100 Years of National Topographic Mapping

Nineteenth Century Exploration Mapping: William Wills' Mapping of the Ghastly Blank

F. J. Leahy
fjleahy@unimelb.edu.au

Abstract

What is now known as the Burke and Wills Expedition started life as the Victorian Exploring Expedition of the newly formed Royal Society of Victoria. It was planned to be essentially a "scientific" expedition. The newspapers of the day referred to the mapping of inland Australia as the *Ghastly Blank* and major goal of the expedition was to provide some mitigation. Members of the party where chosen with a view of having recorded what botany, zoology, geology and meteorology was encountered. Much scientific work was done – unfortunately it is largely unpublished and forgotten due to the expedition's traumatic ending. William John Wills was chosen to be the expedition's "Surveyor, Astronomical and Meteorological Observer" and was the only "scientist" to be included in the small party which reached the north coast.

In the planning phase it was proposed that Wills should have an assistant. That did not occur and so his full list of tasks was daunting. Apart from navigation and charting, his duties included the keeping of meteorological records, noting astronomical phenomena, measurement of the magnetic field and barometric heighting – and he was the only member of the party pushing on to the Gulf of Carpentaria to keep a journal of any significance. At the conclusion of the expedition Wills' navigation attracted much ill-informed criticism and misinformation repeated in almost every publication up to the present day.

The paper identifies the inland mapping of previous explorers which was available to assist Wills in his charting of his track across Australia's continent, reviews his methods and endeavours to show that his techniques were sound and his accuracy exceptional.

Introduction

On August 31st 1858, when Sir William Stawell, President of Victoria's Philosophical Institute, announced that an anonymous donor had offered £1,000 to support exploration into Australia's interior, the Melbourne *Argus* quickly realised it was onto a good news story – especially if the offer was taken up. The *Argus* editorial of the next day could be seen to be heavily promoting an adventure that might provide particularly saleable news for many months. As it turned out, it proved to be a wise investment – aspects of the planning, execution and traumatic ending of the expedition were to dominate the news over the years and particularly those of 1860 and 1861.

There was a condition to be met to secure the £1,000 – namely; a further £2,000 had to be raised, within a year, by public subscription. The *Argus* believed this would not be a problem, saying:

The sum required to be raised by public subscription is so insignificant in comparison with the wealth of this colony and the magnitude of the object proposed to be accomplished, that we should imagine it will be speedily raised.

The paper reserved its more powerful language to suggest to the citizens of Melbourne that the exploration being considered would lead to great advancements in both science and commerce and, in fact, it was almost a sacred duty to support it. The editorial concluded:

A ghastly blank *will no longer stare us in the face when we bend our eyes upon the map of this continent, and the track of the explorers winding over that white plain, may become one of the highways of commerce dotted with centres of population, and vital with the ebb and flow of a periodical tide of travellers. (The Argus 1861A)*

The phrase *a ghastly blank* must have struck a chord at the time and for long after as it appears so frequently in the literature associated with the Burke and Wills Expedition. Moorhead's very popular book "Cooper's Creek", published in 1963, has the opening chapter headed "The Ghastly Blank". Moorhead goes on to explain:

The notion of an inland sea arose from the fact that the mountains so far discovered on the eastern seaboard and all the principle rivers, the Murray, the Darling, and the Murrumbidgee, flowed inland from these mountains towards the west; and in the west lay a tremendous unexplored tract, an area some 1600 miles long by 800 miles wide, bounded by the 20th and 32nd degrees of latitude and the 115th and 140th degrees of longitude: an area more half the size of Europe. This was 'the ghastly blank'. (Moorhead 1963)

The Expedition

The expedition mounted by the Royal Society of Victoria in 1860 was originally known as The Victorian Exploring Expedition Victorian (VEE) – now universally recognised as the Burke and Wills Expedition due to its dramatic ending and deaths of the major players - Robert O'Hara Burke and William John Wills.

The expedition had a long gestation. The Royal Society of Victoria grew out of the Philosophical Institute of Victoria when the latter was granted a Royal Charter in November 1859. The Royal Society inherited an "Exploration Committee" which had been meeting since 1857. Discussions dragged on until 1860 when the Victorian Government added £6000 to the exploration fund of £2200 raised by public subscription. In rather short order for the Exploration Committee, Burke was appointed leader, although the subject needed to be considered at a number of meetings with the resolution being far from unanimous. One appointment that appears to have been quickly resolved (probably in recognition that Burke did not have the skills) was that of William John Wills as the Surveyor, Astronomical and Meteorological Observer.

The expedition itself was brought together with a good measure of chaos at Royal Park in Melbourne. The party of 17 men, 26 camels, 28 horses and 6 wagons, made its way out of that Park on the afternoon of 20 August 1860, to camp at Queens Park in Moonee Ponds. An outline of the full expedition is shown in Figure-1 where every third or fourth camp site is plotted. The party's leaders reached Swan Hill on 6 September – the heavily loaded wagons having been bogged at Bulla arrived some days later. The expedition set out for Balranald on 11 September arriving on the 15th and moved off for Menindee two days later.

