



ENGINEERS
AUSTRALIA

EHA MAGAZINE



Engineering Heritage Australia Magazine

ISSN 2206-0200 (Online)

May 2022
Volume 4 Number 2

EDITOR:

Margret Doring, FIEAust. CPEng. M.ICOMOS

The Engineering Heritage Australia Magazine is published by Engineers Australia's National Committee for Engineering Heritage. Statements made or opinions expressed in the Magazine are those of the authors and do not necessarily reflect the views of Engineers Australia.

Contact EHA by email at:

EHA@engineersaustralia.org.au

or visit the website at:

<https://www.engineersaustralia.org.au/Communities-And-Groups/Special-Interest-Groups/Engineering-Heritage-Australia>

Unsubscribe: If you do not wish to receive any further material from Engineering Heritage Australia, contact EHA at :

EHA@engineersaustralia.org.au

Subscribe: Readers who want to be added to the subscriber list can contact EHA via our email at :

EHA@engineersaustralia.org.au

Readers wishing to submit material for publication in the Engineering Heritage Australia Magazine, can contact the Editor via email at :

EHA@engineersaustralia.org.au

Cover Images:

Front: Opening day of the Sydney Harbour Bridge (19th March 1932). The Bridge is illuminated with search lights at night, in addition to the roadway lighting.
Source: NSW State Archives No.833765

Back: The Crossley Gas Engine, lying abandoned in the bush in Gippsland in 1979.
Source: Photo by Brian Healey (Dec'd).

This is a free magazine covering stories and news items about industrial and engineering heritage in Australia and elsewhere. It is published online as a down-loadable PDF document for readers to view on screen or print their own copies. EA members and non-members on the EHA mailing lists will receive emails notifying them of new issues, with a link to the relevant Engineers Australia website page.

CONTENTS

Editorial	3
Engineering Heritage Awards, 2021	4
90 th Birthday of the Sydney Harbour Bridge	7
An Illuminating Story	9
Fred David – Refugee Aeronautical Engineer	10
The Mysterious Bradfield Cylinder	19
A Crossley Model XA Gas Engine at Swift's Creek	22
Connections	28

Australasian Engineering Heritage Conference 2022 Transport and Communications Looking Forward -- Looking Back.

The conference will run from 12–13 October 2022.

The Australasian Engineering Heritage Conference 2022 will bring together like-minded people with an interest in heritage. Focusing on engineering heritage, it aims to bring these two aspects together in relationship, emphasising how the past determines the future.

Find out more at:

<https://www.engineersaustralia.org.au/event/2022/03/australasian-engineering-heritage-conference-2022-41536>

Editorial

I do try to avoid too much of the personal and the political in these editorials, but it has been rather difficult these last several months – what with Covid striking a member of the family, and a Federal Election building to a crescendo. Both have been deeply distracting, but at last our isolation efforts have prevented any spread of the disease to the rest of the family – or the neighbours – and the election results might mean the new Government takes the dire threats to everyone, of existing and accelerating climate change, absolutely seriously.

I sometimes thought I was never going to get this issue of the Magazine completed at all – it is amazing that it's actually ready on time. We started with a brief account of the 2021 winners of some Engineers Australia Awards – Awards of Merit for two EHA members, one each from WA and Queensland, and three Colin Crisp Awards, one for a Conservation Project and two for two separate Publications.

The occasion, on the 19th March 2022, of the 90th Birthday of the official opening of the Sydney Harbour Bridge brought forth several stories. One from Bill Phippen gives an overview of design decisions leading up to the opening and assessing of tenders in 1924 – almost 100 years ago. The story is augmented with two wonderful night-time photos of the bridge on Opening Day, and three of sparse bridge traffic a month later, that Bill discovered when scanning photographs from the NSW State Rail Authority Archives. The next story is a brief one from Ian Bowie, also related to Opening Day. If you noticed the great photo of the ceremonial first switching on of the Bridge lights in February 1932, Ian's amusing story is about how those lights came to be made.

David Radcliffe follows with another great story of the engineers and industries of Port Melbourne. This one is about the brilliant and talented Fred David, Aeronautical Engineer and Austrian Jewish refugee from Nazi Germany, who was recruited by the Australian Commonwealth Aircraft Corporation in Fishermans Bend, and came to Australia in 1939. *His fascinating career across four continents spanned aeronautically designed biplanes to guided missiles.*

Bill Phippen's intriguing story about *The Mysterious Bradfield Cylinder* is a bit like some 1920s parlour game puzzle. Related to the early days before construction of the Sydney Harbour Bridge started, it was sparked by Bill's discovery of some very puzzling photographs among the NSW State Rail Authority collection he was scanning. He was fascinated by what his detective work brought to light.

The last story, about a circa 1907 Crossley Model XA Gas Engine comes from Mal Smith, a Forest Fire Officer from East Gippsland in Victoria. Mal first saw that engine when he was a schoolboy, exploring the wilds of the East Gippsland forests with some mates. He never forgot it, and many years later, when he was working in those forests, he got involved in a restoration project, set up to *Save the World's Last Crossley Model XA Gas Engine*. His story is about the history of the engine, and the efforts to get it to a safe place out of the forests. It's a fascinating engine, and a good story.

A Few More Connections Items

This issue of the Magazine has a bumper collection of Connections items - more than three pages this time, in their rightful place. For several years now, I have been collecting these small stories, and then leaving myself with no space for them in that issue – maybe there'll be some space next time! This time I worked my way down a long string of folders with different topics, and still ended up with about 30 more items than I could fit into the last pages – so as I had nothing else to say in my editorial (or far too much!), I thought I would add a few more Connections items – so here goes:

Margret J. Doring

The SIA Newsletter gave me this one, from *Aspire: The Concrete Bridge Magazine (Summer 2021)* It's about clear and colourless waterproofing and protective treatment for older concrete, offering advantages over other commonly used systems. It's found successful uses with historic concrete buildings and bridges over the past two decades. It's found at: <http://www.aspirebridge.com/magazine/2021Summer/CBP-PreservingOurInfrastructure.pdf>

Back in April 2021, Heritage NSW reported it has been busy with the remarkable exposure of the 1893 Buster shipwreck at Woolgoolga. One of our 2000 historic shipwrecks managed by Heritage NSW, the scale of recent public interest and visitation to the wreck showcases the community's passion with its heritage places. See some excellent coverage by ABC and several recent shipwreck interviews with Tim Smith OAM, Director Operations, at: <https://www.heritage.nsw.gov.au/about-our-heritage/maritime/buster-shipwreck/>

Engineering Heritage Australia Awards for 2021

One of the awards available to members of Engineers Australia is the Award of Merit. The Engineering Heritage Award of Merit is aimed at recognising and showing appreciation for outstanding service, and is awarded to people who make significant contributions to the cause of engineering heritage in a variety of ways, mostly as volunteers and often over many years. In 2021 there were two recipients of this award – Doug Ayre in Western Australia, and Jim Simmers in Queensland. Here are their stories.

