

Following the Camel and Compass Trail One Hundred Years on

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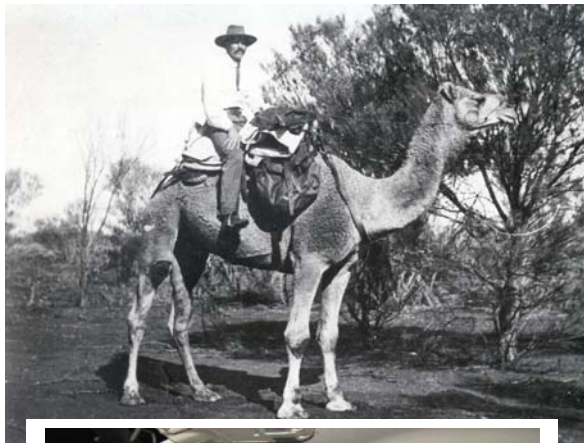
Key words: Historical surveying, early Indigenous contact, Canning Stock Route

SUMMARY

In this paper, the authors Ken Leighton and James Canning tell the story of one of the most significant explorations in the history of Western Australia, carried out in arduous conditions by a dedicated Surveyor and his team in 1906.

The experiences of the original expedition into remote Aboriginal homelands and the subsequent development of the iconic “Canning Stock Route” become the subject of review as the authors investigate the region and the survey after the passage of 100 years.

Employing a century of improvements in surveying technology, the authors combine desktop computations with a series of field survey expeditions to compare survey results from the past and present era, often with surprising results.



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ABSTRACT

In the mere space of 100 years, the world of surveying has undergone both incremental and quantum leaps. This fact is exceptionally highlighted by the recent work of surveyors Ken Leighton and James Canning along Australia's most isolated linear landscape, the Canning Stock Route. Stretching 1700 kilometres through several remote Western Australian deserts, this iconic path was originally surveyed by an exploration party in 1906, led by a celebrated Government Surveyor; Alfred Wernam Canning.

Surveyor Canning had recently completed the epic construction of a 1,850 kilometre vermin barrier fence to protect the expanding Western Australian agricultural industry, so was no stranger to the isolation and privations to be experienced on this new adventure.

In an unforgiving and sparsely explored land Canning relied heavily on help from the local Aboriginal inhabitants to guide him between their precious water holes. For the locals this would be their first encounter with 'White' people and their accoutrements and it did not always go well.

But in the true spirit of the early explorer persistence was rewarded with success. The stock route was developed and with a chequered history of droving, death and disaster eventually became reborn as the "Holy Grail" of the modern four wheel drive adventurer.

A century later and although the physical landscape appears superficially unchanged challenges brought by its popularity threaten the sustainability of the track as a tourist journey. The cultures that collided one hundred years ago, now, with the recognition of Native Title, threaten to collide again.

To properly manage the tourist impact first requires an inventory of significant places. In 2009 Ken and James combined their expertise with other key organisations as part of a three year project to systematically travel along the route with local Traditional Owners to record the sites and stories of the past.

Using previously unknown 100 year old maps prepared by Alfred Canning as a background, the modern surveyors were able to combine the latest electronic technologies to correlate Canning's observations with existing features. What they found often surprised them. The original camel and compass traverse was remarkably accurate given the 900 sand dunes that needed to be crossed and the lack of survey control.

This paper will discuss Canning's epic survey and the difficulties faced in successfully traversing over a blank map. Compare that with today and the conclusions we can draw with the benefit of the most modern technologies.

For Canning, 100 years ago, the survey and construction of a stock route served a singular purpose of efficiently moving large mobs of cattle through a vast and hostile environment to the southern markets of Western Australia. Inconceivably for Canning but very real for us now is the need to move large mobs of tourists along this same track. As contemporary surveyors we are part of a process to record and preserve that history and to ensure that future generations of travellers can safely and sensitively enjoy the experience that came from the cross-over of the disparate cultures 100 years ago.

INTRODUCTION (from Leighton, Veth and McDonald 2008)

The Canning Stock Route (CSR) of Western Australia has similarities with the great Silk Road that linked Asia with the Middle East. Whilst not sharing the same beginnings in antiquity or having the same economic genesis, it is equally an iconic cross-cultural transect across a desert landscape embedded with a myriad locations of Indigenous art, and complex Dreaming stories. And whilst the contemporary history of the CSR is only one hundred years old the land has been inhabited for over 30,000 years through the Last Glacial Maximum til the present. For those 30,000 years the Australian Aborigines lived throughout the Western Desert landscape largely in harmony with each other and the environment that provided their daily sustenance. Like the Silk Road they had tracks through their country that afforded them opportunities to trade, maintain their kinship and law, and to regenerate and transmit their mythology and history.



Figure 1: Location of CSR within Western Australia

On contact with the first Europeans, just one hundred years ago, those 30,000 years of isolation ended. Australia was an expanding British colony and it was inevitable that the quest for more arable lands was going to meet the Aboriginal culture head-on (see Veth et al. 2008). The history of contact within Australia has parallels in other settler societies where traditional land owners were enmeshed with a new system of labour and land title. The development of the CSR created a new pathway through the desert – it served a limited purpose for the Europeans and has now been granted as exclusive possession native title to the descendants of those Traditional Owners who met Canning's party over 100 years ago.

