

THE HOBART TIME BALL AND TIME GUN: A CRITICAL REVIEW

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Abstract: Discussion at the Royal Society in Hobart in 1865 and acoustic experiments in 1868 led to a combined time ball and time gun service in Hobart from March 1875. Complaints from residents led to relocation of the gun a month later, but it was then fired from Queen's Battery in the Domain for half a century. The drop of the ball at Battery Point was always the master signal; the gun was fired when the ball was seen to drop. During the early years, private citizens in Hobart provided the time reference. From September 1886, an electric telegraph signal from Hobart Observatory was used to provide correct time to the ball operator, but signals were of questionable accuracy. During February 1910, the source of the telegraph signal was changed from Hobart Observatory to Melbourne Observatory, but the service was still unreliable and there was pressure to re-equip Hobart Observatory. Finally, automatic dropping of the time ball by telegraph from Melbourne was introduced in November 1910. The time ball service ended in February 1927. The time gun had probably ceased to operate by the end of 1923, but before that date there were sometimes long gaps in the time gun service, particularly on Sundays.

Keywords: time ball, time gun, Hobart

1 INTRODUCTION

Time guns were a popular means of signalling time during the nineteenth century. They were favoured by business owners, who wanted to regulate their work forces, but they were often disliked intensely by those living nearby and by those of a fragile disposition. Sound propagates at only about 340 m/sec. Correction for the time delay to an observer was feasible, but wind and weather could have a significant effect if the distance was large.

Time balls were silent, at least to an external observer, but it was difficult to site them so that they could be seen by inhabitants across a city and there were problems with industrial pollution that restricted visibility. Public clocks could be regulated by an observatory, although most were not, but they also gave restricted visibility. Time balls at an elevated shore position were the signals favoured by ships at anchor, and various preparatory signals were used to alert them to an imminent drop. They were always preferred by the Admiralty. The origin and purpose of time balls for rating chronometers is well described by Bartky and Dick (1981).

Leading astronomers sought to provide signals that were accurate to a small fraction of a second, using high quality transit instruments to observe the passage of chosen stars across the local meridian, regulated master clocks, controlled slave clocks and automatic electric telegraphy. Those aims could be met at locations like Greenwich, Edinburgh, Melbourne and Sydney, which had fine observatories and clear processes for signalling any errors. They were easily degraded if instruments were not of the highest quality and if manual intervention was necessary.

A time gun service, accurate to a small fraction of a second, was introduced in Edinburgh in June 1861, complementing a time ball service which started officially in March 1854 (Kinns, 2011). Edinburgh's success encouraged experiments with time guns in many other places. It often took several years from initial experiments to the introduction of a time gun. Sometimes, they were abandoned altogether. Local politics and budget constraints played their part, as they do today. Religious observance mattered and a Sun-

day time gun service was often not provided or abandoned.

There were time guns at many locations in Australia, including as far north as Townsville in Queensland, but many were fired without reference to astronomical observations and they were often in error by several minutes. For example, complaints about intrusion and poor accuracy of the gun, as well as damage caused to property near the gun itself, were common in Brisbane from 1867 onwards.

The recent digitisation of Australian newspapers has made it possible to find long-forgotten editorials and published correspondence about the time signals in both Tasmania and mainland Australia. Of Australian locations, only Hobart was listed as having both a time ball and a time gun in Admiralty lists of time signals. This paper describes the story of Hobart time signals and illustrates the challenges that had to be met in providing a service that would be acceptable to both town residents and mariners, using modest resources. It is derived substantially from articles and correspondence in *The Mercury*, Hobart's principal daily newspaper.

1.1 Locations of the Time Ball and Time Gun in Hobart

A map of Hobart published by the Government Printer in 1922 showed the approximate locations of the time ball and time gun at that time. It can be related easily to modern maps, using the street layout. Figure 1 is a detail from that map, where the principal locations are highlighted. Note that N is on the left and E is at the top. The key areas are Battery Point and The Domain, which includes Queen's Battery, separated by Sullivan's Cove.

The time ball was always at Battery Point. The time gun was at Queen's Battery from April 1875. Lenna, erected in the late 1870s and now a hotel, features in almost all known photographs of the time ball.

Hobart Observatory was located in the Military Barracks, west of the time ball, but was only used for the time service between 1886 and 1910. An earlier (primarily geomagnetic) observatory had been estab-

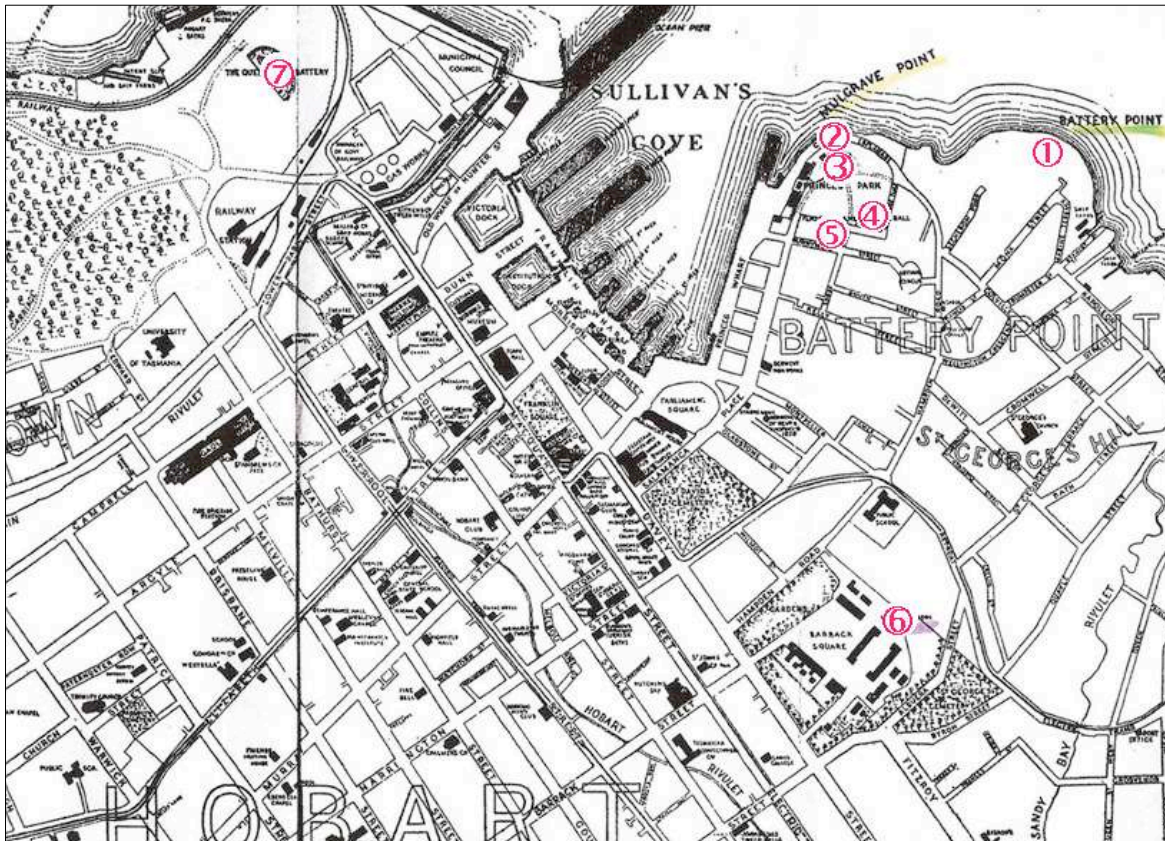


Figure 1: 1922 Map of Hobart, Tasmania, showing localities mentioned in the text. Key: ① = Battery Point; ② = Mulgrave Point; ③ = Harbour Master's Residence; ④ = Flag Staff & Time Ball; ⑤ = Lenna; ⑥ = Hobart Observatory; ⑦ = Queen's Battery (courtesy: Lesley Abell).

Table 1: The entry for Hobart in the 1880 Admiralty list

Signal Station Latitude and Longitude	Place	Signals Adopted	Situation of Time Signal	Time of Signal Being Made		Additional Details
				Greenwich Mean Time.	Local Mean Time.	
42° 53' 32" S. 147° 21' 13" E.	Hobart Town	Ball and Gun	Flagstaff at Fort Mulgrave	h. m. s. 15 10 35	h. m. s. 1 0 0	Ball dropped exactly at 1 ^h 0 ^m p.m. Hobart Town Mean Time

Table 2: The dual entry for Hobart in the 1898 Admiralty list

No.	Signal Station Latitude and Longitude	Place	Signal Adopted	Situation of Time Signal	Time of Signal Being made		Additional Details
					Greenwich Mean Time.	Local Mean Time.	
53	42° 53' 32" S. 147° 20' 28" E.	Hobart	Ball	Flagstaff on site of Fort Mulgrave. 85 feet above high water.	h. m. s. 15 0 0	h. m. s. 0 49 22	Ball hoisted half way up as preparatory at 10 minutes before signal. Ball hoisted close up at 5 minutes before signal. Ball dropped every day at 1 ^h 00 ^m 00 ^s p.m. standard time of Tasmania (see page 2).
54	42° 52' 45" S. 147° 20' 38" E.	Hobart	Gun*	Queen's Battery	-	-	Gun fired simultaneously with drop of ball. [Note. – The ball at the flagstaff is dropped by hand, and not to be implicitly relied on; when it fails, a red pennant will be hoisted at masthead for one hour.]

lished in 1840 at Rossbank by Captain James Clark Ross (Savours and McConnell, 1982). Francis Abbott then set up his private observatory, including a transit telescope, in 1855 (Orchiston, 1992). This was used to calibrate time signals until 1886, first by Francis

and then by his son, Charles. After 1910, the time ball was operated by telegraph from Melbourne Observatory. These developments are described in more detail later in this paper.