Award of Merit for Doug Ayre, FIEAust, CPEng(Ret), Engineering Heritage WA .



Mike Taylor, Chair of Engineering Heritage Australia (at left) congratulates Doug Ayre on his Award of Merit.

Prior to Engineering Heritage Western Australia's (EHWA) meeting held on 15 February 2022, an Award of Merit was presented by Susan Kreemer Pickford, General Manager WA, to Doug Ayre FIEAust CPEng(Ret). This award by Engineers Australia recognises Doug's significant contribution to the conservation of engineering heritage. Doug is an honorary life member of the Oral History Association of Australia. He has conducted several courses training oral historians. With his expertise in oral history, in 2010 he wrote Engineering Heritage Australia's national *Guidelines for the Engineering Heritage Oral History Program*. Doug is recognised for his expertise in interviewing in the engineering and technical area.

A list of all the Western Australian 'Award of Merit' recipients is available from EHWA's website at:

https://ehwa.mywikis.wiki/wiki/Award_of_Merit_for_Engineering_Heritage.

Citation for Doug Ayre's Award of Merit.

After working 10 years in the UK, Doug migrated to Western Australia in 1971 and worked as a manager in both electricity and gas, and with the energy safety regulator.

Doug became interested in history and completed a Certificate in Museum Studies at Edith Cowan University and a Bachelor of Arts (Hons) Degree in History from Murdoch University in Perth. In 2001 Doug established his own business, History Development Pty. Ltd., with a focus on oral history. He is an honorary life member of the Oral History Association of Australia, a member of the Toodyay Historical Society and Curator of the Scout Heritage Centre of WA.

In 2010 Doug joined Engineering Heritage Western Australia (EHWA) and led their oral history activities. EHWA currently has 13 completed oral histories, with 10 carried out personally by Doug between 2009 and 2019. All have been lodged with the WA State Library and some are also in the Mitchell Library in NSW.

Prior to joining EHWA, in 2006 and 2007 Doug worked on the East Perth Power Station Project and completed three oral histories there. In 2011 Doug managed national oral history issues in general and revised the procedure for oral history work to ensure that it was compatible with the digital recording and archival requirements of Engineers Australia National Library Manager. During this period Doug was a corresponding member of and reported to the Engineering Heritage Australia National Board.

Doug retired as a member of EHWA in April 2013, but as a corresponding member, continued to support EHWA's ongoing oral history program. Each of the 10 oral histories undertaken by Doug have involved multiple meetings with interviewees and significant time in reviewing and finalising approved transcripts.

In recognition of his expertise, Doug was elected President of the Oral History Association of Australia – WA Branch in 2015 and has conducted several courses training oral historians on behalf of that organisation. Doug is recognised for his expertise in interviewing in the engineering and technical area, and in an interview for Engineers Australia, Doug said of oral history: *It's an important part of our cultural heritage, if you don't get the story down, when that person dies, it dies with them.* Doug's contribution to 'getting the story down' for Engineering Heritage has been substantial and is continuing. He is a worthy recipient of the Award of Merit.

Engineering Heritage Australia Awards for 2021

Award of Merit for Jim Simmers, FIEAust, CPEng(Ret), Engineering Heritage Queensland.

At the Engineers Australia, Queensland Division End of Year celebrations held on 15 December 2021, an Award of Merit was presented to Jim Simmers FIEAust CPEng (Ret) by the Queensland President Suzanne Burow, FIEAust, CPEng, NER. This award by Engineers Australia recognises Jim's significant contribution to the conservation of engineering heritage and in particular to Jim's contribution to the history of the electricity industry in Queensland.

Jim gave a heartfelt thank you speech to the gathering which included his very proud family. The End of Year celebrations also involved presentations to recipients of other awards such as Fellow, Engineering Executive, Queensland President's Award 2021 and Hall of Fame recipients for 2021.

Citation for Jim Simmers' Award of Merit.

James Simmers (Jim) spent most of his working life in the Southeast Queensland Electricity Board (SEQEB). Following graduation as an Electrical Engineer in 1958, Jim served a two-year graduate-apprenticeship with a major UK electrical manufacturer (Metropolitan-Vickers). He was then Distribution Engineer with a city council in New Zealand for five years. In 1965 Jim moved to Brisbane to the Southern Electric Authority, which later became SEQEB, where he was involved principally in system planning and substations. Jim represented the Australian supply industry on Australian Standards committees for shunt capacitors and standard voltages, producing six technical papers within the field.

On 'retiring' in 1997 he was involved in research into the rating of underground power cables at the Queensland University of Technology, where he worked until final retirement in 1999.

His interest in electrical history has continued post retirement with volunteering at the Queensland Energy Museum to which he was technical adviser. He has authored numerous papers varying from *Edison Tubes Down Under* to *Distribution System Voltage Control Methods*. After formal retirement Jim wrote numerous papers on the many aspects of Brisbane's Early Lighting System from Parliament House to the Electrification of the Suburbs. Jim has been both secretary and chairman of the Queensland Division Electrical Branch. Jim has been active on the committee of the Queensland Branch of Engineering Heritage Australia for ten years since 2004, the archivist for seven years and is still a corresponding member.

Jim is a Fellow of Engineers Australia and has been a regular participant with other EHA(Q) Panel members over many years. He continues to be a corresponding member and attends Panel Technical Evenings and other Engineering Heritage events.

Jim's long years of service to Engineers Australia and Engineering Heritage in Queensland, both during his working life and in his many years on the Queensland Engineering Heritage Panel, has made a notable contribution to Engineering Heritage in Queensland and makes him a worthy recipient of an Award of Merit.



Jim Simmers receiving his Award of Merit from the 2021 EA Queensland Division President Suzanne Burow, FIEAust., CPEng.

The 2021 Colin Crisp Awards

Here's what the Engineers Australia website says about the Colin Crisp Awards: – *The Colin Crisp Award perpetuates the memory of Colin Crisp, who was a structural engineer well known for his work in the conservation of heritage structures. This project award is given for excellence in the conservation and recording of items of heritage significance; in recording engineering accomplishment and the development of technology; or in education and raising awareness in engineering heritage.* The awards are made for Conservation Projects and/or for Documentation Projects. A little more detail is available at: <https://aeca.engineersaustralia.org.au/colin-crisp-award/> The 2021 awards went to a Conservation Project, and there were joint winners for two separate Publications. The citations for these awards are on the next page.