DEVELOPMENT OF THE STOCK ROUTE (from Gard 2004 and Leighton 2007)

The Kimberley cattle industry in the far north of Western Australia started in the 1880s and was running at about the same pace of development as the expanding gold mining industry in Kalgoorlie and Coolgardie, over 2,000 kilometres to the south. These hungry miners provided a ready meat market but the cattle of the Kimberley were becoming increasingly affected by a parasitic tick and were quarantined from being transported south. The cattlemen reasoned that a 2,000 kilometre, well watered stock route through the centre of Western Australia and the change of climate along the way would see the tick drop off and the cattle arrive in good condition. As time attested it worked. The tick indeed dropped off and died along the way, the cattle flourished, calves were born and all generally arrived in better shape than when they left the Kimberley.

In 1906 the State Government, under pressure from the Kimberley pastoralists, agreed to an investigation for a stock route to bring live cattle to the southern markets. As an already accomplished surveyor Alfred Wernam Canning was chosen to lead the expedition to chart a prospective stock route. He had recently completed the epic construction of the No.1 Rabbit Proof Fence. At 1,850 kilometres long it was christened the 'longest fence in the world' and effectively isolated a huge tract of Western Australia from the swarming rabbits that had bridged the continent from the east.

In planning the course for a stock route Canning was working from a blank map; knowledge of the terrain was scant with only a few hardy explorers including Peter Egerton-Warburton 1873, John Forrest 1874, and David Carnegie 1897 skirting his prospective route. Carnegie strongly advised against even attempting to establish a stock route as he had experienced great difficulty in finding water.



Figure 2: Cameleer and just some of his charges with the well troughing aboard.

Canning and his team took two years to locate a route that would be suitable for a stock route. His report was enthusiastically received by the government and the Kimberley cattlemen and he was commissioned to mount a construction expedition to dig and equip 51 wells along the 2,000 kilometre route. Between 1908 and 1910 Canning and his 30 man team

achieved remarkable success in providing a path through three deserts with regular watering points. Everything he needed for this epic 2½ year task needed to be taken with them; there would be no resupply. He needed 70 camels to transport his 100 tons of food and equipment. The only fresh food would be the milk and meat from the 267 goats and whatever game they could shoot along the way.

Canning knew that the location of a suitable stock route was going to be principally determined by the ready availability of water. The water had to be potable, at a reasonable depth and at intervals not exceeding a fair day's driving distance (about 25 kilometres). To this end he enlisted the help of local Aboriginal people to act as guides. Often his wells were sunk alongside or on an existing Aboriginal waterhole. Canning reasoned that by replacing the native well there was less likelihood of vandalism or polluting by the locals. In 1906 there was minimal Aboriginal cultural awareness and certainly the concept of informed consent or what today might be termed a land-use agreement was non-existent. Canning would have been unaware that he himself was committing cultural vandalism. The replacement of shallow native wells with deeper wells proved problematic for Aboriginal custodians. Pulling water using the large heavy bucket required three adult men or a camel – many desperate Aborigines subsequently suffered substantial injuries, or in fact drowned, trying to recover water. In less than 20 years the majority of wells had been vandalised or burnt to render them inoperable. If the CSR was to remain viable as a means of moving mobs of cattle from North to South maintenance was desperately required.

SOCIAL IMPACT OF THE STOCK ROUTE

For the local Aboriginal people the opening of the stock route would change their life forever. It now provided a perennial pathway through the desert by virtue of the permanent water in the wells (not withstanding the difficulties of procuring it). This relative ease of access and even infrequent provisioning from driving teams meant groups could potentially be more mobile along north-south routes and this may have facilitated social contact and movement over even a wider transect of country from which they were familiar.

Contact with the drovers and the resultant assimilation process had started and together with the movement of the desert people into desert fringe pastoral stations and 'new' outback towns, it became inevitable that the desert was slowly depopulated – but never abandoned in the cultural sense of the word (cf. Veth 2003).

It also seems to have had another impact. It appears that almost all of the recorded rock art in the vicinity of the CSR predates contact and from studies by Gould, 1980 post contact activities were largely restricted to retouching the existing bodies rather than new works.

Today the Martu and Kimberley traditional owners still meet on country for matters of law and 'business'. Excursions to collect bush food are more opportunistic and usually associated with other visitation purposes. What has changed profoundly is the recognition of the Aboriginal peoples' ongoing connection with country by the Australian community. In 1976 the Aboriginal Land Rights Act paved the way for Aboriginal individuals to make claims for

land rights to their traditional lands, subsequently after a series of successful higher court decisions the Federal Government proclaimed the Native Title Act in 1993 which grants title to protect these established rights. The CSR is now almost completely contained within the boundaries of four separate native title areas. The claimants represent different social groups and only in two do the claimants live in communities within their title area. Exclusions exist to allow legitimate business (usually non-indigenous owned) to operate, and pre-existing pastoral leases and other alienated land have been accepted as extinguishing native entitlement. The CSR is also excluded to allow tourists the right of access and enjoyment of the route.

TRANSFORMATION FROM DROVING TO DRIVING THE CANNING STOCK ROUTE (from Leighton, Veth and McDonald 2008)

Canning and his team completed the construction of the 51 wells in 1910 and within a year the first mob of cattle was being driven south. The success of that trip heralded the start of the stock route's life as a feasible overland passage for the Kimberley drovers. But soon after ill-fate befell a droving party – the team was murdered by Aborigines and the mob scattered. This was to be the first of a few attacks on droving teams and, understandably the cattle industry got nervous about the risk of undertaking the three month journey.