The journey from Balranald to the Darling River was fraught – stormy weather, bogged wagons, horses and camels repeatedly lost. Burke, with Wills navigating, took off ahead of the camels and wagons carrying the stores, and reached the river at Bilbarka on 25 September – Bilbarka being close to today's township of Pooncarrie. Further delays occurred; the wagons were bogged down in the sandy mallee country, horses and camels were lost again, arguments flared resulting in sackings and resignations. Other members were hired.

After weeks of delays, the party made the frontier settlement of Menindee on 15 October where Burke divided the party and set off for Cooper Creek on the 19 October. The reduced party included Wills, Grey, King, Brahe, Patton, Mcdonaugh, Patten and Dost Mahomet and with local man Wright volunteering to act as guide. On 30 October, Wright returned from Torowato with orders to follow up with the remaining personnel and stores. (In all the reporting of the events, little mention is made of the two guides recruited from the local aboriginal community.)

A depot was established at Cooper Creek in the last week of November 1860. On 12 December and without waiting for the support party, Burke moved off with Wills, King and Grey towards the Gulf of Carpentaria leaving Brahe in charge of the depot. The Gulf was reached on 12 February 1861. The return to the depot was a struggle, camels failing, rations short and their health deteriorating. Grey died on 16 April, the others arrived back at the depot on the evening of 21 April to find a note from Brahe to say no support had arrived from Menindee and his party had left that morning.

Too weak to follow Brahe, the three failed in their attempt to escape to the nearest homestead in South Australia and with food exhausted Burke and Wills succumbed at the end of June. King was cared for by the aboriginal community on Cooper Creek until rescued by Howitt in September.

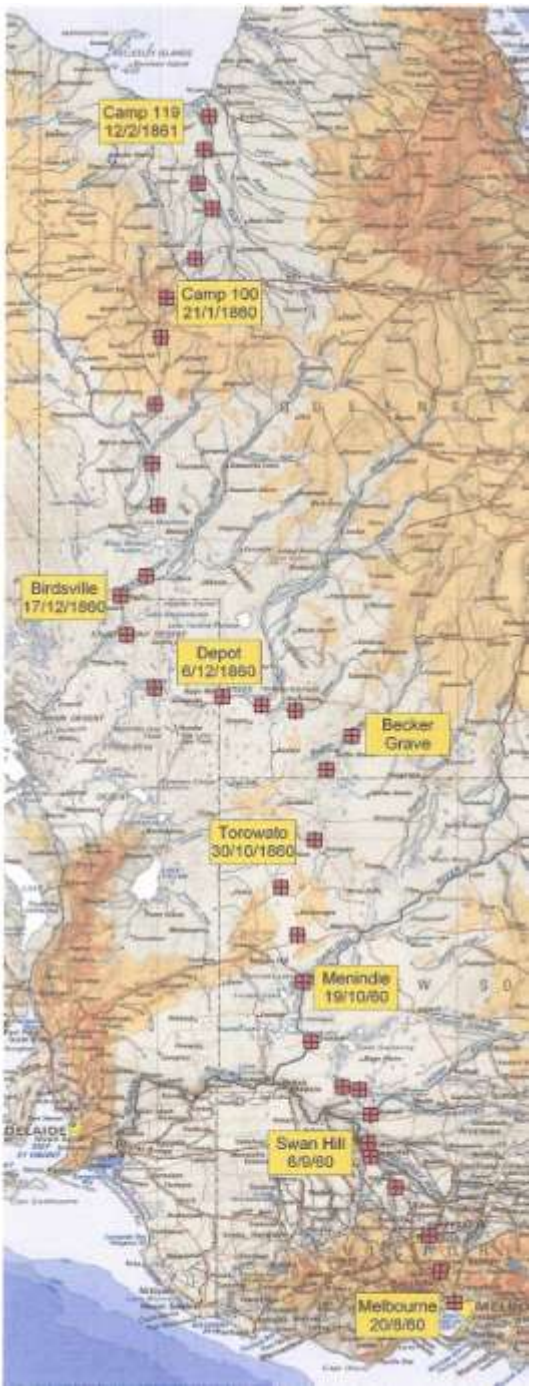

Figure 1. Track of the Burke and Wills Expedition

The mapping of inland Australia by 1858

It could be inferred from Moorhead's description of The Ghastly Blank, that it was widely believed in 1858 that the rivers of western New South Wales ended in *a tremendous unexplored tract* and possibly *an inland sea*. Oxley's explorations in 1817 and 1818 and the discovery of a number of westward flowing rivers (Lachlan, Macquarie, Bogan) had given rise to the intriguing thought that these may debouch into an "inland sea" in the centre of continent. Moorhead was somewhat wide of the mark in this as by 1830 the explorations of Sturt had gathered enough evidence to show that the rivers of any consequence flowed into the Darling and thence to the Murray and down to the sea in South Australia. Sturt himself however, retained the dream of an inland sea and with this in mind he set out again in 1844 from the Darling at Laidley Ponds (Menindee) to explore the centre of the Australian continent. His confidence in finding inland waters was such he carried a boat on one of his bullock wagons. He moved north to discover Eyre and Cooper Creeks but ironically, it was lack of water that prevented him from reaching his goal (Sturt 1849). Despite what Sturt saw as a failure, his mapping of the expedition was excellent and played a major role in determining the path of the Burke and Wills Expedition.