2 LISTING OF TIME SIGNALS

2.1 The Admiralty Lists

Between 1880 and 1898, the Admiralty in London published five editions of time signals for mariners. The first and last of these show the growth of time signal provision worldwide towards the end of the nineteenth century (*Lists of time signals*, 1880 and 1898). The number of distinct entries increased from 71 to 154 during that period, some having more than one type of signal. Errors did occur, including one in the 1880 Hobart entry where the location of the time gun was specified wrongly. The number of listed time balls had increased from 52 to 94 while the number of listed time guns had grown from 9 to 30. Other time guns, notably in Malta and Madras, were also mentioned under additional notes in 1898. Many others are known to have existed worldwide. There were no time gun entries for mainland Australia, so the time gun at Fort Denison, for example, was not regarded by the Admiralty as an official signal for Sydney.

2.2 The Entries for Hobart

The entries for Hobart in the 1880 and 1898 editions of the Admiralty list show how information was presented. The first edition contains the entry shown in Table 1 (*List of time signals*, 1880).

The 1880 “Situation of Time Signal” gave an incorrect location for the time gun. It had been at Queen’s Battery, with different latitude and longitude, from 10 April 1875. This was corrected later. The 1898 list was organised by reference number and contained more detail than the 1880 list. The double entry (Nos. 53 and 54) for Hobart is shown in Table 2 (*List of time signals*, 1898).

Gun* in the fourth column of Table 2 is a reference to a general footnote to the 1898 list, which gives specific acoustic information. It reads:

When the flash of a gun cannot be distinctly seen, the sound of the report may be made use of as an approximate indication of the time, by allowing for the necessary interval for the sound to travel the intervening space.

Sound travels about 1,090 feet in a second of time, at the temperature of 32° Fahrenheit, and the speed increases at the rate of 1.15 per second for each degree of temperature above the freezing point. In fogs, however, the use of sound is not to be relied upon ...

A warning about the reliability of the Hobart signals was recorded in the 1898 list entry (Table 2) and there was a note on contemporary charts pointing out that the Hobart time ball was inaccurate (see Nunn, 1908).

2.3 Accuracy of Coordinates

There was a significant adjustment to the Hobart time ball longitude between the Admiralty lists of 1880 and 1898, which appeared to move the time ball 1.0 km further west (inland). This is likely to have been an attempted correction, because the revised locations for the gun and ball were still slightly too far east and south to be in accord with modern GPS coordinates. The 1898 differences in latitude and longitude between the time gun and time ball indicate that the gun was 1.45 km further north and 0.23 km further

east than the time ball. Although time signal locations are not known precisely, Figure 1 suggests that the actual separation was close to 1.2 km.

Coordinates for the Hobart observation point in the Barracks Reserve were estimated in 1874 by the United States Transit of Venus expedition in conjunction with Melbourne Observatory. The Hobart Observatory transit hut was 110 m south and 16 m east of the pier used for the 1874 transit instrument (*Government Departments*, 1913). The derived location of the Hobart Observatory transit instrument, stated by Purey-Cust (1894b), was about 40' too far west.

The locations estimated using Google Earth are listed in Table 3. These coordinates confirm that the time ball was approximately 1.0 km from the Observatory transit instrument in the Military Barracks, as previously noted by Nunn (1908).

Table 3: Locations of the Hobart time ball, time gun, Hobart Observatory and the 1874 transit of Venus site.

Location	Latitude (S)	Longitude (E)
Time ball	42°53' 16"	147°20' 10"
Time gun	42°52' 40"	147°20' 14"
Observatory transit instrument	42°53' 23"	147°19' 39"
1874 US transit of Venus pier (van Roode, 2011)	42°53' 19"	147°19' 38"

2.4 Entries in *Walch’s Tasmanian Almanac*

Issues of *Walch’s Tasmanian Almanac* between 1876 and 1928 contain entries concerning the time ball and time gun service, but their accuracy is uncertain. Newspaper announcements show that some changes were introduced more than a year before their inclusion in the *Almanac*. A daily time gun and time ball service was started on 6 March 1875 (The time gun (editorial), 1875c). The *Almanac* for 1875 would have been issued before the service became established, so it was not mentioned. The time ball entry for 1928 was certainly posthumous, as the service ended on 19 February 1927 and the time gun service earlier still.

The initial and final entries (*Walch’s Tasmanian Almanacs*, 1876 and 1928) indicate that the time gun was at Queen’s Battery throughout. It had been located from 6 March to 10 April 1875 at the Prince of Wales’ Battery, at Fort Mulgrave near Battery Point, but this preceded the first *Almanac* entry. Figure 2 shows the gun being fired at Queen’s Battery in the Domain.

The entries in *Walch’s Tasmanian Almanac* changed from time to time. Those from 1884 to 1887 all read:

Time Signal. - Black ball drops daily at one o’clock p.m. on the Albert Battery staff, a time gun being simultaneously fired from the Queen’s Battery.

The entry for 1888 was changed to:

Time Signal. - Black ball on flagstaff; ball half way up at 12.50 pm, ball close up at 12.55 pm, ball dropped at 1pm. Hobart mean time; gun fired simultaneously from Queen’s Battery. *Note.* – when the signal fails in accuracy a red pennant is hoisted at mast-head for one hour.

The 1888 entry was maintained with only minor alterations until 1918, when a Sunday service was no

longer offered and daylight saving time was introduced as an experiment in Tasmania. The time reference was changed from “Hobart mean time” to “Hobart Observatory mean time” in 1890, then to “Hobart Observatory standard time” in 1899 and finally to “Melbourne Observatory standard time” in 1911. The Australian colonies had actually adopted international time zones on 1 February 1895. The pennant colour was changed from red to white in 1899, but the pennant was not mentioned in 1911 or later.

3 THE DEVELOPMENT OF TIME SIGNALS IN HOBART

Hobart offered a time ball and time gun service from 1875 until the 1920s, but it was a long time in gestation. Information about the time gun in Edinburgh was published in Hobart in 1861. There was serious debate and some preliminary time gun trials in 1865, followed by a remarkable experiment in 1868, but neither led to an early public service. The time ball service ended on 19 February 1927 (Collier, 1953a, 1953b); the final demise of the time gun service is likely to have occurred as early as 1923.

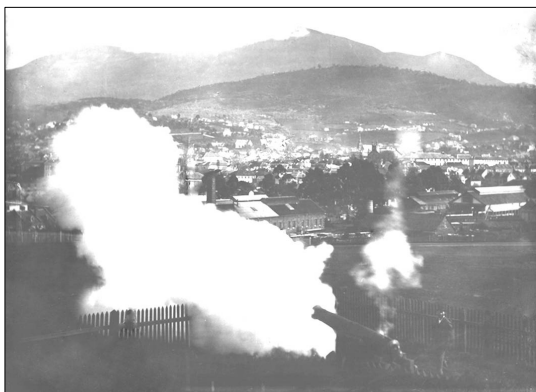


Figure 2: The Hobart time gun is fired at Queen’s Battery (courtesy: John Lennox).

3.1 Notice Concerning the Edinburgh Time Gun

The *Mercury* newspaper often published informative articles about events worldwide. In a column headed “Scotland” (1861) there was a detailed description of how the newly-introduced time gun in Edinburgh was fired. It set a new standard for time gun accuracy. Remarkably, a 1.3 km long telegraph wire was suspended directly between Nelson’s Monument and Edinburgh Castle and used to control the pendulum of the gun clock (Kinns, 2011). It was replaced 12 years later by a wire with intermediate supports (Ritchie, 1873).

The Astronomer Royal for Scotland, Charles Piazzi Smyth, reported details of time signal accuracy to Astronomer Royal Sir George Airy (Smyth, 1878):

With the Time-Ball the first instant of the fall is recommended to observers, but is in reality always about 0.15 sec. too late, on account of the time necessarily taken up in the action of the trigger.

With the Time-Gun the fire is 0.05 sec. too soon, owing to the difference of instants at which the escapement of the clock concerned is liberated, and at which the electrically controlled pendulum arrives at the end of the arc at each second.

An accuracy of a small fraction of a second was feasible, provided that fully-automatic operation by a controlled clock was used. Automatic operation was never used for the time gun in Hobart.

3.2 The Debate and Experiments in 1865

The Royal Society of Tasmania was a forum for active and well-informed debate about time signals for Tasmania. Francis Abbott (1799–1883) was the leading contributor. He had an extraordinary life, having been deported from England to Tasmania in 1845 for obtaining two watches by false pretences, before re-establishing himself in Hobart after 1849 as a respected citizen (Orchiston, 1992). He made extensive meteorological and astronomical observations, adopting the role of voluntary government meteorologist until almost the end of his life (ibid.).