In the earlier years between 1911 and 1931 only eight mobs of cattle had made the journey – this lack of use primarily attributable to fear of attack from disenfranchised natives. However, there was enough interest in reopening the stock route that in 1929 the government ordered the refurbishment of the wells. The initial contractor failed to complete the task and so at the age of 70 Alfred Canning was recalled to reinvigorate the stock route. Again in 1942 the wells were comprehensively repaired but after this refurbishment of the wells, to 1959, only another twenty mobs of cattle came down the stock route. During that time the quarantine embargo had been lifted and cattle could be more efficiently exported via ship and road.

The transformation of the CSR from an arduous three month cattle droving journey to a two week four-wheel drive adventure took 45 of its 100 year life. With the completion of the last cattle drive in 1959 the CSR lay neglected, destined to become a fading dotted red line on the maps and at risk of being forgotten forever. Then in 1963 the CSR was reborn after the first successful passage by surveyors in a four-wheel drive vehicle. In 1977 the first commercial tourist operator was taking tourists along a track only cattle and horses and few men had trod before. One hundred years on and by now more vehicles than cattle have travelled the length of the CSR. The CSR is now regarded as an international icon of adventure as one of the toughest, longest and most isolated tracks in the world. The challenge is annually taken up by an estimated 800 vehicles over a six month winter season when the temperatures and rainfall along the track moderate.

The CSR, by all accounts, is a demanding journey, where the attraction for the traveler is the journey itself rather than any destination. This alone makes it a different holiday destination and the evidence is that recent rising fuel prices and the challenging terrain combined with the

risk of serious damage to vehicle through mechanical failure do not deter the determined. The challenges that Canning faced 100 years ago are not that dissimilar today. He needed to carry enough supplies to endure; he needed reliability and load bearing capacity, hence his decision of camels over horses. Today's traveler each recognises a bit of Canning in themselves. They are often well outside their comfort zone seeing the desert landscape and the night sky just as Canning saw it, touching the wells that Canning and his team built by hand and struggling to cross the same 900 sand dunes that formed such a formidable barrier for Canning.

THE 1906 EXPLORATION SURVEY

Many records of the 1906 expedition have been lost or remain hidden in government archives. There are however a number of reference documents and historical accounts from which we can interpret knowledge of the first expedition. Canning's team of eight men was accompanied by 23 camels and two horses. Their provisions of food and supplies for the 5 month journey to Halls Creek were estimated at 2.5 tonnes with a further 1.5 tonnes of water to be carried by camel.

A vast array of equipment was accumulated to support the expedition. Of specific interest to surveyors was the survey gear inventory. This included theodolite, prismatic compass, binoculars, maps, plans, five chain (100.58 metre) measuring chain, chronometer and Nautical Almanac. (Smith 1966)

Whilst the expedition gained some benefit from previous explorations, the stock route journey was predominantly uncharted. The geographic co-ordinates for commencement and destination points would be known along with locations of several natural watering points including Weld Spring (Forrest 1874) in the south and Separation Well (Wells 1896) and Godfreys Tank (Carnegie 1896) to the north. Canning's 1906 fieldbooks show regular latitude observations, but are devoid of longitude observations. The surveyed route generally meanders up to 80 kilometres either side of the rhumb line between Wiluna and Halls Creek, on a bearing of approximately 40 degrees.

During the exploration survey and the return journey southward, Canning prepared 10 field books showing details of terrain, vegetation, feeding grounds for stock, geology, topography and most importantly: watering points and reference marks such as blazed trees, rock cairns and survey posts.

Our research has not established whether the magnetic variations at either end of the route were identified at the time of the survey. In the context of broad scale navigation, the current (2010) deviation (+1°30' at Wiluna and +3°30' at Halls Creek) may not have had a significant impact upon field measurements. In his field book 1B, Canning states:

Compass Bearing of Streets Wiluna 360°0'20"
Bearing Given on Plan 358°5'

From current Landgate mapping the orientation of Wiluna's main street is $357^{\circ}53'$. This suggests a magnetic declination of about $-2^{\circ}07'$ in 1906. The annual variation of magnetic declination has implications for the accurate retracing of an old survey, but of greater influence is the accuracy of the pacing and compass bearings.

A review of the expedition references indicates that progress was made by way of establishing a base camp at each newly identified water source, then scouting in several directions until a reliable watering point was source was found. Surveyor Canning would undertake a theodolite latitude observation at places of significance such as wells or camp sites, then record a traverse to the forward station by compass bearing and distance.

Although the survey team was equipped with a 5 chain measuring band, it appears that the main traverse measurements for the route were recorded by counting paces whilst walking. A typical page of field book traverse measurement would locate significant features, changes in vegetation or topography at wide intervals of up to several kilometres. A sample of sequential chainages from fieldbook 1B is recorded (in links) thus: 195400, 219400 and 227400 without any intervening detail. This suggests that there was no significant feature worth documenting in the vast distances (4828 metres and 1609 metres respectively) between traverse points. This fact reinforces the assumption that distances are not measured by laying out a measuring band, as there are no intervening recordings and measurements are generally rounded to the nearest 100 links (20.12 metres).