Colin Crisp was a good friend and colleague of mine. We worked together on many projects and committees from 1979 on. Find out more about him in the June 2015 EHA Magazine, pages 4 & 5, *Who Was Colin Crisp?*

From the Editor

Engineering Heritage Australia Awards for 2021 The Colin Crisp Awards

Conservation Project Winner – Saving No.21 Dredger at Morwell in Victoria.

No.21 Dredger was the first bucket wheel excavator to be used at the Morwell open cut brown coal mine. The Morwell open cut was a new major open cut project developed by the State Electricity Corporation of Victoria, with work starting on the site in 1949. No 21 Dredger had a long period of service in the mine and worked between October 1955 and August 1992. It was used to excavate overburden and to supply brown coal to the Yallourn Power Station, and later the Morwell Power Station and Briquette Factory, and Hazelwood Power Station. In August 1992 the Dredger was withdrawn from a standby role, retired, and preparations were made for its disposal.



There was a strong local movement during the late 1980's to establish a regional heritage centre and have a range of mining machinery on display in the region. After a *PowerWorks Visitor Centre* was opened at Ridge Road Morwell, No.21 dredger, with support from local industry, was driven out of the mine and placed on display in 1995. Since then, a group now known as *Gippsland International Incorporated*, representing *Friends of the No.21 Dredger*, have worked tirelessly to interpret the Dredger and return it to suitable condition for exhibition. Ian Newnham, as Secretary of *Gippsland International Incorporated* accepted the Award

The Dredger's history, description and significance can be found in the EHVictoria Nomination at:

<https://portal.engineersaustralia.org.au/system/files/engineering-heritage-australia/nomination-title/No.21%20Dredger.Nomination.V2.September%202016.pdf> .

Citation for Colin Crisp Award 2021 – Winner, Conservation Project

To acknowledge the tenacity and dedication of this small group of like-minded individuals in saving this last remaining exemplar of the earliest brown coal dredging plant (as was specified and operated by the SEC of Victoria from the earliest days until 1950) and their diligent attention to proper Heritage Engineering practices. Furthermore, to affirm the gratitude and appreciation of EHA and the entire engineering community.

Publications – Joint Winners

Citation – to Robert T. Taaffe for Signal Boxes of New South Wales Railways and Tramways

For a massive body of work [4 volumes] that not only identifies some 1460 architecturally interesting buildings throughout the landscape of NSW but, even more importantly, records the engineering of their mechanisms and electrical systems including their commonalities and peculiarities. The four volumes cover the development and safeworking of the NSW railways over 140 years and are a wonderful addition to the engineering heritage and history of the State.



Citation – to the Steel Reinforcement Institute of Australia for A Guide to Historical Steel Reinforcement in Australia (A Two Volume Set)

For the accumulation and publication of the history of steel reinforcement manufactured and used in concrete construction in Australia in the period from 1895 to the present. The work has discovered a trove of documents that would surely have been lost to the digital age without this intervention. The two volumes will become a treasured resource to the practice of Heritage Engineering ensuring that both the historical engineering methods and the critical material characteristics of the times past remain available to guide preservation processes.



The Sydney Harbour Bridge 90th Birthday

By Bill Phippen

19 March 2022 was conveniently a Saturday for Sydney to mark the anniversary of 'Our Bridge'. 90 years is a contrived anniversary in many ways, but perhaps the underlying thought was that the big one – the 100th – is not that far away. Many newspapers ran features, libraries had exhibitions and special trains and buses were provided.



After dark on Opening Day, 19th March 1932, the Sydney Harbour Bridge is brilliantly illuminated with search lights. Source: NSW State Archives No.833724.

Of course, the 100th anniversary is already here for many of the steps in the process of building the bridge. The bridge's ancient history back to legendary colonial architect Francis Greenway has been recounted many times but its 'modern' history can be deemed to have begun in September 1921 – and the anniversary of that date has already passed. Tenders were called for the construction of a bridge. It was not the bridge that is there now, but from late 1921 the process was unbroken until the ribbon cutting more than ten years later.

The Labor state government of James Dooley, facing an imminent election, started the ball rolling, perhaps with pork-barrelling intent. They also re-started work on the underground city railway in February 1922.

The proposed bridge in the specifications issued was a steel truss cantilever. Bridge hero and Engineer-in-Chief John Bradfield probably knew that an arch would be a better solution and cheaper too, but the question was how to erect it. The harbour must be spanned in a single leap with no piers in shipping lanes as the danger to ships and the bridge would be too great otherwise. There could be no falsework during construction as the water was too deep, silt on the harbour floor too thick and the channel could not be blocked. The span would be 500 metres.

It was clear that a cantilever could be built. The Forth Bridge of longer span had been built 30 years before and the Quebec Bridge had been finished with a span longer than Sydney in 1919, albeit after two disastrous collapses during construction. The drawback of the cantilever was the wasted back spans – half the heavy and expensive steel work would be over dry land which did not need a bridge. An arch would use all its steel structure in the over-water section.

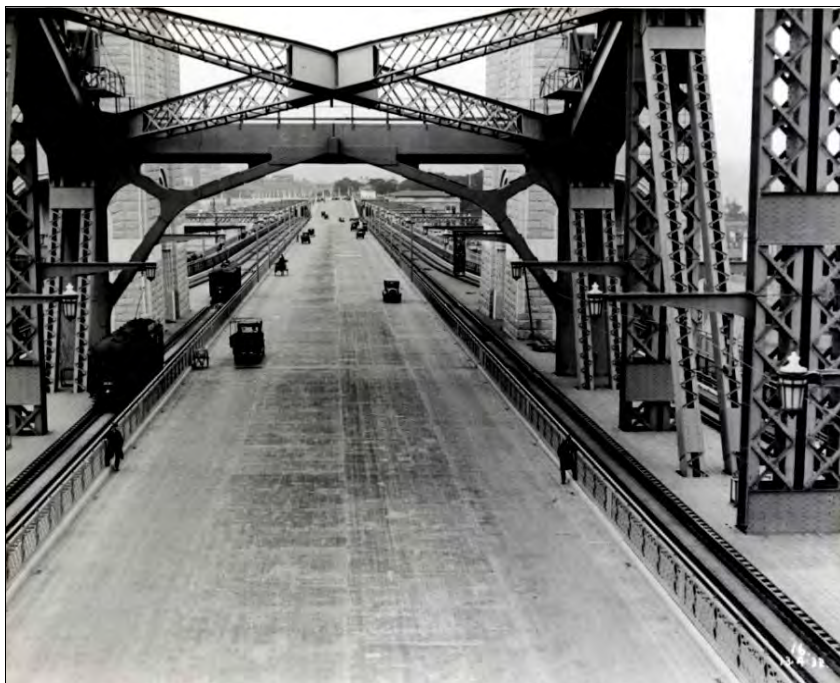


On the night of February 11th 1932, the Bridge lights are first ceremonially switched on, in the presence of a small crowd of notables. Source: NSW State Archives, No.833578.