Two articles entitled “Time Signals” by Abbott were published in the Hobart *Mercury* during 1865. The first (Abbott, 1865a) accompanied a report on a 9 May meeting of the Royal Society (Royal Society, 1865). Abbott argued strongly in favour of a daily one o’clock gun for Hobart, but he encountered opposition. There was a reported exchange about a time gun at the University of Melbourne:

Mr. DOBSON observed if a time gun was established it would be well to be careful in fixing upon a proper site. When he was in Melbourne in February last the firing of the time gun at the University was discontinued as it was supposed to be the cause of some mortality in the Lying-in Hospital, situated in the immediate vicinity.

Mr. ABBOTT said that subsequent observation must have shown this opinion to be erroneous, as when he was in Melbourne, at a much later date, the firing of the gun had been resumed.

There was also discussion about cost, Mr. Davies believing that a time gun would cost at least £150 to £200 per year. He was in favour of a time ball, as at Greenwich, and

... suggested that before any action could be taken, it would be necessary to determine with accuracy to what distance the sound of a gun could be heard. He thought, if requested by the Royal Society, that the Volunteer Artillery might be able to institute some experiments. (ibid.).

In the second article (Abbott, 1865b) gave a detailed summary of leading innovations worldwide. Parts of that second article are transcribed below, because it gives useful insight into the thinking of the period. Abbott remained a strong proponent of time guns, thinking more of business requirements than the needs of mariners. He reported on some preliminary experiments using time guns:

At the May meeting of the Society, some notes were read and a discussion took place as to the desirability of establishing time signals in the colony. In the opinion of that meeting further information was required on the subject, and a committee was appointed to make inquiry as to the size of gun necessary, the distance at which a report could be heard, and the amount of expense that would be incurred.

Part of this duty the committee has been relieved from, through the kindness of Colonel Chesney, who partly for this purpose and partly for military service, has caused three guns to be fired at 4 p.m., on the first Thursday in every month, provided the weather was

fine, and if not on the first day following. Through the Horological Institute of London, I am now in possession of further information on the subject, especially on the method for obtaining and transmitting correct time, and have therefore thought it desirable to bring the practical portion more fully before the Society, as time signals are now held to be of great importance in all manufacturing or commercial towns, in which either public or private works are carried on.

Abbott then gave considerable detail about the methods used for determining time at the Cantonal Observatory at Neuchatel in Switzerland and at the Royal Observatory at Greenwich, together with the telegraph systems that were used for wider distribution. He went on to describe time gun arrangements for Newcastle in England and Glasgow in Scotland:

Very general reference is made to these [Newcastle] guns, not only by the public generally, but also by manufacturers and ship-building companies, for regulating their works, and not less important are the facilities they give for rating chronometers.

The first Glasgow time gun was supplemented by a second one in St. Vincent's Place on the 29th of October, and these two by a third at the Broomielaw, on the 10th of November, while a fourth gun was added to the system at Greenock on the 21st of November, all four being simultaneously fired through the agency of the electric current from the Observatory.

The Glasgow arrangement was initiated on 1 October 1863 with firing of the first gun near Sauchiehall Street (Glasgow ..., 1863). It was highly controversial. The guns were controlled from Edinburgh Observatory, and the plan was declared without consulting Glasgow Observatory or the University, let alone the citizens of Glasgow. The trial with four guns was terminated in February 1864 (Discontinuance ..., 1864). There had been a Glasgow time ball between 1857 and 1864, but it had uncertain accuracy. Both time guns and time balls were abandoned in favour of public clocks controlled electrically from Glasgow Observatory (Kinns, 2010).

Abbott (1865b) also described the use of multiple time guns in Madras:

At Madras, measures have been taken by the astronomer, Mr. Norman Pogson, with funds supplied to him by the Governor-in-Council, to convert no less than five time guns, which are daily fired in and about that city, by connecting them electrically with the normal meantime clock at his observatory. Mr. Pogson says that "the smoke by day, and the flash by night of a time-gun, are far better and more conspicuous signals than any time ball".

Confusing multiple reports and sound reflections probably caused early discard of the multiple gun arrangement. Only one gun was noted for Madras in the 1880 Admiralty list, in a subsidiary note which pointed out that it was for local use, not for rating chronometers.

Abbott (ibid.) then summarised his views concerning the cost and benefits to large projects in Tasmania. He argued that the cost of powder for guns in both Hobart and Launceston, fired three times per week, would be only £15 12s per year, and

If the government expects to carry out the proposed railways, and other public works, a very large number of men will be required, and it is quite clear that if something approaching to correct time is not adopted,

a few minutes loss for each man every meal will very soon amount to a much more considerable sum than the cost of a few time signals.

The paper finished with reported observations by the Astronomer Royal at Greenwich, George Airy, about the economic and navigational benefits of time signals. The cost of the powder for guns featured strongly in the argument for guns at Hobart and Launceston. It featured also in later arguments—which lasted well into the twentieth century—about whether the time gun service should be continued.

3.3 The 1868 Acoustic Experiments

The Colonial Secretary in Hobart announced on 22 June 1868 that experiments with time guns were to be carried out on 30 June and sought written responses from members of the public. His announcement was published on successive days in *The Mercury* up to and including the day of the experiments (Daily time gun, 1868). Francis Abbott was nominated as the source of correct time in the notice, which is transcribed in full below:

Gentlemen interested in the establishment of the above, and resident in the vicinity of Hobart Town, are informed that certain experiments will be tried on TUESDAY, the 30th inst., commencing at 12, noon (Abbott's time), to test the question of "What nature of ordnance should be used for the purpose?"

At the time above-named a 10lb charge will be fired as a signal that the experiments are about to commence. Two minutes afterwards the first experimental gun will be fired; two minutes afterwards, a second; and so on until 25 rounds are completed.

The pieces of ordnance will be formed up in or near the Queen's battery, Domain, and pointed towards Drouthy Point.

The Colonial Secretary would feel obliged if gentlemen resident at Bridgewater, Brighton, Richmond, Sorell, Kingborough, Risdon, and other places within a radius of fifty miles from Hobart Town, would furnish a return to this Office on or before 8th day July, of the following description ...

Table 3 shows how respondents were expected to complete their returns.

The successful completion of the experiments was reported on the following day (A daily time gun, 1868):

Yesterday, by order of the Colonial Secretary, a number of experiments were made at the Queen's Battery to test the applicability of certain pieces of ordnance to the purposes of a daily time gun. There were a considerable number of gentlemen present to watch the experiments, which were conducted by Staff-Sergeant Major Eccleston of the Artillery. The signal gun was fired at noon, and twenty-five rounds were then discharged from six pieces of ordnance of different natures, the charges of course varying according to the nature of the piece ... The guns were discharged at intervals of two minutes and were distinctly heard all over the city. The effect in the outlying districts has, of course, yet to be proved ... Gentlemen who may have been on the look out for the guns in any of the districts, but who may not have heard them, would do well to notify that fact to the authorities, as a knowledge of it will assist in arriving at a decision.

It was an ambitious acoustic experiment, but the results appear to have remained unreported to the general public. Fifty miles (80 km) corresponds to a

sound propagation time of about 4 minutes. Signal delays would have been significant at any of the outlying locations. It was to be more than six years before a combined time gun and time ball service was implemented.

Table 3: Specification for returns concerning the time gun experiments of 30 June 1868.

EXAMPLE	
No. of Round.	Distinctness of the Report of each Round expressed in figures. Maximum 10.
1	4
2	1
3	10
4	6
5	7
6	2
And so on.	And so on.
The signal gun need not be included in this return.	
RICHARD DRY,	
Colonial Secretary's Office,	Colonial Secretary.
22 nd June, 1868.	30j

3.4 Introduction of the Service during 1875

An editorial (1874) published in *The Mercury* on 31 December 1874 noted that a Saturday time gun had been introduced recently at Queen's Battery, but argued in favour of a daily time ball:

Our complaint, on a recent occasion, respecting the great inconvenience caused by the want of a town clock to give correct standard time, had the effect of arousing the powers that be to the necessity for firing a gun from the Queen's Battery, in the Domain, at one o'clock precisely, on Saturday. The step was in the right direction, but a good deal remains to be accomplished before public convenience can be satisfied in respect of an approximate knowledge of the time of day. The firing of a gun once a week is a small mercy in its way, and one for which no insignificant section of the community is correspondingly grateful. But the particular class who would most be benefited by the signal, namely, seafaring people, might, in no restricted sense, remain totally ignorant of the fact. Dozens of ships might arrive at and depart from port on consecutive dates without ever hearing a gun, and consequently remain unacquainted with the correct time. This grave oversight could easily be remedied if the authorities of Hobart Town adopted a practice, in vogue in ports of much less consequence, we allude to the practice of dropping a time-ball at one o'clock precisely every day of the week. The ball could be placed under the charge of the Marine Board – a body not overburdened with work at any particular period of the year; and if placed in a conspicuous position of the city – Battery Point for instance – the diurnal descent of the ball would soon be regarded as a boon immeasurably in advance of the signal gun.

The intention to implement a daily time gun service was announced early in 1875 (The time gun (editorial), 1875a). The gun was not, however, to be located at Queen's Battery:

We understand that, by an arrangement between the Government, Marine Board and City Council, the firing of a gun daily will be secured. The gun will be fired from the Prince of Wales Battery, daily at noon, and the time regulated by a chronometer to be kept on the spot.