Bearings in the 1906 field books are typically recorded to the nearest degree. To expect higher precision from a prismatic compass is probably unrealistic however there are several instances where bearings are recorded to the half degree (30 minutes of arc) and one instance of a quarter of a degree (15 minutes of arc).

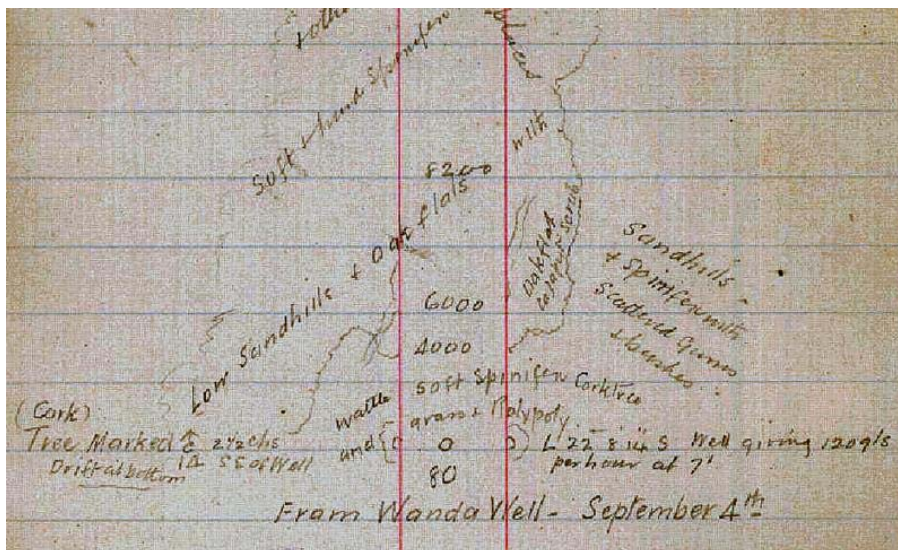


Figure 3: Extract of AW Canning fieldbook showing detail around Wanda Well

Topographic features on either side of the main traverse lines were often located by intersection of bearings from 2 or more stations, with occasional spur branches traversing into areas of interest. In the example, Figure 3, we see reference tree C14 typically identified with a tie measurement from Wanda Well of “2½ Chains SE of Well”

The accuracy of the “compass and pace” survey method is impaired by a number of factors. Firstly, to sight a bearing, the surveyor requires an open vista. The presence of myriad sand dunes and frequent situations of dense scrub taller than 2 metres high has potential to limit the length of a forward sighting. The repetitious nature of the landscape also provides few opportunities for clearly distinct target features. Whilst calibration of a measured pace can provide repeatability of 2 to 3% on firm level terrain, one must consider that the presence of soft sand, dunes up to 12 metres high, vegetation and physical barriers such as stony outcrops must reduce the reliability of the measurements.

Coupling these physical factors with personal challenges of heat, thirst, hunger, tiredness and distractions to concentration by insects, dust and wind, the potential for erroneous pace counting must also be significant.

Latitude observations were conducted at watering points and other places of significance to the surveyor. The lack of longitude measurement may be due to the unreliability of timekeeping equipment (a one minute error on a chronograph translates directly to a 1500 metre error in position) or perhaps because latitude was simply a more useful measure of progress given the traverse was generally northerly. It appears from the field book recordings, that altitude observations were made to a pair of stars as they achieve a meridian transit. By choosing one northern star (typically Vega) and one southern star (typically Gamma Crux, the topmost star of the Southern Cross) instrumental collimation error can be eliminated. A compass may be used to identify when the star is close to transit and no timekeeping equipment is required. Calculation of the latitude is a simple addition of declination from the Nautical Almanac so that no complex mathematics are required to achieve a result (Mackie 1982). The precision of such a latitude observation is governed by the quality of optics and circle graduations in the theodolite and may be heavily influenced by the atmospheric refraction. Surveyor Canning applied refraction corrections which require atmospheric temperature and pressure to be reliable. There is no recording of temperature or pressure in the field records which suggests that these values may have been estimated. (See comparative comment in Results paragraph).

Despite the limitations of the employed survey methods, by successfully completing a 1700 kilometre traverse, Alfred Canning demonstrated that his chosen method was adequate for effectively navigating through the desert and returning to the watering points at a later date.

During the summer of 1906/1907, Canning and his team spent the Kimberley “Wet Season” at Flora Valley station before returning to Perth via the Stock Route. It is reported that Canning spent much of this time preparing charts of the outward survey. His charts were drawn from traverses in the field records onto 100 x 70 cm linen paper by protractor and parallel ruler to various imperial scales but most typically 1:126720 (the imperial equivalent

of one inch per two miles). These charts later formed the basis for a complete Stock Route Map over six metres long which is believed to be prepared by draftsmen of the Mines Department in Perth after completion of the well building expedition.

VALUE OF ABORIGINAL GUIDES TO THE SURVEY PARTY.