Exploration of the north of the continent was equally unsuccessful in the search for sizeable rivers running out of the centre. The coastal surveys of Flinders, King and Stokes (Perry 1982; Horden 1989) had not discovered in the Gulf of Carpentaria any river of the size long looked for. The most thorough of the coastal surveys was that of Stokes (in the H.M.S. Beagle of Darwin fame) in 1841. Stokes was repeating Flinders' 1802 survey of the Gulf of Carpentaria in the *Investigator*. Knowing that the *Beagle* drew at least half a metre less than the *Investigator*, Stokes could keep closer to shore – as Horden remarks:

> *. . . Flinders could have missed a river at the bottom of the Gulf, and Stokes hoped to find one there. This was his last chance to find Australia's Nile. The FitzRoy, Adelaide and Victoria had all disappointed him: none had led to the heart of the continent. (Horden 1989)*

The land exploration of the northern coast by Leichardt in 1845 and Gregory in 1855 confirmed that the thought of finding a Nile flowing out of Australia's interior was fanciful. On the other side of the continent, Eyre's coastal expedition from Adelaide to Albany in 1840 had discounted the likelihood of a river of any size meeting the southern seas.

Probably the best known summary of the mapping of inland Australia available in 1858 could be seen in that published by John Arrowsmith in 1845 and shown in Figure-2. The number of references to this map in the contemporary literature associated with the Burke and Wills Expedition indicate that it was widely available and regarded as definitive. (Had this conference been titled *200 Years of National Topographic Mapping*, John Arrowsmith's work might have been the subject of a number of papers.) "The Ghastly Blank" is clearly displayed. The coast line is well mapped with Arrowsmith accrediting John Clement Wickham and John Lort Stokes of the *Beagle* for a major part – but the work of Cook and Flinders is still evident (Perry 1982). The mapping of the southern coast is likely to be derived from Flinders, his nemesis Baudin or Eyre's land exploration of 1840.

When it comes to inland Australia, little is shown between the north coast and Lake Torrens in South Australia and the Darling River in New South Wales. Leichardt's expedition could have been still in the field at the time of publication and so it is not surprising his mapping is not included. However, it is of interest, that the position of Sturt's party on February 13th

1845, early on his 1845/46 expedition is shown. One could wonder how Arrowsmith in London, obtained that information - this expedition did not finish until early 1846.

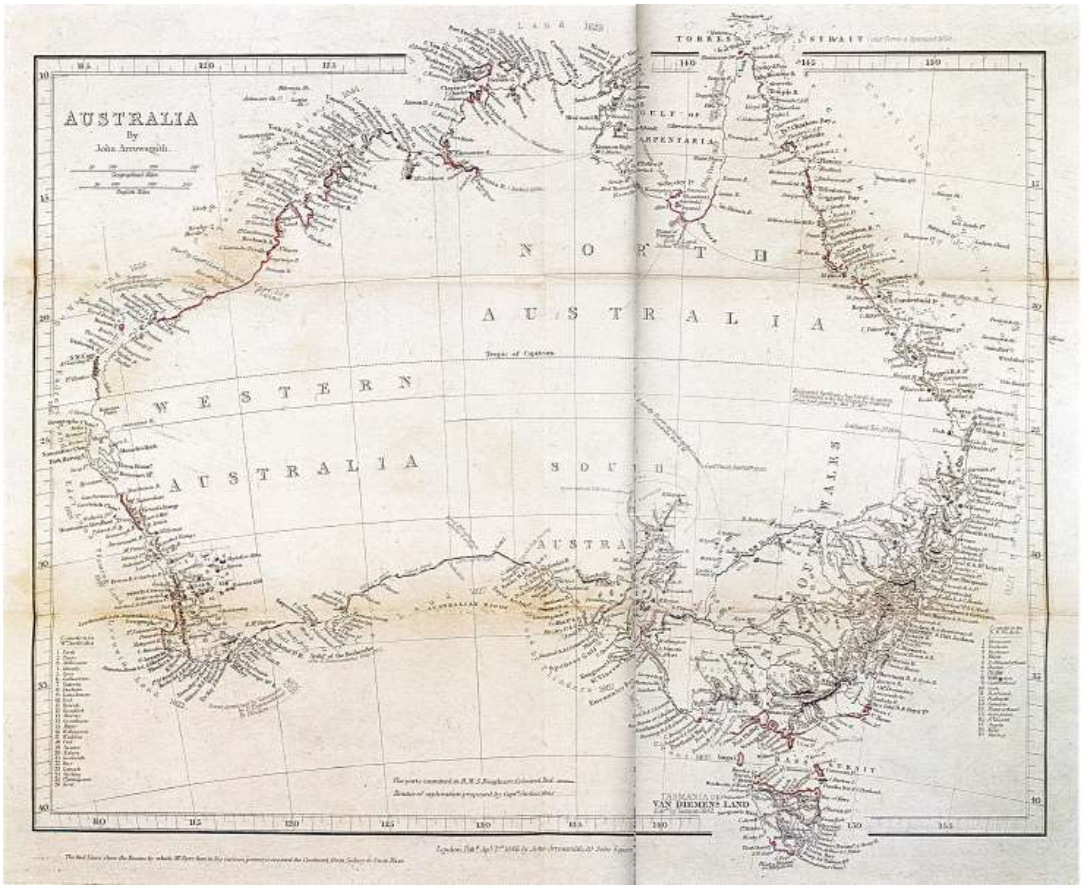

Figure 2 John Arrowsmith's 1845 map of Australia

Mapping available to the Burke and Wills Expedition

For many reasons Burke was an extremely poor choice for leader – the one highlighted here being that he had no knowledge of navigation. Leaders of similar expeditions came from a surveying, mapping, broad engineering or naval background and had some experience of navigation - many were well versed in astronomical navigation.