The Sydney Harbour Bridge 90th Birthday

The concept of cantilevering the halves of an arch by holding them back by cables into sound rock had been proved at Victoria Falls in 1905 by Georges Camille Imbault and Ralph Freeman, but that span was only 157 metres with just two railway tracks. The technique was developed further by Gustav Lindenthal in New York at Hells Gate in 1916 but there the span was only 298 metres and the deck only carried four railway lines. Sydney needed the same railway width and six lanes of traffic as well. The increase in span, width and load was too bold a step.

Once tenders were called Bradfield had some legwork to do to convince the handful of contractors capable of doing the work, that they should make the effort to tender. That had all been done before, earlier in the century and the process had been aborted when a new government elected in 1904 decided to not build any bridge.



The 18th April 1932, a month after Opening Day, and the view is from high up looking south towards the CBD, with the toll booths in the distance, way past the south pylons. Two trams are heading to North Sydney and a horse and cart head into the city. Two men pose against the fences. A handcart between tram & lorry might be theirs. Note that no traffic lanes or centreline are marked.
Source: NSW State Archives No. 833836.



18th April 1932, looking north towards North Sydney. A train heads south, some cars & lorries & a lone motor cyclist occupy the roadway.
Source: NSW State Archives No.833832.

In March 1922 Bradfield left Sydney to travel to Canada, the United States and Europe to try to impress would-be tenderers that this time would be different. The bridge would be built, even if the Act had not yet passed through parliament.

Bradfield had left his secretary and confederate, Kathleen Butler, to shepherd the bill through the parliament, but James Dooley lost the election, and the incoming government was more inclined to spend public works cash in the bush than on the convenience of North Shore commuters, so they announced their intention to cable Bradfield, then in New York, to stay his trip.

Luckily for the bridge, Butler knew where Bradfield was in New York in more detail than the Premier did, so she cabled advice to him to leave for Europe as soon as possible. If the official cable ever reached New York, Bradfield was not there to receive it.

In the United States and in Europe several tenderers expressed their confidence that they could build a 500 metre steel arch and so he cabled home to extend the closing date for tenders, and on his return to Sydney in October, Bradfield issued new specifications which included the option of an arch – and that is the type of bridge which was deemed to be the best design when the tenders were opened and assessed in February 1924.



The North Sydney bridge approaches, photographed from the north-east pylon on 18th April 1932. Both train & tram station roofs at Milson's Point are visible, with trains in both directions, a solitary tram travelling north & many walkers.

NSW State Archives No.833842.

An Illuminating Story

By Ian Bowie

Credit must be given to the archival resources of the former Roads and Maritime Services of New South Wales for this information on the enterprise shown by engineering graduates of yesteryear. It is consequently possible to confirm as fact a most unusual narrative that could easily have faded away as apocryphal or urban myth.

Those who have travelled over the Sydney Harbour Bridge at night will have noticed – usually with some delight – the gradual installation of near-replicas of the original 1932 lamps, albeit now LED powered and with bronze frames, that had disappeared in the 1960s with the introduction of mercury vapour units. These *art deco* patterns have been commented on favourably since they started to appear in their recent form in 2019.

In 1931 the Great Depression placed even the brightest engineering graduates in the same position as a sizeable proportion of Australia's population – unemployed and without prospects. A senior engineer suggested that, if the young engineers banded together in a formal organisation, they could compete for small contract work that was occasionally available.

Thus the impressively named Engineering Development Company was registered and a dilapidated old shed in Rozelle was acquired as a factory. Of the seven initial directors of the Company, five were University of Sydney Civil Engineering graduates: Edwin Harrison from 1929; and from 1931 there were Charles Inman; Norman Reynolds; John McGlynn; and Harold Britton. (The last two went on to hold top positions in Sydney Water Board.) The chairman, Arthur Brown, had a Mechanical & Electrical Engineering degree from Sydney University.

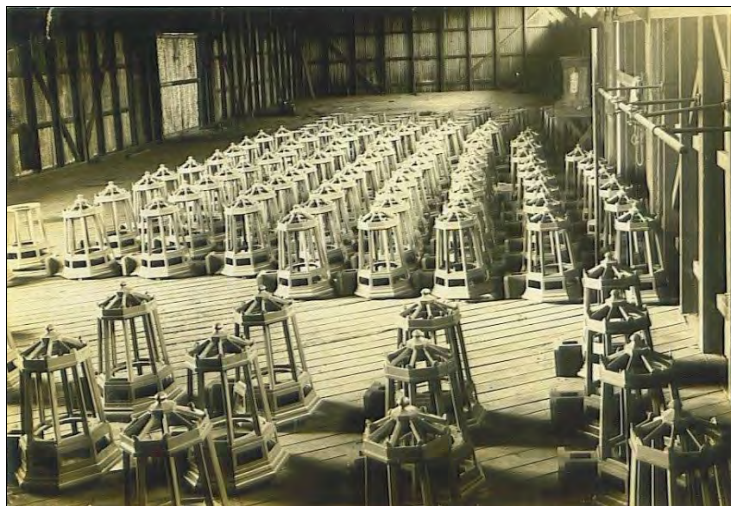


Four Directors of E.D.Co Ltd '31

Board of directors' meeting, Engineering Development Company, 1931. John McGlynn is second from right. Source: NSW RMS Archive.

An element of experience was included by the appointment as company secretary of Mr. T. J. Roseby who had recently retired as Secretary of the Water Board. Capital was raised by what is now called crowd-funding, especially from those colleagues fortunate enough to have jobs. It does not require much imagination to realise that the directors would also be the source of the sweated labour.

After a small lighting contract for the railways, the company was delighted to be awarded a sub-contract, under the main contractor for lighting the Sydney Harbour Bridge, for the supply of no less than 297 lamp units for the Bridge and related works. These were typically about just under a metre high, but were in six patterns depending on whether they were on the main span, on columns, or large units on the sides of the viaducts.