Since 1873 there had been about five exploring parties traversing various parts of outback WA. Most had brief contact with the local Aborigines, and some used south-west (Noongar) Aboriginal guides. The presence of such a guide did not give right-of-passage through other tribal lands and skirmishes between Aboriginal people and explorers are well documented. Canning did not take a south-west Aboriginal person but relied on and co-opted local Aboriginal people to guide him. These would have been desert people with little or no previous contact with white people, nor their camels or horses. This would inevitably have been a very threatening and alarming meeting (see Sutton in Veth et al. 2008) especially considering that Canning's purpose was to locate the water holes that were so precious to their survival. Canning reported that he retained the Aborigines only through their 'tribal' lands and when their knowledge ran out he released them with a food and clothing bonus. Some chose to stay on and continued to draw rations and Canning had been adamant that no Aboriginal person was to be turned away from the camp without some provisions – sometimes to his own party's detriment (Smith 1966).

Canning's reliance on Aboriginal people to guide him meant that he had to opportunistically source them. It was the task of his trusted and experienced second-in-command Hubert Trotman to provide the team with guides who could take them to water holes in the general direction of the stock route. The conduct of Canning, as leader, Trotman, as 2IC, and the rest of the team came under intense scrutiny of a Royal Commission of Inquiry in 1907 following accusations by the team cook of mal-treatment of Aborigines. Canning admitted co-opting help and restraining guides at night but considered this was justified as the safety of his party and the potential success of the expedition relied solely on his ability to locate and map reliable water supplies. The Royal Commission exonerated the party and found the cook's accusations to be malicious and based on petty jealousies. Further scrutiny of the Royal Commission transcripts provides great insight to the hardship of the expedition and the severity of the treatment.

In his report of the expedition Canning explained that he only used Aboriginal guides on the outbound journey. For the return trip to Wiluna he had his maps and observations to direct him and had no need to recruit guides. On occasion he did make contact with groups of Aborigines and these occurrences were usually friendly except for one instance when a tragic scenario played out ending with the death of an Aborigine and one of Canning's team.

Without doubt it was Canning's tenacity and intuition and skill as a bushman that got the route through, but he acknowledged that without the assistance and knowledge of the local Aboriginal people even that would not have been enough.

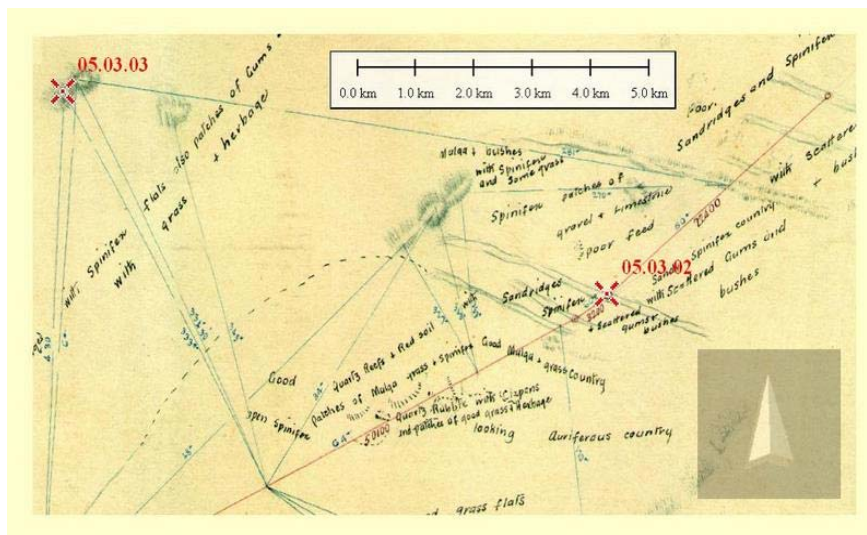
2009 SURVEY PREPARATIONS

Seven of the charts prepared by Alfred Canning at Flora Valley in 1907 were discovered in Government archives by Ken Leighton early in 2009. Until their discovery, there was no contemporary knowledge of their location or existence. With permission from the State Records Office Ken then arranged through Landgate for the charts to be electronically scanned with high quality imaging equipment. From this valuable reference resource, James Canning then commenced a process in Melbourne for georeferencing the information contained in the charts, to be employed in a mid-2009 survey expedition.

The first step in this process was to identify the charting sequence of 23 separate traverses by comparison with the 6 metre map using place names and topographic features such as wells (for which GPS coordinates were available from previous field trips), isolated hills, creeks or claypans. The chart images were then cut into 23 sections, with a singular traverse spine for each section.

After a month of experimental techniques with a wide range of computer software a methodology was developed to place the 1906 charts into a commercially available Geographic Information System. Global Mapper (TM) was chosen for the task as its many cost-effective features enabled a streamlined approach to both the data encoding and the subsequent field surveys.

This was achieved by identifying a minimum of two geographic features within a section and preparing a trial overlay, using Google Earth (TM) satellite imagery to identify the coordinates of a feature. After the initial trial, it was usually possible to identify further features within each section, to obtain 5 or 6 control points for a more robust rectification of the chart image.



In the extract Figure 4, where there are no man made landmarks, the chart is initially georeferenced to satellite imagery using prominent hills and sand dunes for control. Patterns and locations of measured dunes from 1906 appear to be principally unaltered, possibly due to stabilisation from vegetation.

Figure 4: Extract of 1906 chart overlaid with geographic features as control points (in Red)

Considering the method by which the 1906 charts were surveyed and plotted, it soon became obvious that a simple scale and rotation of the image would not provide a sensible result. Due to the irregularity of scale within a section, combined with plotting inaccuracies it became necessary to apply a triangulated rectification, distorting the image files to fit with the known geographic co-ordinates of the control points.