Baron Von Mueller, the Victorian Government Botanist, was one of the few members of the Royal Society with experience in exploration as he had been on Gregory's 1856 renowned expedition traversing from the mouth of the Victoria River (now in the Northern Territory), across the Gulf of Carpentaria and eventually down to Brisbane. Von Mueller read a paper to the Philosophical Institute of Victoria (forerunner to the Royal Society) in November 1857 (Mueller 1857) in which he gave an excellent review of the exploration of Australia to that date and cogently presents the reasons and possibilities for further expeditions – which did not, incidentally, include the view that any inland sea or large river would likely to be found. The paper was obviously aimed at influencing the Philosophical Institute (and later the Royal Society) to take up the challenge of exploration in the name of the relatively new colony of Victoria.

Von Mueller had strong advice about the need for precise mapping of the exploration saying:

> *The survey should be exact, and independent of the use of chronometers and above all, the positions of permanent waters should be marked with scrupulous accuracy. On this may depend the lives of those who may steer for the positions of a former explorer after the obliteration of his track, particularly in our depressed interior where bearings are not always to be secured.*

We might wonder at his seemingly ill informed comment that the survey should be *independent of the use of chronometers*. By 1860, the practice of determining precise longitude by a relatively simple astronomic observation with Greenwich Mean Time (GMT) provided by accurate chronometers, was well established. The alternative to chronometers was to establish GMT by "lunar distances". The time so determined was less precise than when chronometers were at their best, the observation difficult and the computation long and complex. Gregory had a low regard for chronometers after his navigation had suffered from their poor performance and advised other explorers against their use - his experience showed the technology was not robust enough to keep good time over months of transport on horseback. Before setting out in October 1861 on an expedition in search of Burke and Wills, the explorer Landsborough writes:

> *I have got a sextant for taking the latitude, but I have not a chronometer, as Mr. Gregory thought the jolting it would get should render it useless (Landsborough 1862).*

While Arrowsmith's map was the most widely published source available to Wills, the more useful material came from the later surveys of Sturt, Leichardt and Gregory – a summary of these explorations can be seen in (Favenc 1998). In attempting to reach the "centre of the continent", Sturt had discovered the permanent waters of Cooper Creek after earlier pushing northwards along the more ephemeral Eyre Creek until lack of water forced his retreat. The instructions issued to Burke by the Royal Society's Exploration Committee focussed on both sites saying:

> *The Committee having decided on Cooper's Creek, of Sturt's, as the basis of your operations, request that you will proceed thither, form a depôt of provisions and stores, and make arrangements for keeping open a communication in your rear to the Darling . . . . The object of the Committee in directing you to Cooper's Creek is, that you should explore the country intervening between it and Leichhardt's track, south of the Gulf of Carpentaria, avoiding as far as practicable, Sturt's route on the west, and Gregory's, down the Victoria, on the east.*

In 1849, John Arrowsmith had published the *Map of Captain Sturt's Route from Adelaide into the Centre of Australia*. (Perry 1982) – the southern section of this detailed map is shown in Figure-3. With the Exploration Committee's instruction to use *Cooper's Creek, of Sturt's, as the basis of your operations*, we can assume Wills had studied this map so as to become familiar with Sturt's locations for Cooper and Eyre creeks – he possibly carried a copy. His diary for Sunday, December 16th 1860 records:

> *The two horses having been shod, and our reports finished, we started at forty minutes past six a.m. for Eyre's Creek . . . (The Argus 1861B)*

With Surt's track so well mapped from Menindee to Cooper Creek, it seems odd that Burke did not follow it. For some reason, he moved more or less due north from Menindee and well east of Sturt's track. He was being guided over this stage by Wright, the "bushman"

employed by Burke at Menindee. The party initially moved north, almost to the latitude of Sturt's Cooper Creek, and then moving west to form a depot on one of its permanent waterholes – the well known Camp 65, the site of the present day tourist attraction of the "Dig Tree".

In leaving Camp 65 and moving towards Eyre Creek, the party travelled a little to the north of Sturt's earlier track and were lucky enough to come upon the Diamentina River – a much better prospect than Eyre Creek for further travel north. By its very nature, exploration of inland Australia in the mid-nineteenth century is marked by its capriciousness. Sturt must have made his way across the lower reaches of the Diamentina but did not recognise it as a major inland water course, no doubt due to its transient nature, both over time and space - a property it shares with many inland waterways.

Sturt made a big issue of his discovery of Eyre Creek (Sturt 1849) – one that captured the interest of the Exploration Committee of the Royal Society. In the hindsight of Google Earth, it can be seen to be a minor stream, and in reality, leading into a ghastly blank. It is interesting to conjecture on the course his exploration would have taken had Sturt shared Burke's fortune in stumbling onto the Diamentina.