The Hobart time gun service was announced on Friday 5 March, with the statement that it would commence on the following Monday 8 March (The time gun (editorial), 1875b), the gun being fired at 1 p.m., not noon:

It has been arranged that an eight-day chronometer will be kept in the office attached to the flagstaff at Battery Point, and, as we some time ago said would be arranged, the Marine Board have undertaken to fire a gun every day at 1 p.m., in order to intimate the correct time to the public. This new arrangement will come into operation on Monday Next.

There was no mention of a time ball, but the announcement was inaccurate. A daily time ball and time gun service actually started on Saturday 6 March (The time gun (editorial), 1875c), both signals being made at 1 p.m.:

Arrangements have been made by the Marine Board, on and after to-day, under which a gun will be fired every day, including Sundays, at 1 p.m. At five minutes to one o'clock a ball will be hoisted at the top of the upper flagstaff, and will be lowered exactly at one by chronometer time, to be kept at the signal station. Simultaneously with the dropping of the ball, the gun will be fired by the Master Gunner from the battery adjoining the flagstaff.

The time gun was at Battery Point for the initial daily service, but it was soon moved back to Queen's Battery, where the 1868 acoustic trials had taken place and where it had been for the Saturday only service.

3.5 The Early Complaints

The difficulty in striking a balance between social impact and business needs can be illustrated by extracts from correspondence and editorials. The Hobart time gun attracted many complaints when it was positioned near the time ball. The charge had to be reduced to reduce local disturbance, but it then failed to serve its purpose. A letter signed "More Powder" (1875) made matters clear:

... it doesn't make half noise enough, and so in part does away with the gratitude the boom would otherwise inspire.

When the gun was weekly discharged from the Queen's Battery, in the Domain, the sound could be plainly heard all over the town, and even many miles away; and, therefore, I would suggest the continued use in the same place. It would not interfere with the simultaneous dropping of the ball – the flagstaff being in plain view – and I am sure those who can't see the ball will be very glad to hear the gun.

A letter signed "Howitzer" (1875) was supportive:

I see by this morning's *Mercury* that the inefficiency of the time gun is very justly complained of. Buried as it is in that model battery for all useful purposes, it had better be discontinued, and only the ball used.

I believe there is a 32 pounder brass Howitzer in the store, which is the only suitable gun for the purpose. Placed in the Queen's Battery, or better still in Franklin Square, I am sure there will not be any complaint then.

This was followed by an editorial (The time gun (editorial), 1875d) which included the observations: "We think we may safely say that the firing daily of the gun has given very general satisfaction ... [and] We understand that a remonstrance on the part of the people near the present place of firing has been sent

to the Government.” The complaints had an effect, and the time gun was moved on 10 April (Time gun (editorial), 1875e):

In consequence of certain of the residents in the vicinity of the Prince of Wales' Battery having represented to the Colonial Secretary that the firing of the gun had caused considerable annoyance, by the breaking of glass, &c., it has been decided to fire the gun for the future from the right flank of the Queen's Battery in the Domain. The new arrangement will come into operation today.

The 'Gun Clock', which can still be seen at Narxyna Heritage Museum in Hobart, was probably provided for the gunner at the Queen's Battery. It is too large to have been the chronometer used at Battery Point.

A letter signed "W.N." (1875) written on 5 July was published in *The Mercury*. The issue now was the Sunday firing:

The necessity of firing the gun on Sunday has never yet been understood, but plenty of reasons could be given why doing so for six days in the week would serve all good purposes ...

While the Holy Communion was being administered on Sunday last in Trinity Church, the gun was fired, and the report being so loud, made the windows rattle, and coming so unexpectedly, those within the building were much startled; in fact, the sensation produced was far from pleasant.

Secular interests appear to have prevailed until 1918 when *Walch's Tasmanian Almanac* first specified that no time signals were given on Sundays. There were intervening periods when the Sunday service was not provided, apparently to save money.

4 DETERMINATION OF TIME

4.1 By Horologists, Up to 1886

The skills and enthusiasm of individual Hobart citizens provided the means for determination of time during the early years of Hobart time signals (Mercer, 1999). David Barclay developed a successful business selling watches, clocks, instruments and jewellery. In about 1860 he imported a regulator clock from Edward J. Dent of London. It was said to have a variation of only half a minute per year from Melbourne Observatory standard time (*ibid.*). It is now in the Tasmanian Museum and Art Gallery.

Francis Abbott had been the author of papers concerning time signals in 1865 and was also the source of correct time for the gun experiments of 1868. He played that role in Hobart for many years afterwards. He would have used Barclay's clock, calibrated using his own regular transit observations, together with a chronometer to transfer time to the ball operator. Such transit observations were not usually subject to independent scrutiny and were viewed with suspicion by leading astronomers, as was the case in Glasgow (Kinns, 2010). Admiralty reservations about the accuracy of Hobart time signals are likely to have stemmed from this period.

Francis Abbott's declining health led to the end of his personal time service in 1880, as well as his meteorological observations. This forced the foundation of Hobart Observatory in 1882, with Captain Shortt as its first Director (Orchiston, 1992). The early emphasis was on continuing Abbott's meteorological

work. Charles Abbott continued his father's time service for several years, but he wished to relinquish responsibility for it in 1886 (Shortt, 1886a).

The accuracy of Barclay's clock was noted in later discussion at the Royal Society in Hobart, when methods for improving the accuracy of Hobart time signals were under discussion. Reported remarks by the Government Meteorologist (Kingsmill, 1894) included the following observations:

... he thought he was at liberty to mention that ere long there would be, through the generosity of a citizen, a better means of obtaining correct time than at present. (Applause.) Mr. David Barclay had very kindly placed his clock, known to be the best in the Southern Hemisphere, at disposal to be connected electrically with the observatory. With liberty to read Mr. Barclay's clock alongside the present instrument in cloudy weather, when it was often and for lengthy periods impossible to take observations, a better standard of time might be looked for in the future. When this was done he would not be afraid to see electrical signalling established. (Applause.)

Barclay's clock was used as the Observatory reference until 1910, being far superior to the Observatory's own solar mean time clock.

4.2 Telegraph from Hobart Observatory

Sufficient funds were available for the time service to be transferred from Charles Abbott to Hobart Observatory in 1886 (Shortt, 1886a). Captain Shortt was in favour of dropping the ball electrically. He received assistance from Robert Ellery, the Government Astronomer in Melbourne (Gascoigne, 1992), and Robert Henry, the Superintendent of Telegraphs in Hobart, concerning the necessary equipment and procedures (Shortt, 1886b). A press announcement about the new service was prepared (*ibid.*).

The announcement stated that significant improvements to the method of time ball operation would be made from 1 September 1886 (Time ball ..., 1886). From that date, the Battery Point signal station would receive telegraph signals from the Observatory clock, whereas time had been provided previously using a chronometer that was corrected weekly. The published announcement showed that fully automatic dropping of the ball was discarded in favour of manual response to telegraph signals:

On and after tomorrow arrangements have been made by which correct time will be communicated to the Mulgrave Battery every day at one o'clock by Captain Shortt, R.N. ... The giving of correct time has hitherto been well attended to by Mr. C. Abbott of Murray Street, who sent a man once a week to correct the chronometer, but as this mode was not so sure as an automatic and electrical system, it was resolved that the signals should be given from the astronomical clock at the observatory to Battery Point signal station, and also to the central telegraph office in order that they might be transferred daily to the various telegraph offices in the colony. The signals are given direct by the clock which completes the electrical circuit at 40, 30, 20, 10, 4, 2 and 0 seconds to 1 p.m., the last signal of course being at one o'clock, when the man in charge drops the time ball and also sends a return signal to the observatory by means of an electric bell to show that he had done so. The signals are given on galvanometers, which, while simple and very easy to understand, are still efficient for the purpose and are not liable to get out of order. In the event of

the clock getting out of order, which is not very probable or failing to send the signals, arrangements have been made to send them by hand. The clock and galvanometers were obtained through Mr. R. J. Ellery, of the Melbourne observatory, and Mr. R. Henry, the superintendent of telegraphs, has taken a great interest in making the electrical arrangements as complete as possible. The time-ball will be dropped by hand, and any error in the dropping will be clearly notified in the newspapers of the following day. Credit is due to Captain Shortt for his invaluable efforts to obtain accurate observations, and it is to be hoped that they will be attended with the greatest success.

The change to operation using a daily telegraph signal should have improved the signal accuracy relative to the earlier method of operation, but later evaluations by naval officers of the Hobart time ball showed there were serious deficiencies in observatory instruments and procedures. Henry Kingsmill was appointed as Meteorological Observer following the death of Captain Shortt in 1892, and he continued the time service.