In some cases, the vast desert landscape provided insufficient clues to uniquely identify geographic features. This led to a further refinement by re-plotting the actual traverse lines by encoding bearings and distances from a fixed point, then rotating and scaling the newly plotted traverse onto known control points. After this, it was possible to use the vertices of the adjusted traverse as the control points for triangulated rectification of the images.

The net result of approximately 100 hours of processing by this method has yielded a set of adjusted images which may be overlaid into any GIS as a background which identifies the path of the 1906 expedition to its highest precision ever.

It was interesting to note that the encoded traverse legs were consistently short of the true ground measurements by approximately 5-10 % Variations were less prominent in “West to East” traverses than in “South to North” lines. We attribute this characteristic to the effect of losing precision with each dune crossing, as the dunes are oriented with their steep sides being generally square to the direction of northerly travel.

Our next challenge was to test the accuracy of the adjusted data in a 4 week field survey.

THE CANNING STOCK ROUTE RESEARCH PROGRAM

In 2008 the Australian National University (ANU), together with a number of industry partners including Landgate, was successful in winning an Australian Research Council (ARC) grant. The grant provided funding for a three year program to identify, map and interpret Aboriginal *Jukurrpa* (dreaming) and rock art sites along and adjacent to the CSR. Archaeologists from the ANU have been joined by specialists from other agencies in a coordinated effort to assemble a comprehensive body of information relating both to the Aboriginal and European cultures. The research is recorded in a strong spatial and temporal context as it relates to Indigenous story lines dating back tens of thousands of years but kept alive in contemporary Aboriginal culture.

The intersection of the two cultures at ‘contact’ one hundred years ago introduced a European baseline and provides the catalyst for merging Aboriginal language, through placenames, into the common vernacular. Canning started the process by giving his wells Aboriginal names. In many instances he was replacing the native wells with his own but demonstrated his empathy with the local inhabitants by continuing to use their names. Landgate has recently embarked on a program to widen the use of Aboriginal names in recognition of their claim of traditional ownership and cultural links over much of Western Australia.

Concurrent with the recording of the Aboriginal significant cultural sites is the inventory of European and natural topographic history. During the three year program Landgate has provided technical assistance to the researchers and has embarked on research of its own based on the surveys of Canning. The project has had significant success in finding previously unknown working plans produced by Canning in 1907 and has amassed information from a variety of disparate sources of research being conducted by private individuals. The CSR evokes a curiosity in many individuals, perhaps as a combination of its isolation and its popularity and uncomplicated history. It is relatively easy to research and there is good quality data available from Canning's original fieldbooks, journals and government files. But there is still much to be done and it has become apparent that there are many private expeditions and people engaged in research that are contributing to the collective body of knowledge progressing towards the 'ultimate' story of the CSR.

RECENT DISCOVERIES

During the four week 2009 expedition for the ARC linkage project, James and Ken were able to explore of the Northern half of the Stock Route from Halls Creek to Georgia Bore. With the relative comfort of 21st century technology, their modern mapping tools were put to the test. A vehicle was equipped with several GPS receivers logging into notebook computers.

For portable field situations a ruggedized notebook computer was connected to a 'hat' mounted patch antenna, giving the flexibility to work any distance away from the vehicle. The navigation software was configured to record the 'breadcrumb' trail every 5 metres providing a constant record of our track. Altitude was also recorded and the Global Mapper

software has the facility to create 3D models on the fly – a useful facility for the research archaeologists to see patterns of artefacts surrounding native wells.



Figure 5: James wearing a ruggedised notebook with a patch GPS antenna on his hat. He is standing alongside CSR well number 27 and the remains of some of the water recovery equipment.

Both Global Mapper and OziExplorer software provided live links to a moving map through the connection to GPS. A library of background maps included the National 1:250K topographic series, satellite imagery and geo-referenced scans of original Canning 1907 charts. These enabled the team to effectively "trace" parts of the original expedition as

demonstrated in the extract below. This allowed the team to conduct real-time searches for elusive landmarks, in this example it is “Ural Native Well”. The well was pre-plotted into the mapping at three possible locations;

- a) by the 1906 bearing and distance traverse encoded from “Wanda”, the nearest known well to the West (Red)
- b) by the 1906 bearing and distance traverse encoded from “Libral”, the nearest known well to the East (Yellow)
- c) by the position plotted by AW Canning on the geo-referenced 1907 Chart using both Wanda and Libral as control points (black circle on background map)

It is evident by the plotting that these locations do not coincide due to a traverse misclosure of 750 metres. Canning’s plotted position logically appears to be half way between the two.