Figure 3 Arrowsmith's map of Sturt's expedition to Cooper Creek

Burke's party followed the Diamentina through the present day township of Birdsville but then (in Wills words) *Finding that the creek was trending considerably towards the east* (The Argus 1861B) they left the river and set off due north along the 140th meridian – it would seem that now their interest was focused on the Gulf of Carpentaria and getting there as soon as possible. And it would appear to be one of the few times Burke followed his instructions closely as he was now *avoiding as far as practicable, Sturt's route on the west, and Gregory's, down the Victoria, on the east.* (Gregory's Victoria River is now the Barcoo which can be seen to be the upper reaches of Cooper Creek.) It has been argued that up to this stage, Wills was navigating through known country - both Sturt and Gregory had been to Cooper Creek previously. But it should also be recognised that the expedition's path through New South Wales was new and had neither been formally explored nor mapped.

The expedition was now in unexplored territory and Burke's obsession was becomes clear; to be the first European to make a north/south crossing of the Australian continent. The scientific tasks set for Burke were largely ignored – both the botanical collector and naturalist were left at Menindee. (Although it should be noted, Wills had trained Brahe, who remained at the depot, to observe and record meteorological data. This he did assiduously over a four month period. Wills and Brahe are now accredited with establishing Australia's first inland meteorological station.)

Wills day to day task was now to map the expedition's movement over the uncharted area between the Diamentina River and the Gulf of Carpentaria. The party progressed close to the 140th meridian until the watershed between south and north flowing rivers close to Camp 100

- some 40 kilometres west of the present day Cloncurry. On descending from the range good travelling (with water) was found firstly along the Corella Creek which joined Cloncurry River and then the Flinders River to lead the party to the Gulf. The members were understandably anxious as they approached the coast as it was now nearly 2 months since departing Cooper Creek with just 3 months' supplies. The questioning of the survivor King at the (Commission of Enquiry 1862) gives a rare insight into Wills' use of previous exploration mapping:

> *Q816. Who first made the discovery of reaching the sea, or did you all come upon it reaching the salt water where the tide was ? - Mr Wills knew it; he had told us two or three days before we reached the salt water that we were in the country that had been discovered by Mr Gregory and other previous explorers.*
>
> *Q817. Some days before you got upon it he told you that? - Yes, and showed us on the chart the supposed place where Mr Gregory crossed this small creek.*

Evaluation of Wills' navigation

When it came to navigational duties, the critical components of the Exploration Committee's instructions to Wills were carried in the first four sections (Committee of the Victorian Exploring Expedition 1860):

1. *Every opportunity should be taken to ascertain the geographical position of the party, referring it to some well marked point,. . . . .*

2. *This should be done by astronomical observations, as well as by dead reckoning. The dead reckoning always to commence with the last good, reliable astronomical observations made.*

3. *For determining the Latitude, the different methods chosen to depend entirely upon circumstances, and it is only mentioned here that observations on sun, moon and stars will have to be used.*

4. *The determination of the Longitude should be effected by lunar distances; if with stars, eastern and western distances should invariably be taken when possible, and the longitude should be derived from both sets. These observations, as well as those on latitude, should always be reduced immediately after the observations, or at least as soon after as possible. The longitude should further be ascertained whenever an opportunity occurs by occultation of stars, by eclipses of the sun, moon and Jupiter's satellites. There is no necessity, however, for reducing these observations whilst on the journey, as it would be impossible to devote that amount of care to this work without interfering with the more essential work, and which would be desirable; and the original observations should, as early as possible be clearly copied with ink, in a book, with every fact necessary for the subsequent reduction.*

The later sections go on stipulate that he should (possibly in his spare time) also observe all astronomical phenomena of interest, make frequent determinations of the variation of the compass, trace the zodiacal light on a good star chart, keep a lookout for meteors, take meteorological observations, take barometric heights of critical points, record the temperature of rivers and lakes, note the direction of the flight of birds and take *magnetical* observations.

In navigating, Wills followed his instructions closely. Each day the party's movement was plotted by "dead reckoning" after recording the magnetic bearing and the time taken on each leg of the day's traverse – the distance being calculated by applying the assumed speed of travel. Wills records the difficulty of estimating the distance when the topography prevented straight-line travel. His records show the figure of 2.3 nautical miles an hour on some sections and 2.0 at others. Latitude observations were taken every two or three days and the intervening dead reckoning "adjusted" to fit the difference in latitude. Wills was taking azimuth observations to keep a close check on the magnetic declination and so had confidence in the accuracy of his compass readings. Consequently, he uses a clever variation of Bowditch's Rule to make the adjustment where the distances only are adjusted and the bearings retained. As the travel was mainly northwards, the process worked well in determining latitude but provided little control of longitude.

Accurate longitude determination was a bigger problem. Wills' astronomic records show he kept a comparison of his two "chronometer watches" and which show them to drift apart by up to 40 seconds a day. This would preclude their use to determine precise longitude by the traditional observation of timing the altitude of stars. Thus Wills resorted to "lunar distances" to determine Green Mean Time (GMT) and subsequently longitude by the traditional observation. The lunar distance process is based on regarding the moon's full circle movement through the stars every 27.3 days as a clock. In 1763 Nevil Maskelyne, fifth English Astronomer Royal, advocated a system where the angles between the moon and select stars along its path be computed in advance for particular instances of GMT and tables of these were published in the nautical almanac. Time could then be established at any position on the earth (and independent of a local time piece), by measuring the angle between the moon and one of the selected stars (the lunar distance) and then, by interpolation of the published tables, establishing the instant of GMT (Wikipedia 2010).