4.3 The Method of Time Gun Operation in 1893

On 31 March 1893 a lengthy editorial in *The Mercury* (How Hobart time gun ..., 1893) explained how the time ball was then being operated. The first part of the editorial explained how time was determined using transit instruments to observe the passage of stars across the meridian. This was followed by a description of the procedure for dropping the ball and firing the gun:

The true time having been thus obtained, and the record of the Observatory clock checked, the dropping of the time-ball and the firing of the gun is a simpler matter. Mr. Shea, in charge of the time-ball at Mulgrave signalling station, is communicated with by wire. He receives the electric bell signals from Mr. Kingsmill to hoisting the ball, but for dropping it on the instant of 1 o'clock the signal flash is sent automatically and electrically from the Observatory clock. The dropping of the time-ball is effected by hand, because electrical apparatus have been found incorrect. Mr. Shea is first rung up at about a quarter to 1 o'clock, as a hint to get ready. At 12.50 he receives the signal to hoist the time-ball half-way up the pole, and this is also an indication to gunner Caulfield, on the Domain, to be also in readiness. At 12.55 Mr. Shea receives the last signal from Mr. Kingsmill, which means that the ball is to be sent to the top of the pole. Then comes the 1 o'clock signal from the Observatory clock, down goes the ball instanter; the gunner sees the ball drop, pulls a plug, and fires the gun, the total waste of time being usually 3sec. to 5sec. only. The true time to the second is the dropping of the time-ball. Anyone at Bellerive seeing the ball drop, would learn that it was 1 o'clock at least 10sec. before it is indicated by hearing the discharge of the gun, for sound only travels at the rate of about 4sec. to a mile. It will thus be seen that there are three persons concerned in the operation – Mr. Kingsmill the Meteorological Observer, the man in charge at the signal station, and the gunner in the Domain.

The gun is an old howitzer of 1848 ... The charge of gunpowder is put in a little bag, and weighs about 3lb, each discharge costing the Government 2s. for powder. The bag of powder having been rammed "home", a friction tube is inserted in the vent hole, to which is attached a piece of cord, and all is ready. The gunner holds the cord out straight in readiness as the moment for firing approaches, and keeping his eyes on the

ball. As the ball falls he pulls the cord and the gun is discharged by the time the ball is down. The muzzle of the gun points to the gasworks, and occasionally when the atmosphere is dense and foggy a strange phenomenon is witnessed when the gun is fired – it forms a long tunnel through the vapour.

Mr. Kingsmill communicates the time in the same way to the Post-office, whence it is wired to Launceston and different parts of the island [of Tasmania].

4.4 The Purey-Cust Report of 1894

In 1894 an important report concerning the time ball was prepared by Lieutenant Commander Purey-Cust, then in command of the survey yacht, *HMS Dart*. Herbert Purey-Cust later served as Hydrographer of the Royal Navy, from 1909 to 1914, and was knighted in 1919 (Obituary Notice ..., 1939). His Hobart report became a parliamentary paper (see Kingsmill, 1904).

In preparing his report, Purey-Cust worked for a month at Hobart Observatory, testing instruments and checking calculations (Kingsmill, 1904). His report was wide ranging and included comment on the transit instrument and its alignment (Purey-Cust, 1894b). He gave a lucid explanation of the procedure for dropping the ball using signals from Hobart Observatory, located in the Military Barracks:

Signals are sent from the observatory to the signalman at the flagstaff, Fort Mulgrave, where the time ball is situated, by electricity during the last minute previous to 1 p.m. The electrical fittings are so inferior that they frequently break down entirely for days together. Mr. Ellery, the Government Astronomer at Melbourne, whilst recently in Hobart, gave as his opinion that this might be remedied by a very simple alteration. Again, the ball is hoisted by a rope and winch, and, in order for the ball to appear to drop at 1 p.m., it is necessary for the signalman to let go the winch handle a certain time beforehand; this he does when he sees the last time signal at 2 seconds to 1 p.m., and the ball itself drops about half a second past 1 o'clock. By dint of long practice and habit this error is fairly constant, and varies from 0.5 seconds to 0.8 seconds too late; but it is obvious that that the error is liable to variation, and that under the circumstances it is absolutely impossible for the man to drop the ball exactly at 1 p.m. This, I think, might be obviated by some simple automatic method of dropping it to work with the assistance of a relay by the same electric current, from the Observatory, that works the time signal. It would be a good plan in future, when the time ball fails in accuracy, to hoist it again immediately half-mast, close up at 1.55, and drop it in the usual manner at 2 p.m, publishing the error in the next morning's paper. This is the usual method adopted in many ports in similar cases.

There was particular concern about the observatory clocks (Time service ..., 1910):

There were two clocks. One, a sidereal, in the transit hut, was exposed to every variation of temperature, and in consequence had an ever fluctuating rate. The other, a mean solar clock, in the observatory building, had to be corrected every day at noon to exact mean time for dropping the ball, and could therefore be said to have no known rate. Consequently in cloudy weather no dependence could be placed on either of them, and the time was regulated by a single box chronometer kept in the observatory building. There were no ready means of accurately forecasting the clock in the tourist [*sic*] hut used for observation with either the

chronometer or the mean solar clock. At small expense a clock face might be fitted close to the mean solar clock, electrically connected with the sidereal clock, affording a simple and extremely accurate method of comparison between the two. That was the method usually adopted in all observatories. A good standard clock was much needed. That could be placed in the cellar, for the sake of uniformity of temperature, and electrically connected, as above, with the room in which was the mean solar clock.

In a covering letter to the Premier of Tasmania, Purey-Cust (1894a) made the following observations:

The question of the correct time signals by the dropping of the ball is of extreme importance to the shipping world ... At present, I am confident that the time is ascertained at the Observatory with the requisite accuracy, but with the numerous defects of the small transit instrument alluded to in my report, it requires constant and very careful management.

Despite the many criticisms in the report, the response was complacent. A similar evaluation in 1908 showed that little was done for the next fourteen years. Barclay's clock was, however, reintroduced.

4.5 Transfer of Functions

In 1903 there was concern about a proposed transfer of the duties of the Meteorological Department to the University. Meteorologist Kingsmill made the mid-day observations of the Sun and star observations at night that allowed accurate regulation of the Hobart Observatory clock. There was a fear that members of University staff would not have the time to continue Kingsmill's work. A deputation from the Royal Society met the Chief Secretary on 9 July 1903 (The Meteorological Department, 1903). Deputation members reported on favourable comments from mariners:

The naval officers had expressed themselves highly gratified at the accuracy of the time gun, and as the port was visited by a large number of vessels accurate time was of the greatest importance. He hoped the Government would not take any steps that would militate against the efficiency of the department.

Mr. Morton quoted the remarks of captains of ocean-going steamers stating that the time was more accurate in Hobart than in any of the ports in the Southern Hemisphere, and that they always set their instruments by the Hobart time gun. The importance of accurate time in such matters was vital.

The accuracy of the Hobart signals is likely to have been overstated, when time balls at several locations in Australia had heavy-duty mechanisms with automatic control by electric telegraph from well-equipped observatories (Kinns and Abell, 2009). The Admiralty was more critical, as shown by a subsequent report (Nunn, 1908).

State functions were being transferred to the Federal Government during the early twentieth century and there was further concern in 1907 about continuation of the time gun service (The time gun ..., 1907):

The president of the Chamber of Commerce (Hon. W. H. Burgess) who was a member of a deputation which waited on the Premier yesterday, asked what provision was made for the continuance of the time service after the transfer of the Meteorological Department to the Federal Government. At present it was part of the work of the observatory. The Federal Government proposed to take over only the meteorological service,

leaving the astronomical work to the individual States. It was important in a seaport like Hobart that standard time should be daily recorded for the benefit of shipmasters who wished to regulate chronometers and he (Mr. Burgess), therefore, asked whether the time service would be continued. The Premier consulted the Under-Secretary (Mr. P. C. Douglas), and then informed the deputation that a sum had been placed in the Estimates and that the time gun would continue to be fired at 1 p.m. daily.

The time gun service survived, but it was already under budget pressure.

4.6 The Nunn Report of 1908

Despite the deficiencies highlighted by Purey-Cust in 1894, little was done to improve matters. Another report was produced by Commander Nunn, from *HMS Powerful*. It was made available in Hobart during February 1909 but was written during the previous year (Nunn, 1908). He made nine observations, of which the first six are reproduced below:

(1) The transit instrument is the same as that described in paragraph 1 of Lieut. Commander Cust's report dated April 5, 1894, and from the observations taken with it the errors and rates of the standard clock are determined. The standard clock at present used is the property of and in the house of a Mr. Barclay, who allows it to be used for the purpose, as the Observatory does not possess a clock reliable enough.

(2) Mr. Barclay's clock is electrically connected with the signalling clock, which is adjusted daily to exact time by movement of weights on its pendulum. The signalling clock is connected to [a] galvanometer at Fort Mulgrave, and works the galvanometer needle which gives the signal to drop the time-ball.

(3) The time-ball is dropped on the flagstaff at Fort Mulgrave, about half a mile from the Observatory. It works up and down the flagstaff, and is hoisted by hand-winch about half-way up at ten minutes, and close up at five minutes, before 1 o'clock, and a hand brake put on. The signalman releases the brake when the 1 o'clock signal is made by the deflection of the galvanometer needle, and the ball drops. This method renders it very liable to personal errors.

(4) The connection between the Observatory and the signal-station galvanometer is also apparently faulty, as there are frequent failures of the signal. When the galvanometer fails to give the signal, the signalman releases the ball by chronometer time.

(5) The chronometer which is used is a very old one. There are no records of it having been cleaned for years, and it has to be carried from the hand-winch, as the Establishment does not possess a suitable back or deck watch for the purpose.

(6) It would appear by reference to paragraphs 1, 2 and 3 of Commander Cust's report that no material improvement has been made in the state of the time service since Commander Cust reported on it as inadequate and liable to error 14 years ago.