Sydney Harbour Bridge lamps being assembled in the Rozelle factory, 1931. Source: NSW RMS Archive.

The main lamp frames of “fine cast iron” were produced by a local foundry before being taken to the Rozelle premises for completion with other components. In spite of the pressure of time, all lamps were in place for the grand opening of the Sydney Harbour Bridge in March, 1932 – the 90th birthday of which has recently been celebrated.

A recent heritage report states that thirteen of the lighting units from 1932 survive – mainly on the north side approaches. There was a gradual replacement of the company's directors when people found continuing employment. It would be interesting to know the progress and fate of the Engineering Development Company – another story indeed.

Fred David – Refugee Aeronautical Engineer

By David F. Radcliffe

Introduction

Fred David led the design of the CA-12 Boomerang, the only operational fighter aircraft designed and built in Australia. Conceived by him in the days immediately following the Japanese raid on Pearl Harbour, the first Boomerang flew less than six months later. The irony is that the aeronautical knowledge Fred David drew on to design this fighter was acquired in the German aircraft industry from the mid-1920s to the mid-1930s plus two years in Japan working on the design of a dive bomber used at Pearl Harbour. Now stateless, he came to Australia in 1939 recruited by the Commonwealth Aircraft Corporation in Fishermans Bend. His fascinating career across four continents spanned aeronautically designed biplanes to guided missiles



Operational CA-12 Boomerang Aircraft photographed 1944.

Source: Australian War Memorial.

Old Vienna

Born Friedrich Wilhelm Dawid on January 17, 1900, in Vienna, his father was a merchant. Originally from Bzenec, Moravia (now part of the Czech Republic), his was one of the many Jewish families that had moved to Vienna, as part of a massive migration to the capital from all parts of the Hapsburg Empire in the latter decades of the late 19th century. It was a period of major social change and economic development with middle class residential apartments transforming the artisanal character of the inner-city districts of Vienna¹.



Café Scene in Vienna (1909).

Source: Wien Museum

As he entered his teens, Friedrich was not to know that many of the key players who would shape the geo-political world for the next 50 years, and with it, Friedrich's life and career, resided in Vienna. At different times, these included Leon Trotsky, Adolf Hitler, Joseph Tito, and Joseph Stalin². Not far from where the Dawid family lived, Trotsky, Hitler and Stalin would have taken coffee, read newspapers, and above all discussed politics with their friends, in that most Viennese of institutions, the café. Not far away, the heir presumptive to the Austrian Empire, Archduke Franz Ferdinand, whose assassination would trigger the Great War, resided at the Hapsburg Palace.

Then a month after his fourteenth birthday, Friedrich's immediate world changed when his father passed away leaving the family – not destitute – but much less comfortably off. However, Friedrich was able to complete his secondary school studies, and passed the university entrance examination in July 1918. He enrolled in what is today the Technical University of Wien where he studied Mechanical Engineering³. From the second year of his studies onwards, he was completely exempted from tuition fees, indicating the family was not well-off. His time at Technical University Wien coincided with the collapse of the Hapsburg Monarchy and a turbulent period leading to the formation of the First Austrian Republic in 1919. The immediate post-war period saw unrest in the streets, spiralling inflation, and the precipitous decline in the value of the Austrian currency. The old certainties of empire were swept away as Austria-Hungary fragmented into its component parts. In the summer of 1922, as Friedrich graduated, the future of Austria as a viable country and a modern industrial economy remained problematic.

1 Rozenblit, M.L. (1983) *The Jews of Vienna, 1867-1914: Assimilation and Identity*, SUNY Press, pp. 368.

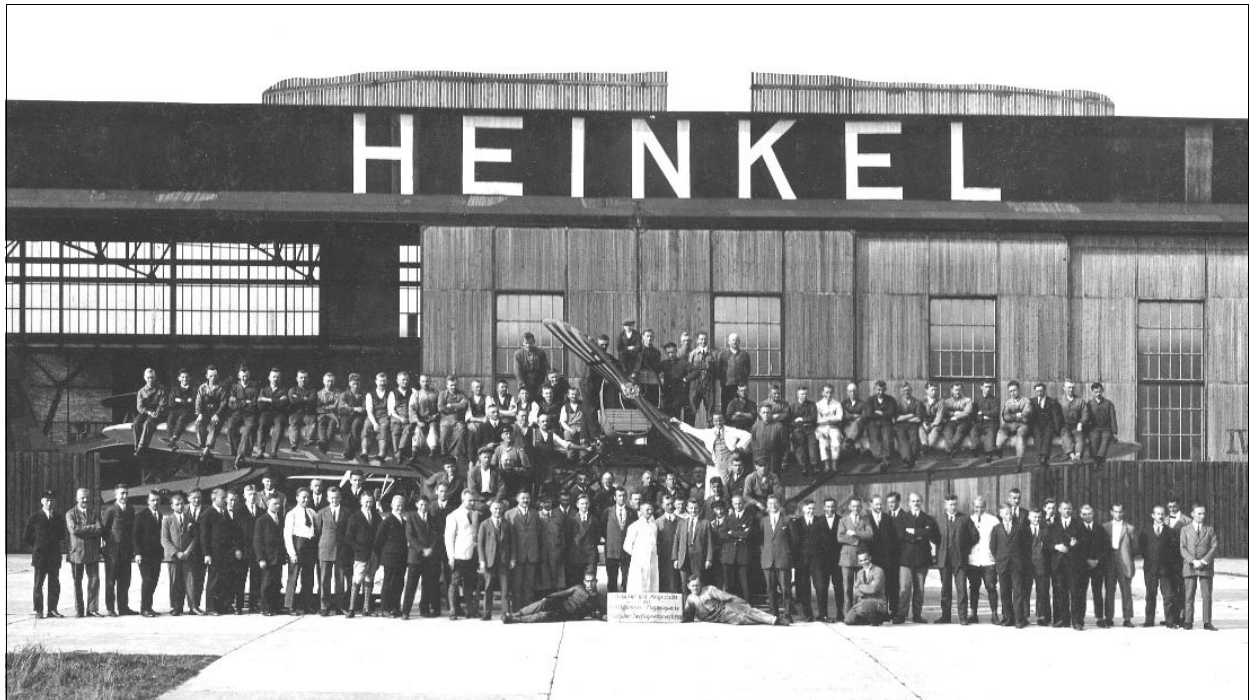
2 Emmerson, C. (2013) *1913: In Search of the World before the Great War*, Public Affairs: New York, pp. 87-109.