Due to the slow relative movement of moon through the stars, the time so determined cannot be very accurate. In the best of circumstances (lunar distance to a star directly in the path of the moon), a sextant recording to the nearest 10 seconds of arc will determine time to no better than 18 seconds. (And it is doubtful that under the circumstances, Wills would have been able to take a single lunar distance with an error as small as 10 seconds of arc.) Errors in time transfer directly into errors in longitude - an error of 18 seconds of time being equivalent to just over 9 km in longitude. Another deterrent to using lunar distances is that the observation itself is difficult (the sextant has to be held at an awkward angle) and, at the time, the computation was no less than tortuous. It appears that Wills observed lunar distances only at critical points of his traverse and observations are weeks apart – a series of seven were made as the party turned to retreat from the Gulf.

Unfortunately much of Wills navigational records have been lost. The surviving records of navigation over the critical northern section, Cooper Creek to the Gulf of Carpentaria, consist of his journal or diary (The Argus 1861B), working chart (Public Records Office of Victoria) and astronomic observations (Wills 1861) for the return track from the Gulf. There is also a "work book" showing computations of dead reckoning and astronomic observations over the section between Menindee and Cooper Creek (Wills 1860). While not contributing to the navigation north of Camp 65 it allows great insight to Wills computational methods. The astronomic observations made on the return from the Gulf finish at Plant Camp. At this site, Wills was forced to abandon (and "plant" for later recovery) his astronomic instruments due to camels failing. "Plant Camp" is Return Camp 46 which is close to the forward Camp 79.

Camp 65 (site of the "Dig" tree on Cooper Creek) and the most northerly Camp 119 (close to the Gulf) are well known. These were visited by others soon after the expedition and blazed trees are still in evidence. Wills' mapping of Camp 65 is remarkably accurate having discrepancies of just 120m in latitude and 440m in longitude when compared to GPS values. His latitude for Camp 119 is also accurate – a discrepancy 309m. Wills plotted the longitude of this site 11.1km from its GPS position. As discussed, a discrepancy in longitude of this magnitude is to be expected with the technology available to Wills.

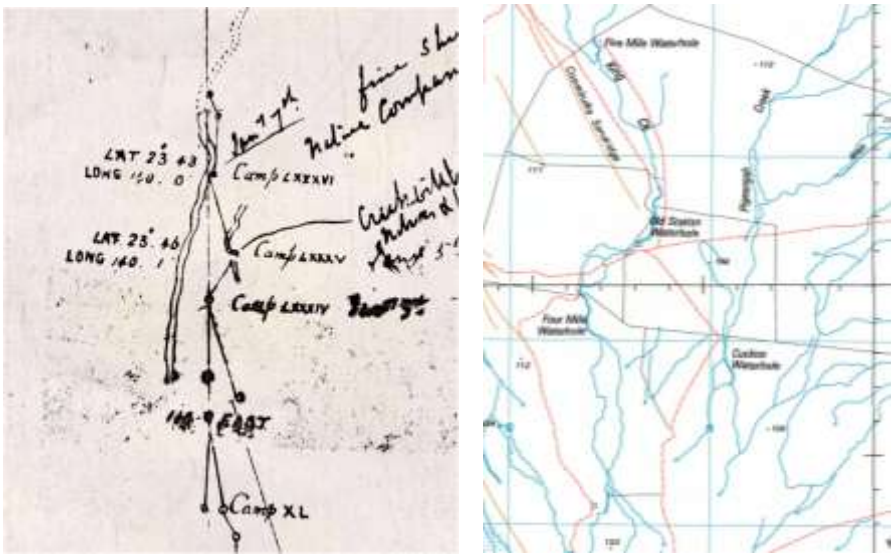

Figure 4 Wills' depiction of Camps 85 and 86 and modern mapping of these sites.

Wills' charting is rudimentary as would be expected in a working document under the conditions it was prepared. But matching this with the journal description of camp sites and the astronomic observations, has allowed a number of other camp sites have been located. For example; figure-4 shows Wills' mapping of two waterholes, being the sites of camps 85 and 86, alongside the NatMap 1:250000 map of the same area.

Figure 5 Blazed trees on Cuckoo and Old Station Waterholes.

In comparison to the positions of the waterholes shown on modern maps, Wills plotted the camp sites about 2km north and about 8km to the east – again, discrepancies of magnitudes to be expected. An investigation of the sites was undertaken in 1984. The waterholes themselves and the intervening country closely match Wills' diary descriptions. Figure-5 shows the blazed trees found – the first on Cuckoo Waterhole, the second on Old Station Waterhole.

From these and other sites, a picture of Wills' accuracy of charting can be formed and is shown in Table-1. It should be noted that at camps 65, 119 and r46 (Return Camp 46) where the discrepancies are small, Wills took star observations for latitudes. For sextant observations, the precision is remarkable. It appears from the records, that no latitude observations were taken at camps 85, 86 and 88. These coordinates are likely to be from adjusted dead reckoning an indicate that overall, errors in Wills' latitudes will be no more than 2.5km. It can also be seen that at Camp 119 the longitude error is 11.2km – still an impressive result for navigation in 1860 over a 1200km track.