Nunn's report showed that Barclay's clock was an important part of time determination in Hobart in 1908, having been connected electrically to the signalling clock even though it remained in a private house near Battery Point. The chronometer used to drop the ball when the electrical connections failed, as they did often, was clearly of doubtful accuracy. The time ball was described as being on the flagstaff at Fort Mulgrave in both the Purey-Cust and Nunn reports.

Nunn concluded with recommendations for changes that he considered essential if the time ball service was to reach the required standards. The aim was to remove the Admiralty qualification concerning accuracy, which had been in existence for a long time:

(7) I would suggest that if the following improvements were carried out, a satisfactory time service could be maintained, and that on a favourable report being made to the hydrographic office of the Admiralty the note referred to by the Master Warden of the Marine Board, Hobart, would be removed from the charts and sailing directions. It would be also removed from the Admiralty list of time signals, where it is to be found on page 25. Suggested improvements: -

(1) That a new and modern transit instrument be obtained.

(2) That a good standard clock be obtained, of a character and reliable enough for the work of a modern observatory.

(3) That all the electrical connections be made efficient.

(8) I am of the opinion that it would be a great advantage to move the transit instrument house from its present position, and place it on the site of the transit pier in the Barrack-reserve, which was used by the United States Transit of Venus Expedition of 1874 (mentioned in paragraph 6 of Lieut. Commander Cust's report), or better still, and more likely to meet future requirements, that a small observatory be built on that site, capable of conducting both the Tasmanian time service and also the branch of the Commonwealth meteorological work.

(9) The present transit instrument house being only a very old and small wooden hut, is not suitable for housing delicate instruments. A flagstaff could be erected and the time-ball dropped from near the Observatory, or on the Observatory itself, thus eliminating many chances of inaccuracy.

Henry Kingsmill died unexpectedly on 16 July 1909 (Death of Mr. Kingsmill, 1909; The late Mr. Kingsmill, 1909), and during the last weeks of his life was trying to establish the costs of new instruments (Time service ..., 1910). His widow, Helen Kingsmill, took over his duties as Meteorological Observer and continued the time service for several months (The one o'clock gun, 1910). Nunn's recommendations were never implemented.

4.7 Telegraph from Melbourne Observatory

During 1910 there was a significant change in the source of the time signal. It was to come by telegraph from Melbourne Observatory. The transition took place on 10 February (Government Departments, 1913). A plan to automate the time ball drop was agreed at a meeting of the Marine Board on 22 March (The time ball, 1910). Implementation was delayed and an editorial showed that the arrangement was still unsatisfactory six months later (Hobart time ball; the present ..., 1910):

The arrangements made by the Tasmanian Government with the Victorian authorities for the receipt of the one o'clock signal daily have been anything but satisfactory. When it was proposed some months ago that the position of astronomer in Tasmania should be done away with there was a good deal of opposition, but the Government of the day insisted upon the need for economy and the public were assured that the arrangements with the Victorian authorities for the transmission of time could be quite satisfactorily carried out. Indeed, the public were told that the

accuracy would be so great that the Admiralty could no longer find any reason for the statement on the charts that the dropping of the time ball was inaccurate. The following reports of the Marine Board's officer whose duty it is to receive the signals and comply with them will show what a farcical arrangement has been made:-

June 9. – Time gun did not fire. No gunner at the Battery.

June 13. – Time signal cancelled. No signals received from Melbourne.

June 14. – Received no signal; gun did not fire, the cause being, I am informed, that the Artillery were at Fort Nelson for firing practice.

June 21. – Time signal not received from Melbourne.

July 25. – Failure of time signal. I am informed failure was at Melbourne Observatory.

July 29. – Time signal cancelled, signals being quite useless and irregular.

August 1. – Time gun fired one minute five seconds late.

September 1. – No signal from Melbourne, reason being a holiday in Melbourne.

September 2. – No signal from Melbourne; failure of the cable.

September 16. – No signal from Melbourne.

The Marine Board forwarded the complaints to the Government, apparently without effect. A recent reply states, however, that the government is in communication with the Victorian authorities.

In all, there were 10 days between 9 June and 16 September when the gun did not fire or was seriously in error, a failure rate of about 10%. On 7 or 8 of these days, there was no time ball signal either. Operation of the gun was even more limited in early 1911 (Old Timer, 1911).

Pietro Baracchi at Melbourne Observatory responded to the complaints. Baracchi was then the second Government Astronomer for Victoria, having succeeded Robert Ellery in 1895 (Perdrix, 1979). He focused entirely on the time ball and suggested that occasional failures in the extended telegraph connection could be expected (Baracchi, 1910). His response was not well received in Hobart, although the Chief Secretary made the important point that "For shipping purposes, it did not matter so much if they did not get the exact time every day, so long as it was correct when they got it." (ibid.).

Baracchi referred to the time ball at Battery Point, not Fort Mulgrave. It is not clear whether this was just an alternative description of the location near Lenna, or implied a change in position.

4.8 Pressure to Upgrade Hobart Observatory

The frequent failures of the telegraph signals from Melbourne led to hope that it might after all be decided to upgrade Hobart Observatory. A long article was published in October 1910, highlighting the Purey-Cust and Nunn reports and arguing the case for upgrade (see Time service ..., 1910), but it was not to be.

4.9 Automation of the Time Ball Drop

It was a long time in coming, but automatic dropping of the Hobart time ball was at last introduced in November 1910 (Hobart time ball. Dropped ..., 1910):

The Hobart Marine Board, anxious for an accurate time service and for the black mark on the Admiralty



Figure 3: Part of the painting, “The Ethel at New Wharf (Prince’s Wharf)”, by Houghton Forrest, 1884. The time ball is shown as a small black circle high on the flagstaff to the left of Lenna (courtesy: Narryna Heritage Museum).

chart to be removed, has had an electrical apparatus fitted up at the Battery Point signal station, by which the time-ball is now automatically dropped from Melbourne at one o’clock, instead of by hand ... The circuit is so arranged that the one o’clock beat of the chronometer at the Melbourne Observatory releases a catch, which locks the winch handle at the signal station, and allows the ball to drop.

The automation was never extended to the time gun, as it had been in Edinburgh from the start of the City’s time gun service in June 1861 (Kinns, 2011).

4.10 Mount Nelson Signals

There is no mention in official notices of a time ball at the Mount Nelson signal station high above Hobart,

but in a book titled *Once Upon a Time ...* Sharland (1976) published anecdotes about a time ball there in a chapter entitled “Hobart’s 1 o’clock gun”:

So in the absence of radio or direct phone links in any of its three distinct stages the time signal ceremony came down to this:

First, a black ball went up on the Mt Nelson signal station about 12.45. Then, at the same time, a second ball went up on the Battery Point mast. At 1 p.m, the Mt Nelson ball was dropped. Simultaneously, or near enough, the Battery Point official who had been watching Mt Nelson let his ball drop. In smart succession, and again by vision, the man on the Domain responded and fired off his gun. And so it was.



Figure 4: A photograph showing Bailey's house on the hill where Lenna now stands, and to the right of it the mast with the time ball (courtesy: Lenna; copy by Martin George).



Figure 5: The time ball and mast in the 1870s (courtesy: Lenna; copy by Martin George).



Figure 6: An 1878 photograph titled "New wharf ...", showing Lenna and the time ball mast (courtesy: W. L. Crowther Library, Tasmanian Archive and Heritage Office).

The existence of a time ball on Mt. Nelson cannot be discounted entirely, but no supporting written evidence or photographs showing a time ball at Mt. Nelson have been found. Curiously, Sharland makes no mention of telegraph links to either Hobart or Melbourne Observatories. If this other time ball existed at all, it was never assigned official status.

5 THE LOCATION OF THE TIME BALL

5.1 The Original Location

An 1884 painting by Haughton Forrest is on display at the Narryna Heritage Museum in Hobart. It shows the time ball on a tall flagstaff near 'Lenna', which by then was a completed building. Figure 3 is a close-up of part of that painting.

Lenna was a major development during the late 1870s on the site of a much smaller house belonging to Captain James Bailey (and known as the Bailey House). The extension to the left of Lenna in Figure 3 was subsequently replaced by a conservatory with a rounded roof, which appears in later photographs.

Photographs showing the house and time ball at various stages of development are on display at Lenna. Details from some of those photographs are included in this section. Figure 4 shows the original Bailey house, time ball and mast. Slanting stays are obvious in this photograph and it is just possible to see a very high topmast.

Figure 5 is part of a photograph which shows Lenna under construction during the late 1870s. It contains the clearest image of the time ball and mast found thus far, with slanting ropes that are either attached to the ball or to the mast behind it. The ball is raised above the transverse spar, but this was probably its original rest position above the stays. Slanting stays to the left of the mast are behind the spar and those to the right are in front of it. Vertical stays from the transverse spar to the ground and stays

between the spar and the topmast can also be seen. Ropes to the time ball itself may have acted as constraints in windy conditions, or to control its descent after the initial free fall.

Close examination of Figure 5 shows a high topmast, as in Figure 4, but with a conspicuous white flagpole to the right. The small building with twin roofs, in front of and to the left of the mast, was probably the signal station. The line of poles running downhill from the signal station is likely to have carried telegraph wires. The mast and time ball in a position above the spar are also obvious in a ship photograph taken in about 1880 ("Victoria barque ..."), but the resolution is insufficient to show the stays. The ball is at a lower rest position and the very high topmast is not visible in later photographs, so at some stage the topmast is likely to have been reduced in height.