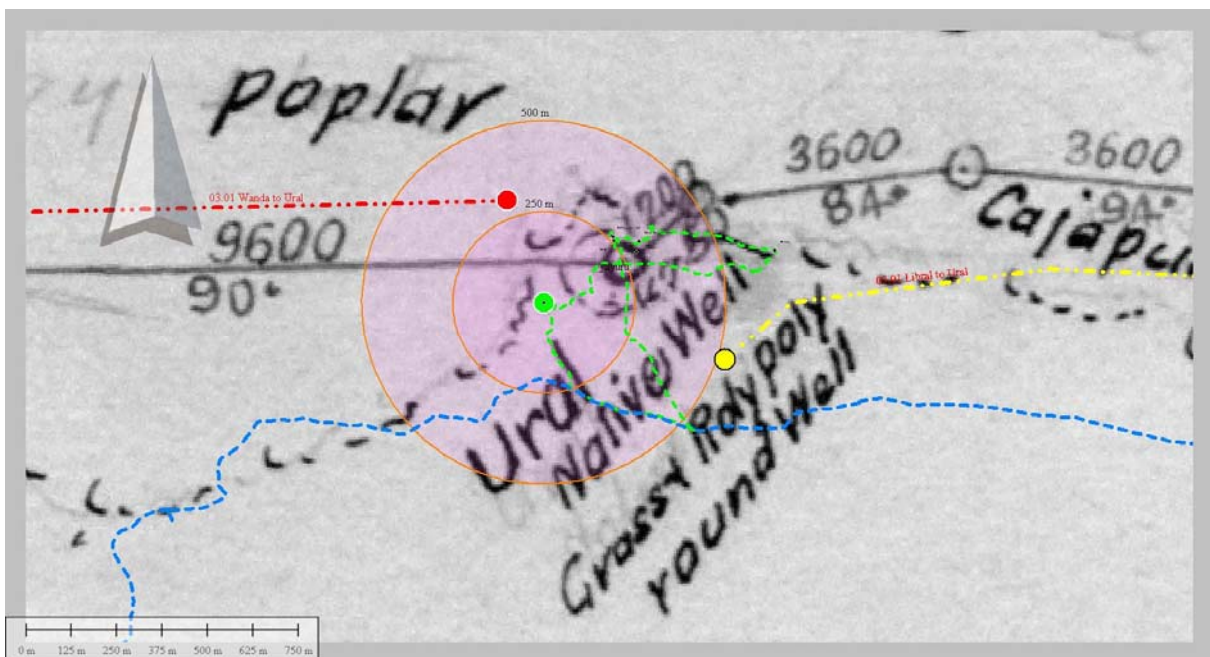


Figure 6: Screen plot of trial locations for Ural Native Well, showing surveyed paths overlaid upon 1906 Chart

Our 4WD track was charted by GPS logger (in blue) as the vehicle progressed into the search area. As it is currently impossible to reach Ural by vehicle, the survey team then proceeded on foot to conduct a search, using the portable setup described above. The laptop tracked the search in real-time (green track) showing that we first visited Canning’s plotted position then widened the search when it was obvious his position was in error. After less than an hour of investigation through thick scrub and a tangle of broken dunes, the Native Well “Ural” was located at the green marker, which was ironically only 250 metres from the formed vehicle track and only 250 metres from Canning’s plotted position of 100 years ago.



Figure 7: Ural native well – partially excavated by animals seeking water

The actual well is little more than a sunken depression, one metre wide, occupied by bees and surrounded by dead reeds in a small claypan, but its lifesaving waters just below the surface may have been used for thousands of years by the Indigenous inhabitants.

This technique was successfully used in a number of searches for significant Aboriginal occupation sites whose locations are not for publication at the present time.

A similar combination of search techniques enabled the team to discover what is believed to be the last remaining healthy reference tree along the Stock Route. In our searches, heavy reliance was placed upon fieldbooks and a diary-styled report by AW Canning in which locations of camps, wells and reference marks were described in words. The tree was blazed by AW Canning's team in 1906 with a traditional "shield" shaped cut approximately 1.2 metres above the ground. Over the intervening century, the bark and sapwood has re-grown over the blaze, leaving only a 40 cm scar in the surface of the tree trunk. Beneath the bark we would expect to find a chiselled broad arrow and the identifying number of the survey mark. In the interests of historic preservation, the tree was left unharmed. The survival of this particular tree has proven to be quite remarkable in a landscape where fire is relatively common. Our reconnaissance of AW Canning reference tree sites between Well 23 and Halls Creek failed to find any other healthy examples, so our celebration of this achievement was marked with "The Surveyors Dance" as depicted above.



Figure 8: James Canning & Ken Leighton celebrating the discovery of A.W. Canning's only surviving reference tree, blazed in 1906





RESULTS

History Workshop - Day 2 - The World's Greatest Surveyors - Session 4
Ken Leighton and James Canning
Following the camel and compass trail one hundred years on (4130)

15/21

FIG Congress 2010
Facing the Challenges – Building the Capacity
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As part of the 2009 expedition, our team followed approximately 650 kilometres of the Canning Stock Route, searching for evidence of survey marks placed by AW Canning in 1906. The ravages of time by fire, ants and decay resulted in an exceptionally low success rate. Apart from the wells themselves, which are the most prominent evidence of the survey, only 4 survey marks were positively identified (and 1 from 2008).


ID	Image - 2009	Location	Details
C22		Junction of the Sturt Creek & Wolfe Creek	Rock cairn found in good condition at the northern extremity of AW Canning 1906 Survey. Origin is unknown but research suggests the cairn was placed in surveys of Sturt Creek by Crossland in 1902.
C23		Godfreys Tank (Kuningerra)	Chiseled broad arrow in the face of rock cliff 4 metres above creek bed.
NFP		Within restricted access Ngurrara Native Title lands	40 cm scar from healed blaze on north face of healthy Eucalypt tree with trunk diameter 50cm, height 10 metres, spread 10 metres.
C34			

Well 30

(Dun
da
Jind
a)

Remains of burnt stump 1 metre tall.