Camp	Latitude error-km	longitude error-km
65	0.6	0.7
85	2.1	9.1
86	1.4	11.7
88	2.3	10.7
119	0.3	11.2
r46	0.4	8.1

Table 1 Errors in coordinates of sites plotted on Wills charts.

The criticism of Wills' navigation

Almost from the time of the expedition's conclusion, Wills' navigation came in for criticism. The explorer Giles was so scathing of Wills' navigation it raises the possibility of his harbouring some deep-seated animosity towards the expedition in general and Burke and Wills in particular. He wrote (Giles 2004):

> *. .the leader was the wrong man. He knew nothing of bush life or bushmanship, navigation, or any art of travel. Robert O'Hara Burke was brave, no doubt, but so hopelessly ignorant of what he was undertaking, that it would have been the greatest wonder if he had returned alive to civilisation. He was accompanied by a young man named Wills as surveyor and observer; he alone kept a diary, and from his own statements therein he was frequently more than a hundred miles out of his reckoning.*

And again:

> *The money this expedition cost, variously estimated at from 40,000 to 60,000 pounds, was almost thrown away, for the map of the route of the expedition was incorrect and unreliable, and Wills' journal of no geographical value, except that it showed they had no difficulty with regard to water.*

The more renowned explorer A. C. Gregory was equally critical - an attitude he maintained until late in life. The historian A. W. Jose says of an interview with Gregory in 1899:

His chief theme was that the Burke and Wills fiasco, which he attributed more definitely to Wills than is usual, because Wills had learned surveying at Melbourne Observatory: "The worst place in the world in those days for practical work". Consequently he was all out in his longitudes and somewhat out in his latitudes so that the track as plotted from Cooper's Creek lay for the most part a good deal west of that plotted from the Gulf. That was largely responsible for the delay on the southern journey which caused them to miss Brahe: but a contributing cause was Burke's violent temper which drove him to attack Gray with a tomahawk for stealing provision, and lost them a day because they had to watch Gray die, and bury him.

When it comes to Giles' statement, analysis of Wills' navigation in the light of modern mapping totally discounts the claim that he was *frequently more than a hundred miles out of his reckoning*. And Giles should not be too confident of his own navigation. He had the advantage over Wills in that his charts were drawn on return from his expeditions and after time to complete the full navigational computations and inclusion of mapping of other explorers. Nevertheless, in his plotting of explorations in remote Western Australia, comparisons with modern mapping show the location of the critical Queen Victoria Spring has errors of 3 km in latitude and 21 km in longitude and Mt Labouchere 49 km in latitude and 26 km in longitude.

Gregory was critical of Wills' training, although Wills started with training similar to Gregory himself. Wills began his surveying career on cadastral surveys as an assistant to Frederick Byerly – later a cadastral surveyor and engineer of some renown in Queensland (Kitson and Mckay 2006). Wills took the examinations for obtaining a "Certificate of Competency" with (Hardy 1943) stating he qualified for the certificate in 1858 after topping the examination for (positional) astronomy. But most important was Wills' work with Georg von Neumayer at his "Meteorological and Magnetical Observatory" in Melbourne (Morrison 2006). (Bonyhady 1991) says of Neumayer that he *worked like a madman; when interrupted looked at his watch every 5 minutes and was happy only when talking of magnetism*. And that Wills was similarly obsessed with astronomy. Neumayer offered Wills a room at the observatory and Wills saw this as a great advantage as *it allowed him to discuss astronomy and magnetism with Neumayer even at mealtimes.*

Neumayer was a remarkable man by any measure being thoroughly educated in the German tradition at the *elite Gymasium and Lyceum in Speyer from 1842 to 1845 . . . before studying at the Polytechnic and then Engineering schools in Munich.* On graduation (Ph.D.) in 1849, he *was appointed as an assistant. . . . to the Scottish-German astronomer, geophysicist and instrument maker Johann von Lamont* (Morrison 2006). Lamont had worked with Gauss. Gregory was possibly unaware of Wills' pedigree in the theory of positional astronomy - Gauss, Lamont and Neumayer.

In the final analysis, Wills' navigation appears to match that of Gregory. A check of Gregory's location of Mt McConnell, passed in the latter stage of his northern Australian exploration, shows an error by 0.5 km in latitude and 10.4 km in longitude – discrepancies very similar to those of Wills when he reached the Gulf. This is to be expected as both were using similar instruments and navigational processes.

The source of the more widely known denigration of Wills work comes from the popular publications on the Burke and Wills Expedition. Sarah Murgatroyd's recent narrative *The Dig Tree* is much praised and deservedly so (Mugatroyd 2002). But it repeats the misinformation

seen in (Favenc 1888), (Clune 1961) and (Bonyhady 1991). Murgatroyd says of the expedition reaching the Gulf of Carpentaria:

> *. . . not even Wills knew where they were. He had plotted their position on the Albert River, which was actually 100 kilometers away to the west . . .*

All these authors give credence to the erroneous belief that Wills plotted the most northerly camp on the Albert River – some 120km west of the expedition's terminus on the Flinders River. This mistake probably arose from the *Argus* report on Burke's death published on Monday 4 November 1861.