The mast was located behind (south) and to the left (east) of Lenna when viewed from New Wharf. It was therefore shielded by Lenna in photographs taken by an observer from the northwest, but not by the smaller Bailey house in Figure 4. Panoramic views show changes to wharves during the period of interest. Stated dates of photographs are often approximate, so these changes help to reduce uncertainty. Figure 6 is a view of New Wharf, taken in about 1878 and viewed from Morrison Street. The unusually long transverse spar on the time ball mast is a striking feature from this angle. A photograph taken in 1895 shows a long open shed on New Wharf to the right of Lenna ("Waterman's Dock"), which does not feature in Figure 6 or in other early views.

Figure 7 is a detail from a photograph with the title "Lenna 1908 showing Signal Station mast with Black Basket at the Cross Trees position [the position of the ball at the transverse spar]". The date may not be precise, but the ball is invariably at this position in ship photographs taken after about 1886. The complete



Figure 7: Photograph titled “Lenna 1908 showing Signal Station mast with Black Basket at the Cross Trees position” (courtesy: Lenna; copy by Martin George).

photograph shows two long sheds on New Wharf, respectively to the left and right of Lenna when viewed from the wharf. The second shed to the left of Lenna was not present in the earlier panoramic views.

The time ball can sometimes be seen in the background in photographs of ships alongside New Wharf, which usually have uncertain dates. The time ball and mast can be seen in a photograph that is known to have been taken in October 1896 (“Kassa dismantled, 1896”). They are particularly clear in a ship photograph titled “Cynisca at New Wharf” that was thought to date to about 1910, but must be earlier as it was taken before erection of the second long shed on New Wharf (unless the suggested date of the photograph shown in Figure 7 is wrong).

5.2 The Size and Construction of the Time Ball

The time ball appears to have had a smaller diameter than the 1.5 m used at Sydney, for example, and for low cost and lightness is likely to have been made of wickerwork. This is consistent with a description of the ball as a “black basket”. A wickerwork ball with

a diameter of 0.9 m was in use at Newcastle, New South Wales, by January 1871, but a new wickerwork ball twice that size was erected in July 1874 (Kinns and Abell, 2009). Charles Todd in Adelaide wrote to Robert Ellery in Melbourne during 1869 about possible use of a wickerwork ball at Semaphore, South Australia, so there are Australian precedents for this type of ball construction (Abell and Kinns, 2010).

5.3 Photographs Appearing to Show a Different Time Ball Location

No explicit statement that the time ball was ever relocated has been found, but Figure 8 appears to show a relocated mast in a photograph of *SS Victory*, which was used as a postcard (courtesy: Peter Allan and Ross Ewington). The photograph may have been taken as early as 1904. The mast appears to be positioned below the signal station building, nearer the waterfront than the original shown in Figure 5. There is no sign of another time ball mast further away. There is some doubling of the image, so vertical poles are thickened. Significantly, a line of poles running downhill from the signal station appears in

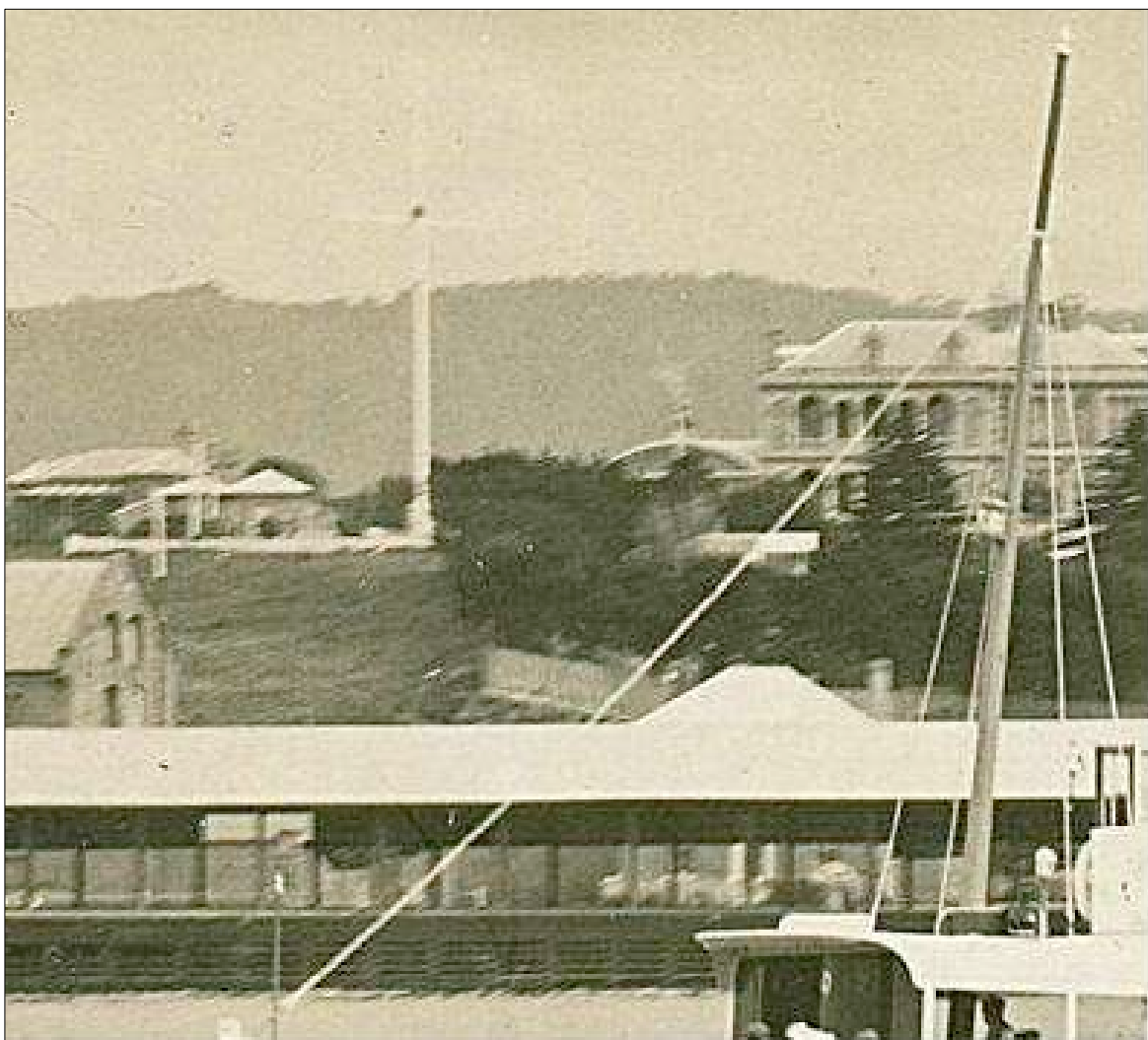


Figure 8: Detail from a postcard of the *SS Victory* by R.C. Harvey, showing what appears to be a different time ball mast and immediately to the left of it the signal station (courtesy: Peter Allan).

Figure 8, as it does in Figure 5. A puzzling feature of this photograph is that the mast appears to be nearer New Wharf than Lenna itself, but this may be an optical illusion. A similar mast can be seen near the right hand edge of a photograph of the barque *Edinburgh* in the W.L. Crowther Library, which was taken before the second long shed had been erected on New Wharf.

Figure 9 is a detail from the latest photograph found so far that shows the time ball. The complete photograph is of the Japanese training cruiser *HIJMS Asama*, which is known to have visited Hobart during 1924 (Vessels in port, 1924). In the full-size photograph the mast appears to be nearer the waterfront than in early photographs.

A single photograph has been found, which suggests that two time ball masts may have co-existed for a period, possibly when a new mast was first erected. Figure 10 shows part of that photograph (“Hobart wharves from the Customs House ...”) believed to date from about 1900, which shows Lenna in the background and the two long sheds on New Wharf. The resolution is insufficient to show much detail

near Lenna, but the signal station and two masts of equal height, perhaps 20 m apart, can be identified. Both masts appear to be carrying a ball. The mast further from the waterfront is in the position shown in Figure 7. It is conceivable that the other mast appears in Figures 8 and 9.

5.4 Final Time Ball Location

A 1950 editorial contained a statement that a new mast had been erected in 1904 and that the time ball had been located on it (Vigilant, 1950):

A few days ago, a new mast was erected at the Battery Point Signal Station. The old one, according to nearby residents, was beginning to show signs of wear. That was not surprising, because it was put up in 1904, to replace one which was erected as far back as 1865. Until 1927, it was customary for a round black ball – known as a time ball – to be hauled to the top of the mast ...

The original time ball location behind Lenna was usually described as on the flagstaff at Fort Mulgrave, rather than the flagstaff at Battery Point. The telegraph signal was, however, described as being

transmitted to the Battery Point signal station when it was first introduced (The one o'clock gun, 1886).

A contemporary report noted that a replacement flagstaff with a height of more than 34 m "... in the same locality ..." had been erected in July 1904, but there was no explicit mention of either the time ball or the long transverse spar (Shipping, 1904). Relocation by a short distance would be consistent with the report:

The erection of a new flagstaff at Battery Point for the signalling of ships was completed on Saturday [30 July 1904]. It is in the same locality as the one it has replaced. When the question of replacing the old mast was under consideration, other localities were suggested, but upon investigation the present position was found to be the most suitable from an all round point of view. The staff is of Tasmanian hardwood: the lower mast is 78 ft. high, and the topmast 36 ft.