3 TU Wien has its roots in the Imperial & Royal Polytechnic Institute of Vienna formed in 1815. With the collapse of the Hapsburg Monarchy, it lost the "Imperial and Royal" title.

Fred David – Refugee Aeronautical Engineer

Mathematical Abilities

Friedrich's first engineering job was with F. Piechatzek of Berlin, a manufacturer of hoisting equipment, where he was employed as a design engineer for ten months from September 1922. He then joined the heavy electrical engineering manufacturer ASEA in Västerås, Sweden where again he worked on the design of lifting machinery. However, the trajectory of his career changed in January 1925 when he accepted a position back in Germany at the Ernst Heinkel Flugzeugwerke (aircraft works) in Warnemünde on the Baltic Coast.

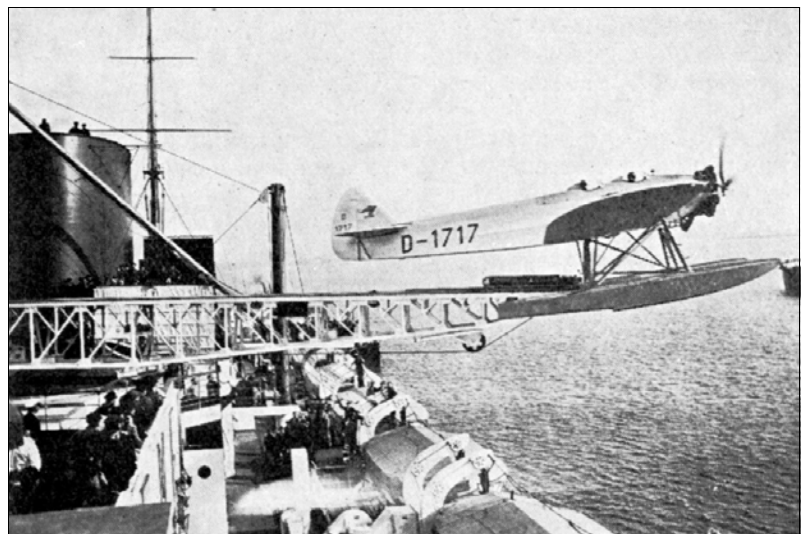


Ernst Heinkel Flugzeugwerke (aircraft works) and staff (circa 1925).

Source: Heinkel Archive.

Friedrich's first task at Heinkel was to do the calculations for the design of a set of rails to launch floatplanes from ships. The launch system relied upon the power of the aircraft to reach take-off speed by the time it reached the end of the rails – there was no catapult. The system was tested on the Japanese battleship *Nagato* off Yokosuka in August 1925. Subsequently sixteen Heinkel designed floatplanes were made in Japan by the Aichi Aircraft Company for the Imperial Japanese Navy.⁴

By then, Friedrich had moved to the statics department at Heinkel where he learned the art of static and aerodynamic calculations associated with aircraft design. Recognized for his excellent mathematical abilities, in November 1926 he was appointed the manager of this office, supervising 22 staff. During his time there, Friedrich was responsible for the oversight of all calculations associated with ten different aircraft types. By 1927, Friedrich was once again involved in the design of systems to launch aircraft from ships, this time using air-powered catapults. The idea was that a plane could be launched at sea from a ship up to 1000 km from shore, and thus get mail carried by the ship to its destination one to two days earlier than if it completed the journey on the ship. In the winter of 1927/28, Friedrich shared his knowledge of aerodynamics by giving a course at the German Aviation School in Warnemünde for seaplane pilots undergoing the training to obtain a license to fly airplanes of any size.



Heinkel HE-12 being catapulted off the SS Bremen (1929)

Source: Wikimedia Commons

⁴ Koos, V. (2006), Ernst Heinkel Flugzeugwerke 1922 bis 1932, HEELVerlag GmbH, p. 66.

Fred David – Refugee Aeronautical Engineer

Then in January 1929, Friedrich sailed to America to take up the position of assistant chief engineer at the Knoll Aircraft Corporation, a start-up in Wichita, Kansas. Knoll, a German aircraft designer who had been the chief engineer with Heinkel in Warnemünde, quickly assembled a team of fellow German aircraft engineers, including Friedrich.



Knoll Aircraft Corporation staff 1929. (Friedrich Dawid under the middle window with a woman on his left-hand side)

Source: courtesy of the Knoll Family.

In August 1929, it was announced that Friedrich was to deliver a course on aerodynamics at Friends University, a local Quaker institution. Unfortunately, the course never took place as the Knoll Aircraft Corporation folded in October 1929, a year after it was founded, and Friedrich was out of a job. He sailed from Montreal to London in October 1930, en route to Germany and a position as design engineer back at Heinkel.

High Performance Aircraft

Aircraft design underwent a transformation at Heinkel with the arrival in 1931 of the gifted Günter brothers, Siegfried and Walter. They led the design of the HE-70, a game-changing, fast mail plane with a monocoque fuselage and elliptical wings and retractable landing gear. Friedrich was a member of the design team that worked on this aircraft. It achieved several speed records and Lufthansa referred to it as the “Heinkel-Blitz”.⁵ The HE-70 influenced the design of aircraft by other manufacturers and was the antecedent of the HE-111, a medium bomber that played a major role in the bombing blitz on Britain in 1940.



Heinkel HE-70 (Blitz) – elliptical wings and empennage (tail assembly) (1933)

Source: (US) National Advisory Committee for Aeronautics.

5 Ernst Heinrich Hirschel, E.H. Prem, H. and Madelung, G. (2004) *Aeronautical Research in Germany: from Lilienthal Until Today*, Springer, Berlin.

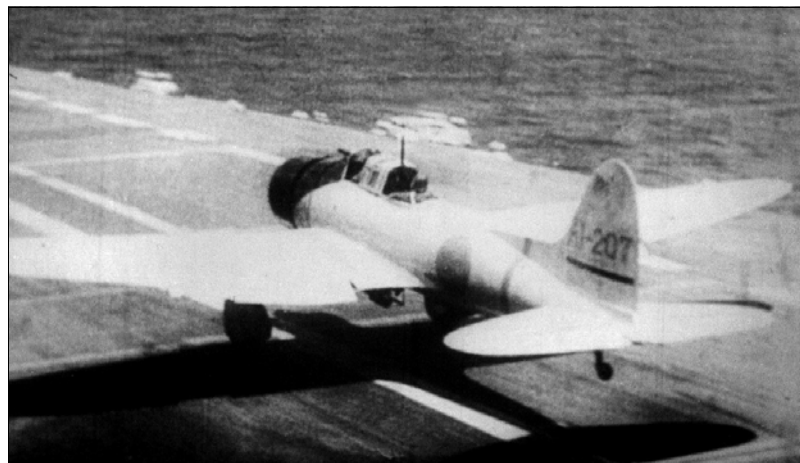
Fred David – Refugee Aeronautical Engineer

After Hitler became German Chancellor in January 1933, sanctions against Jews meant that in April Friedrich had to leave the Heinkel works. However, Ernst Heinkel had a deep respect for Friedrich's abilities, and he wrote a personal reference and assisted him to obtain employment during the remainder of the decade. Friedrich moved to Berlin, where he married Else Frankenberg at a registry office on May 10, 1933. He was 33 and she was 36.