> *Late on Saturday night information reached Melbourne from Sandhurst of the arrival there of a messenger - Mr. Brahe from Mr. Howitt's searching expedition, with a despatch from that leader, conveying the melancholy intelligence that Burke and Wills had perished at Cooper's Creek . . .*
>
> *In his possession were the journals of the leader of the expedition and Mr. Wills's maps and notes (which are now in possession of the Royal Society), which show that Burke and his companions successfully accomplished the crossing of the continent to the shores of the Gulf of Carpentaria, which they reached on the 12th February. The chart kept by Mr. Wills shows that the party followed Sturt's track to its farthest point, in lat. 24, when, finding the country to the north utterly impracticable, a course was struck direct east to the 140th parallel of longitude, which they followed north, almost in a straight line to Albert River.(The Argus 1861C)*

This is all reasonably correct – but not the final sentence: *a course was struck direct east to the 140th parallel of longitude, which they followed north, almost in a straight line to Albert River.* (And not in the ides that longitude has parallels.) Had the reporter spent a few minutes examining Wills' chart, it would have been seen that in following the Corella Creek, the party moved onto the Flinders River finishing on a longitude close to 141st meridian. It is unfortunate this one loose statement of 1861 has been taken as gospel by many writers since with Wills' reputation suffering badly.

Reflection

In assessing the performance William John Wills, Surveyor, Astronomical and Meteorological Observer of the Royal Society's Victorian Exploration Expedition, his records, although necessarily fragmentary and unfinished due to events outside his control, stand as an extraordinary navigational achievement.

In his report on Magnetic Survey of the Colony of Victoria, Georg von Neumayer was moved to say of Wills: (Neumayer 1869).

> *There can be no doubt that, practically and scientifically, he united all the qualities of an explorer; and that, had he lived, he would have eventually attained an equally high reputation in connection with the science of the Australian continent with that he has attained in connection with its exploration and first crossing.*

References

Bonyhady, T. (1991) *Burke and Wills; From Melbourne to Myth*, David Eli Press, Sydney.

Commission of Enquiry. (1862) *Report of the commissioners appointed to enquire into and report upon the circumstances connected with the sufferings and death of Robert O'Hara Burke and William John Wills, the Victorian explorers*. John Ferres, Government Printer, Melbourne.

Committee of the Victorian Exploring Expedition (1860) *Instructions for the Surveyor, Astronomical and Meteorological Observer.* Burke & Wills Web, accessed 20 November 2010, <http://www.burkeandwills.net.au/Instructions/Instructions_to_Wills.htm >

Favenc, E. (1998) *Explorers of Australia*, Senate, UK. (First published in 1888)

Giles, E. (2004) *Australia Twice Traversed*, Project Gutenberg EBook, accessed 20 November 2010, http://www.gutenberg.org/files/4974/4974-h/4974-h.htm

Hardy, A. D. (1943) JOHN HARDY – An Early Victorian Surveyor. *The Victorian Historical Magazine, vol XX, no. 1,* pp. 1-14.

Horden, M. (1989) *Mariners are Warned!*, Melbourne University Press at the Miegunyah Press.

Kitson, B. and McKay, J. (2006) *Surveying Queensland 1839-1945*, Queensland Department of Natural Resources and Water and the Queensland Museum.

Landsborough , W. (1862) *Journal Of Landsborough's Expedition From Carpentaria*, Wilson & MacKinnon, Melbourne.

Moorhead, A. (1985) *Cooper's Creek*, Nelson Publishers, Melbourne. (First published in 1963)

Mueller, F. (1857) *An historical review of the explorations of Australia*, Burke & Wills Web, accessed 20 November 2010, <http://www.burkeandwills.net.au/Royal_Society/Muellers_Review_of_Exploration.htm>

Morrison, D. (2006) Neumayer: pioneer exploration geophysicist, *Preview: The Magazine of the Australian Society of Exploration Geophysicists*, CSIRO Publishing, April 2006, pp 21-24.

Murgatroyd, S. (2002) The *Dig Tree*, The Text Publishing Company, Melbourne.

Neumayer, G. (1869) *Results of the Magnetic Survey of the Colony of Victoria*, Schneider, Mannheim.

Perry, T. (1982) *The Discovery of Australia*, Nelson, Melbourne.

Sturt C. (1849) *Narrative of an expedition into Central Australia performed under the authority of Her Majesty's government, during the years 1844, 5, and 6*. Facsim. Ed. Adelaide: Libraries Board of Australia, 1965.

The Argus, (1861A) Melbourne, Wednesday, September 1, 1858.

The Argus, (1861B) *The Burke and Wills Exploring Expedition (reprint),* Wilson and MacKinnon, Melbourne.

The Argus, (1861C) Melbourne, Monday 4 November 1861.

Wikipedia (2010) *Nevil Maskelyne*, accessed 20 November 2010, <http://en.wikipedia.org/wiki/Nevil_Maskelyne>

Wills, W. J. (1860) , Australian Manuscripts Collection, State Library of Victoria.

Wills, W. J. (1861) Astronomical Observations, Australian Manuscripts Collection, MS 13071, State Library.