Labeled
by I.
Johnson
in
July
1985

Post C1		Well 11 (Goodwin Soak)	One of only two original Canning posts known to exist along the CSR – located in June 2008
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In total, from this and previous expeditions along the CSR, we now have 14 positively identified locations (as distinct from the 5 ‘points’) where Canning made astronomical observations for latitude. On comparison with the GPS positions we expected there would be a substantial range in first differencing. There was a further expectation that there would be a roughly ‘normal’ distribution, as unlike longitude where the result is directly influenced by worsening clock error, latitude is neither correlated nor influenced by systematic error.

If we accept that the GPS location is without gross error (these are hand-held devices rather than survey quality) then Canning’s latitude results were consistently within 500 metres with the median value being 230 metres. This corresponds to about 16 and 8 seconds of arc respectively. It is unlikely Canning would have used better than a 5 inch vernier theodolite, using a candle for illumination. Assuming the smallest graduation of this type of instrument was typically 20 seconds, this is an astounding result! Given the privations and duress under which these observations might likely have been made, makes the results even more remarkable.

Surveyor Canning only recorded his latitude observations at 34 locations. Of those for which we do not have comparative GPS locations some were campsites where he left no physical marker whilst others are a considerable distance from the track which requires some fortitude to visit.

From a surveyor’s perspective, if there was to be criticism levelled, it would be that stone cairns would have been a far superior choice of marking locations for prosperity. But in fairness, cairns are more demanding to construct and where trees are relatively abundant in the West Australian deserts, rocks typically are not. Canning would barely have given a thought to the prospect of tourists in motor vehicles with GPS trying to locate his marks 100 years on – therein lies three concepts completely outside his thought process it would be safe to conclude.

Apart from our surveyors' parochial interest in Alfred Canning's surveying 100 years on, the expedition had a great interest in finding the locations of Canning's latitude observations and physical evidence of his visits. It had been rumoured that the blazed trees were suffering at the hands of the elements and ravages of wildfires. As a part of Landgate's contribution to the discovery project it was our ambition to prove conclusively the existence or not of markers. It appears that indeed most of the blazed trees are gone. In terms of physical markers, all that remains are the locations of the native wells and his 'new' wells.

Concurrently to the search we logged over 1000 kilometres of road and tracks, track directions and intersections, numerous topographic points of interest, Aboriginal names, water quality observations at the wells, geodetic survey markers, signage and potential camp grounds. This data will be merged with observations from expeditions from previous years for inclusion in a GIS and ultimately used for the production of a new and informative map of the route.

CONCLUSION

To fully appreciate the vastness of the Canning Stock Route in 2010, it is essential to spend a few weeks bouncing over severely corrugated roads in a well equipped sturdy vehicle. The scale of the 1906 survey defies the contemporary surveyor to comprehend its enormity. The re-surveys by Canning and Leighton one hundred years afterwards have demonstrated the significant efforts required to gather information in such an isolated region.

Techniques employed to re-trace the paths of georeferenced charts proved to be successful where the terrain and vegetation allow access. With a database of logged positions, the team now has a basis for further refinement of the technique to reliably locate other sites of interest.

It is difficult to choose one piece of technology that provided us the most value on this expedition. Obviously GPS is the key component but without the rectified maps it is basically useless. The software to merge the maps, satellite images and fieldbooks with the GPS was invaluable. Today's sophisticated vehicles and creature comforts mean that we can focus on the task rather than being encumbered by all the logistical nightmares Canning had to endure. The satellite phone was an irreplaceable tool for communicating the surveyors' success stories to the rest of the research team – giving them the inspiration to continue the search.

But most important for us, was not the technology but the time spent with the Aboriginal Traditional Owners. They have the stories of the past, they have the innate sense of place and time, they accepted our peculiar fascination for the inane and shared our joy with finding the inane. They freely gave their names for their special places and welcomed us, as strangers to their land and culture, into the 'mob'.

As Canning observed in his report of 1906 the Aboriginal people made his journey possible, for us the Aboriginal people made our journey memorable.

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BIOGRAPHICAL NOTES

Ken Leighton is a Licensed Surveyor and has worked at Landgate (formerly the Western Australian Department of Lands and Surveys and Surveyor Alfred Canning's employer) for 40 years. He has been involved in all forms of surveying from cadastral, geodetic, natural resource inventory and now occupies the position of Principal Geodetic Surveyor in the Operations business unit.

Ken became interested in the CSR in 2000 and after months of preparation took a group of friends along the track, thus cementing a relationship with the track that has spanned ten years. Since 2005 Ken has been involved with promoting a greater awareness of the management of the CSR as it celebrates 100 years of use, and with pressure building from the tourism fraternity.

He has been on four expeditions along the CSR each one adding a new dimension to the experience and more recently enhanced by travelling with the Traditional Owners and the academics from the Australian National University.

James Canning is a surveyor whose career has spanned across the Australian continent, being Licensed as a Surveyor in Victoria, Queensland and Western Australia. He is currently practicing in a multi disciplined private consulting firm in Victoria Australia, providing surveying, engineering and town planning services for property development and government infrastructure projects.

He graduated from RMIT Bachelor of Applied Science in Surveying in 1986 and has developed a personal interest in the Canning Stock Route history which commenced with the knowledge that its founder, Alfred Wernam Canning was his Great Uncle. Applying computerized survey tools to the interpretation of historical data has become a rewarding past-time which is anticipated to lead to further interesting discoveries.

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