In May 1934, Friedrich was hired by Fieseler-Flugzeugbau in Kassel, central Germany, as a design engineer. Gerhard Fieseler was a German flying ace from World War 1 and a champion aerobatics pilot. The new company quickly developed a reputation for its high performance aerobatic and sports aircraft. Friedrich undertook the load analysis and structural design of high-performance aircraft at Fieseler, gaining a reputation for his ability to transfer theoretical investigations into practice in a simple form. Then in November 1935, Else and Friedrich moved back to the Berlin area where he joined Bücker-Flugzeugbau as head of the project department, overseeing all aerodynamic and static calculations for new aircraft.⁶ During this time, Bücker produced their best-known aircraft, the single seat BÜ-133 Jungmeister, which featured in the 1936 Berlin Olympics, where aerobatics was a demonstration sport. It went on to become the primary advanced trainer for the Luftwaffe leading up to and during the Second World War.



The Bucker Bu-133 Jungmeister flown in 1936 Olympics. Source: Smithsonian Institution.



Aichi D3A dive bomber on Japanese Aircraft Carrier Akagi in 1942. Source: Wikimedia Commons.

Life for Jews in Germany was becoming increasingly precarious so, in March 1937, Friedrich and Else sailed for Japan where he worked as an aerodynamics consultant at Aichi in Nagoya. He worked on the design of the elliptical wings and other aspects of a new dive bomber for the Imperial Japanese Navy, the Aichi D3A, with the Allied code name 'Val'. The chief designer, Tokuchiro Gomei, had spent time at the Heinkel works in the early 1930s learning about all-metal construction techniques, centred on the HE-70 Blitz. However, strict security meant that Friedrich was isolated from the design and prototyping team and worked from an office away from the main factory with Japanese assistants who spoke German and English. He

was only allowed to visit the factory if he was inspecting a component or assembly with which he was directly involved, and even then, he had to be accompanied by a security guard. He felt like a complete outcast.⁷

With Japan and Germany drawing closer together politically, Friedrich began to look for a more secure future. With encouragement from the Australian trade representative in Japan, he took a position at the recently formed and rapidly growing Commonwealth Aircraft Corporation Pty Ltd. in Fishermans Bend, a then mainly industrial inner suburb of Melbourne, south-west of the CBD. Friedrich and Else arrived in Melbourne on March 20, 1939. He changed his name by deed poll to Frederick William David, but he was better known as Fred David. The other members of his immediate family also came to Melbourne to escape from Europe. His older brother Alexander had arrived in September 1938, while his seventy-year-old mother, Hermine, accompanied by his younger brother Arthur and Arthur's wife Elisabeth, arrived in May 1939. The whole family was now effectively stateless.

⁶ Carl Bücker had a long association with Ernst Heinkel going back to the 1920s and had been the pilot of the plane when they tested the catapult system in 1929.

⁷ Meggs, K R. (2020), *Australian-built Aircraft and the Industry (Vol 2): Commonwealth Aircraft Corporation, Books 1 and 2*, Echelon Starboard Publications, Nimbin, NSW. p. 756.

Fred David – Refugee Aeronautical Engineer

Enemy Aliens

Fred David commenced work at the Commonwealth Aircraft Corporation (CAC) at Fishermans Bend on April 17, 1939, as a stress engineer. At that time the principal design and development projects underway were the CA-1 Wirraway and the CA-2 Wackett Trainer. The first flight of a Wirraway took place a few weeks earlier on 27 March and its flight trials and evaluation proceeded until July when the first deliveries were made to the RAAF. The Wirraway, a North American NA-33 modified for local conditions, was the first aircraft type manufactured by the CAC and the Wackett Trainer was the first aircraft to be fully designed and built by the CAC.



Commonwealth Aircraft Corporation (near) and Dept of Aircraft Production (beyond) on Fishermans Bend (c. 1944) Source: State Library of South Australia.

The declaration of war on September 3, 1939, meant that Fred (and all his family) found themselves classified as ‘enemy aliens’. He had to report regularly to the local police and daily to the security personnel at the CAC. Fred was very open with colleagues about his history designing aircraft in Germany.⁸ They never doubted his loyalty, so reporting to security each day before he went about contributing directly to Australia’s war effort must have seemed strange. As ‘enemy aliens’ Fred and Else also got tangled up in the National Security (Land Transfer) Regulations when they attempted to purchase a house in May 1940. It took months to sort out the case but finally the Solicitor-General of the Commonwealth gave consent to the sale and transfer of title. The couple resided at that house for the next forty-four years, until Else’s passing in 1984.



CA-4 Woomera flying over Melbourne - note rear facing gun turrets on the engine nacelles. Source: Commonwealth Aircraft Corporation.

Six months after starting at the CAC, ‘enemy alien’ Fred David was promoted to the position of Design Engineer. He then became the chief engineer on the CA-4 Woomera project, a medium bomber conceived by the General Manager of the CAC, Lawrence Wackett.⁹ There were around 60 people engaged on the project, half in the design and drawing offices and half on the factory floor. Work continued through 1940 and the prototype CA-4 took to the air in September 1941.¹⁰ Over the next few months, the war came close to home for Australians. After the Japanese attack on Pearl Harbour on December 7 the bad news kept coming and the direct threat to Australia was palpable as preparations accelerated against possible attacks or invasion.

Urgent Fighter Aircraft

In the days immediately after the Pearl Harbour attack, Fred David sketched ideas for a fighter that could be quickly developed and produced. Acutely aware of the lack of fighter aircraft available to defend Australia, we needed a stop gap until a frontline fighter could be sourced from the US. Fred discussed his ideas with colleagues and brought it to the attention of senior management, and a proposal to build a fighter-interceptor was put to government at the end of December. Design and development work of what became the Boomerang moved ahead at the CAC with Fred David as that project’s chief design engineer. On 2 February 1942, the War Cabinet approved one prototype to be made, followed by an order for 105 aircraft on February 18.

