Saint Michael and Saint George) in the same year. Despite lacking the formal education of his peers, in an era when many astronomers started their careers with high ranking in the Mathematics Tripos at Cambridge, he was awarded an Honorary MA at Cambridge in 1886 and elected to the Royal Society (FRS) in 1889. Those honours gave him special satisfaction and few have deserved them more. His intellectual status was now beyond question and he was knighted (KCMG) in 1893.

The emphasis in this paper has been on Todd's achievements in telegraphy and his persistence in establishing the time ball at Semaphore, but he also made wide-ranging contributions to observational astronomy and meteorology. As the telegraph system

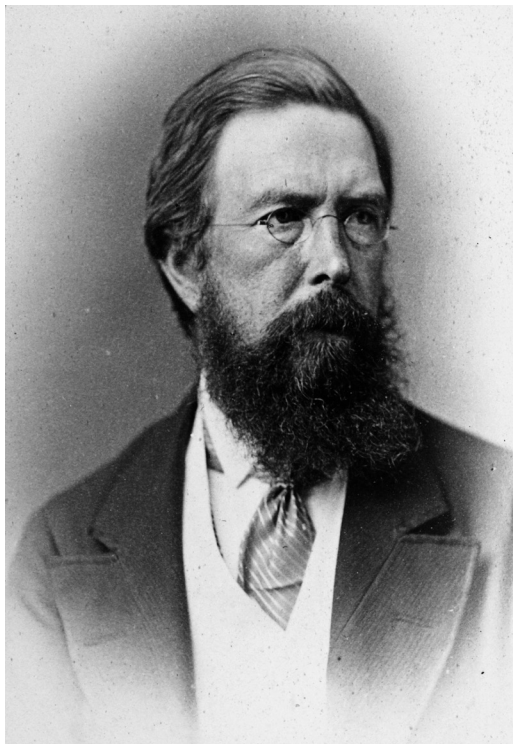


Fig. 5. Charles Todd, photographed in 1880, five years after the Semaphore time ball had come into operation. (Courtesy State Library of South Australia B22103/59.)

expanded so did his network of meteorological stations, with even further expansion when post offices came under Todd's control. When he retired there were 510 rainfall stations in South Australia and the Northern Territory, twenty-two of which were completely equipped for all meteorological observations. He made important observations during the transits of Venus in 1874 and 1882 and published several papers concerning the moons of Jupiter.²⁶

Todd held leading positions in numerous learned societies and educational and public institutions in South Australia, and was always ready to assist and advise. After Federation in 1901 his departments consistently showed a profit. His Federal designation was Deputy Postmaster General (retired June 1905) but, despite the Public Officers Retirement Act (1903), he did not leave the State public service until 1907. Todd died at his summer home in

26. Symes, 'Sir Charles Todd (1826–1910)'.

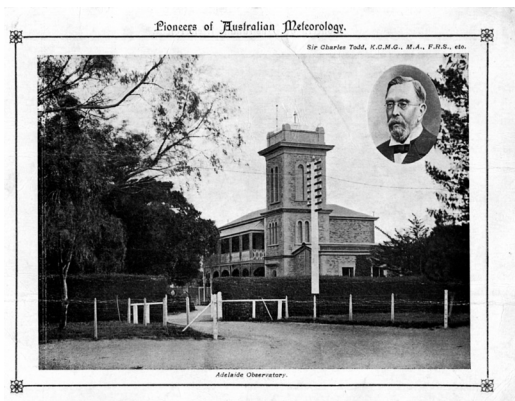


Fig. 6. A photograph, dated 1900, of the Adelaide Observatory, commemorating Todd's contribution to meteorology. The telegraph pole is appropriate considering his pioneering telegraph lines. (Courtesy State Library of South Australia B69996/1.)

Semaphore on 29 January 1910, and was buried at North Road Cemetery, Adelaide, on 31 January. Alice had died in 1898, but her name has been immortalised at Alice Springs. Their daughter Gwendoline married the physicist William Henry Bragg and was mother of William Lawrence Bragg; father and son shared the Nobel Prize in Physics in 1915.

The Sir Charles Todd Building at the Mawson Lakes Campus of the University of South Australia and the Sir Charles Todd Observatory at Stockport, about 80 km north of Adelaide, are among many memorials to Todd. Each year the Telecommunications Society of Australia invites a prominent member of the

telecommunications industry to present the Charles Todd Oration. His name will not be forgotten in Australia.

Full circle to Greenwich

A further family link with the Todd family comes two generations later with one of the Directors of the National Maritime Museum in 1947. The Director was Frank Carr (1903–91) who was a strong supporter of the scheme to make the Observatory a functioning part of the Museum when the observational and time standard work had moved to Herstmonceux. To quote Littlewood and Butler:

Frank Carr's enthusiasm for the project was intensely personal. Both his maternal grandfather Henry David Todd and the latter's elder brother Sir Charles Todd, had been astronomers and had started their careers at Greenwich in the nineteenth century. His mother Agnes had been born in the Observatory at Cambridge and had been brought up on stories of astronomy.²⁷

Whilst Director, Carr was also instrumental in the preservation of the Cutty Sark, contributing to the totality of Greenwich's history with its former observatory, the time ball, and the maritime museum.

Acknowledgements

The authors are most grateful to Lucy, Lady Adrian, Todd's great-granddaughter, for her comments on the manuscript before publication.

27. Kevin Littlewood and Beverley Butler, *Of Ships and Stars*, Athlone Press, London 1988, p. 146.