Figure 9: Detail from a postcard, showing *HJMS Asama* and the time ball in January 1924 (courtesy: Ross Ewington and Graeme Broxam).

The final time ball location was described similarly in a statement made shortly before the time ball service ended (*The Mercury*, 12 January 1927). "Punctually at 1 o'clock each day a big black ball is dropped from the top of the signal flagstaff at Battery Point at Hobart to mark the hour."

There is sufficient ambiguity in published statements and uncertainty in the dates of available photographs to encourage further research into the location of the Hobart time ball mast. Ideally, official statements that the time ball mast was modified or relocated will be found. The most likely dates are in 1886, when the link with Hobart Observatory was established and it may have been decided to reduce the topmast height, and in 1904 when a new mast was erected.

6 DECLINE OF THE TIME SERVICE

6.1 Reduction of the Time Gun Service

Although the 1880 and 1898 Admiralty lists and *Walch's Tasmanian Almanacs* from 1876 to 1917 implied that there was a daily time gun service, the Sunday service was not offered for years at a time. A

letter (Time gun, 1899) pointed out the service deficiency, which appears to have arisen for economic reasons:

During the few years the 1 o'clock time gun has been unused on Sundays, disappointments, inconveniences, and annoyances to the public have increased. Since, for purposes of economy, the Sunday signal was discontinued, Government matters have fortunately altered.

Gratitude would be felt were any of the members for Hobart, or any member of the House of assembly, to move for the replacement on the estimates of the trifling sum necessary for continuing the SUNDAY TIME GUN.

It is clear from published correspondence that the gun was sometimes out of action altogether for extended periods and that the service was missed by many citizens (Old timer, 1911):

Some time ago it was notified in "The Mercury" that the firing of the time gun would be discontinued for a few weeks, as the gunner's time would be fully occupied attending camp. As the prescribed time has long since elapsed, can you inform your readers how it is that the gun is no longer fired? The citizens of Hobart have so long been accustomed to depend on the daily signal that many are wondering why this public convenience should be suddenly stopped, apparently without any particular reason. A good deal of irregularity in giving the signal has occurred since the Commonwealth Government took over the meteorological service, and it now seems we are to lose it entirely. Is it yet another of the benefits (?) we are expected to accept from the Federal authorities?

The time gun service was in fact continued, but with reduced Government enthusiasm for funding the service. It was only the generosity of individual citizens and businesses in Hobart that allowed the service to be continued into the 1920s.

6.2 Budget Problems

The cost of the time gun operation dominated arguments about whether it should be continued after WWI. The firing of the gun had been discontinued by May 1924, but there were frequent protests. An editorial indicated that there was considerable support for revival of the service, but that there was unlikely to be any government funding (The time gun ..., 1924). A letter and a supportive editorial were published a few days later (Sandy Bay resident, 1924; The one o'clock gun, 1924). An editorial on the following day (The time gun, 1924) gave the costs in previous years:

As bearing on the restoration of the time gun, which was for many years fired at Hobart at one o'clock daily, as advocated by many residents of the city, the cost of maintaining "the service" is of considerable interest. It was ascertained from the Town Clerk (Mr. W. A. Bain) yesterday that the expenditure for the year ended June 30, 1922, was £100 13s. 4d., and for the following year, ended June 30, 1923, £90 4s. 5d. For the six months ended December 31, 1923, the cost of the time signal was £54 5s. 3d. Mr. D. H. Harvey had for several years made a donation of £50 per annum towards the expense of firing the gun.

The necessary funding appeared to have been allocated at the end of 1924, but it may never have been used (One o'clock gun, 1924):

The Finance Committee reported to the City Council



Figure 10: Photograph titled "Hobart wharves from the Customs House ..." (courtesy: Photographs and Glass Plate Negatives Collected by E.R. Pretzman, Tasmanian Archive and Heritage Office).

last night that the arrangement made with the proprietary of "News" Ltd. for the firing of the 1 o'clock time gun expired on November 30. The proprietary, however, had intimated its willingness to continue to bear a third of the cost, and Mr. D. H. Harvey, who formerly donated £50 per annum for the purpose, was also willing to contribute a third. The committee recommended that these offers be accepted with thanks, and that the Council bear the remaining one third. The annual cost was estimated at from £140 to £150. The report was adopted.

The service was missed for years afterwards by at least some Hobart residents (Back, Tasmania, 1926):

I am surprised "The Mercury" has not had complaints – and a big number of them – about the demise of our old friend, the one o'clock gun. The population of Hobart and district, served by that old time signal, so faithfully for many years, is well over 50,000, and judging others by my own house, I should say that few families failed to set either clock or watch by the gun. Is the cost such a big item that we cannot afford it?

No direct evidence has been found that the time gun service was actually reinstated after 1923. It was said that Tattersalls provided the necessary funding until 1927, when the time service ceased altogether (Collier, 1953a, 1953b). David Hastie Harvey, who died in 1927, was part owner and manager of that company, so this is probably a reference to his donation (courtesy, Graeme Broxam). In fact, a statement that "... firing of the gun was discontinued some time ago ..." was made when it was announced that the time ball service would soon cease (*The Mercury*, 1927).

A history of Queen's Battery noted that

By Federation the battery was clearly obsolete – Tasmania's isolation provided its best protection. Its major function had become the firing of the one o'clock gun, a 70 pounder which enabled Hobartians to set their clocks until 1923 when modern clocks made it an unnecessary financial burden. (Terry, 1999).

It appears that the time gun service had ended by 1924.

6.3 The End of the Time Ball Service

The time ball service survived longer than the time gun, but its final demise was also attributable to budget limitations (*The Mercury*, 1927). The annual £5 1s 6d cost of the telegraph line to the signal station had been borne by the State Government, but budget transfer to the City and the increasing availability of radio signals led to cessation of the time ball service. It has been established from Marine Board records that the final drop occurred on 19 February 1927 (Collier, 1953b). It was reported a few days later, when it was noted that the ball had already been removed (The last drop, 1927).

7 DISCUSSION AND CONCLUDING REMARKS

Many town citizens greeted time guns with enthusiasm when they were introduced as a means of regulating clocks and watches, but others resented the intrusion. They were valued for their role in allowing mariners to check their chronometers, but the slow speed of sound propagation had to be taken into account. Naval officers and leading astronomers favoured time balls, dropped automatically to a fraction of a second accuracy using an electric telegraph

signal from a well-equipped official observatory. Hobart was the only Australian location to be listed by the Admiralty as having both a time ball and a time gun as official signals. The provision of time signals in Hobart mirrored international developments, but the budget was limited and skilled staff had to make do with inferior equipment.

The Hobart *Mercury* published reports about time signal developments worldwide, many in considerable detail. The 1861 introduction of a time gun in Edinburgh, deliberations by the Royal Society of Tasmania in 1865 and some remarkably sophisticated acoustic trials in Hobart in 1868 were early features.

The official time ball and time gun service in Hobart began in March 1875. The time ball was the primary signal, but it was operated manually until November 1910. The gun was always fired manually when the ball was seen to drop. The gun was relocated in April 1875 from near the time ball at Battery Point to Queen's Battery in the Domain, as a response to protests from residents. The gun was fired from Queen's Battery until the service ended almost half a century later.

The time ball mast was close to 'Lenna', now a hotel, at Battery Point. The ball was painted black and was made of wickerwork. Its diameter was smaller than the 1.5 m favoured at several Australian mainland locations. It can be seen in photographs taken between the 1870s and 1920s. The mast had a long transverse spar. Photographs taken before about 1880 show a very high topmast, with the ball in a rest position well above the spar. The topmast appears to have been reduced in height by 1886, with a lower rest position for the ball. A flagstaff with a height of 34 m, which may have been the time ball mast, was replaced in July 1904. Three photographs appear to show the time ball on a mast positioned nearer the waterfront than the original. Another appears to show two time ball masts separated by a short distance, as might have occurred temporarily if a new mast had been erected, but no written evidence has been found that the time ball was ever relocated.

Hobart astronomers and horologists, using private observatory and clock facilities, were the source of time until the end of August 1886. The time ball operator referred to a chronometer that was checked weekly against the regulator clock, itself calibrated using transit observations. From September 1886, an electric telegraph signal from Hobart Observatory in the Military Barracks was used. Preliminary signals led to raising of the ball and priming of the gun. Naval reports of 1894 and 1908 highlighted deficiencies in the instruments, clocks and procedures for dropping the time ball, which led to ongoing Admiralty qualifications about the accuracy of the time ball signal. They both recommended upgrading facilities in Hobart. The source of the telegraph signal was changed from Hobart Observatory to Melbourne Observatory during February 1910. The service was still unreliable and there was a new campaign to upgrade Hobart Observatory facilities during October 1910, but funds were not made available. After November 1910, the ball was released automatically by telegraph from Melbourne.

The transfer of telegraph signal costs from the State Government to the City precipitated the end of the time ball service in February 1927. By then, radio time signals were becoming widely available and the service was no longer essential. The costs of gun operation had been funded largely from private and business sources after the end of WWI. The time gun service probably ended in 1923, although it had been discontinued from time to time before that.

Further research is needed to resolve ambiguities in photographs and descriptions of time ball location during its period of service. Furthermore, was the time ball ever changed between introduction of the time service in 1875 and its final demise in 1927?

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