The first CA-12 Boomerang flew on 26th May 1942.

8 Knightly, J. (2020), *Fred David: Boomerang Designer*, Flightpath, Vol 31, No 2 (Nov 2019/Jan 2020), p. 65.

9 Hill, B.L. (1998), *Wirraway to Hornet: A History of the Commonwealth Aircraft Corporation Pty Ltd 1936 to 1985*, Southern Cross Publications, p. 60.

10 The prototype CA-4 Woomera crashed in January 1943 killing two crew. While a production prototype, the CA-11 was manufactured and flew, the bomber never went into production and the program was cancelled in 1944.

Fred David – Refugee Aeronautical Engineer



CA-12 Boomerang landing after its first flight (29 May 1942)

Source: Combat Aircraft Constructions.

By world standards this was an incredibly short time span to create a new fighter aircraft. The achievement was even more remarkable given the embryonic state of our aircraft industry. This was Fred David's hour, the culmination of his long 'apprenticeship' learning from leading aircraft designers. Given the compressed time frame and material constraints of its development, Fred David freely acknowledged that the Boomerang was never going to be a cutting-edge fighter aircraft, lacking speed and rate of climb at altitude.

However, its superb manoeuvrability at low altitude, combined with its fire power, enabled the Boomerang to fill a critical niche in our defences as an Army cooperation fighter, undertaking tactical reconnaissance, strafing and target marking. RAAF Boomerang squadrons served in forward operations from northern Australia, New Guinea, Bougainville, and Borneo as well as in home defence. The CAC built a total of 250 Boomerangs, across three variants, with the last one being delivered in February 1945.¹¹

As the Boomerang was going into production, Fred David began to explore the design of a new fighter model, the CA-15, a successor to the CA-12 Boomerang.



Production of CA-12 Boomerang Fighter-Interceptors at the CAC (1943)

Source: Library of Congress.



Boomerang CA-15 Fighter-Interceptor (1946).

Source: Commonwealth Aircraft Corporation.

The CA-15 would embody the latest in airframe design and manufacturing techniques, the first CAC designed aircraft to have a semi-monocoque rather than a tubular framed fuselage. A proposal went to the Department of Aircraft Production in November 1942 and in January 1943 the War Cabinet approved funds for a prototype to be built. In February 1943, Fred David was appointed Chief Design Engineer for all of the CAC.

¹¹ Wilson, S. (1991), *Wirraway, Boomerang & CA-15 in Australian Service*, Aerospace Publications, ACT, pp. 144-157.

Fred David – Refugee Aeronautical Engineer



CAC Boomerang Interceptor promotion (1944).
Source: Wings: Official Magazine of the RAAF.

However, priorities changed dramatically in July that year after a mission led by the Secretary of the Department of Aircraft Production returned from a trip the US and the UK with recommendations for the 'best of type' bomber and fighter to meet RAAF needs after 1944. They selected the American P-51 Mustang over the British Spitfire as the next fighter to be made in Australia by the CAC.¹² As a consequence, the CA-15 project was given a low priority, kept alive only to enable promising young design engineers to be stimulated and to gain experience. While only one CA-15 was completed, this aircraft is arguably the most advanced propeller driven fighter ever built. However, the arrival of jet propulsion had rendered it obsolete. By 1946, the jet powered Gloster Meteor (UK) and P-80 (US) fighters were operational, and all future fighters would be jet powered.

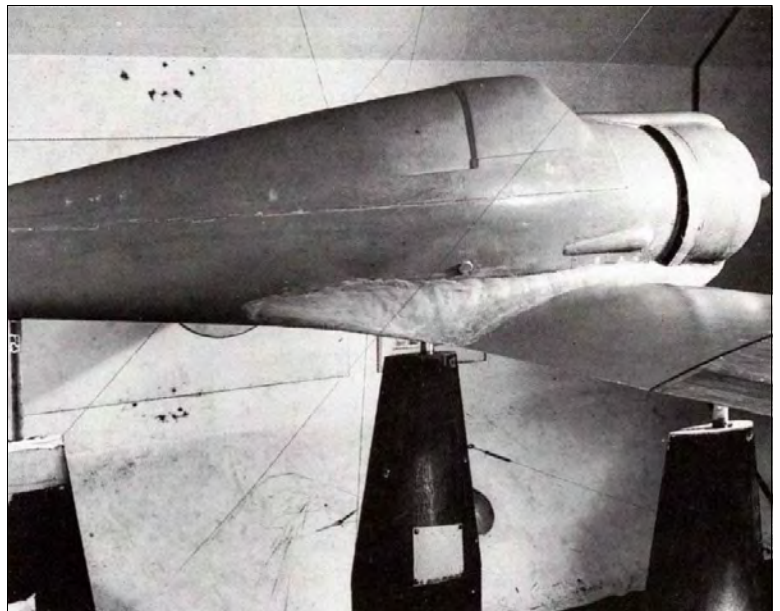
With the end of hostilities in 1945, production priorities at the CAC changed dramatically. They diversified into making an eclectic range of products to meet the needs of post-war Australia including prefabricated houses, buses, and household appliances. Fred David was one of a group of CAC staff who visited the UK to undertake a course on jet engines in 1946, staying on in the UK for nearly a year at the Supersonic Department of the Royal Aircraft Establishment at Farnborough where he studied developments in rockets. With the prospect of designing high performance aircraft in Australia looking bleak, Fred David left the Commonwealth Aircraft Corporation in September 1947.

Aeronautical Research

After leaving the CAC, Fred David took up a position as a Senior Scientific Officer at the Division of Aeronautics of the Council for Scientific and Industrial Research (CSIR), which was located next door to CAC.¹³ Over the years he had interacted frequently with the staff at the Division when they conducted wind tunnel tests and analysed the performance of various aircraft he was designing and developing at the CAC. This shift in career direction from aircraft design to research and development was encouraged by the Director of the Division of Aeronautics, Lawrence Coombes, who had visited Fred David when he was based at Farnborough in 1947.

Construction of CSIR laboratory facilities at Fishermans Bend had commenced in August 1939, and while work continued until the end of 1941, the main building was already occupied in May 1940.

A centre piece of the laboratory was the enormous low speed wind tunnel completed in 1941, the first in Australia. In 1949, the Division of Aeronautics was transferred from the CSIR to the Department of Supply and renamed the Aeronautical Research Laboratories (ARL). Fred David was promoted to Principal Research Scientist in charge of the Applied Aerodynamics Section in March 1950 and a year later he was appointed as the Superintendent of Aerodynamics.



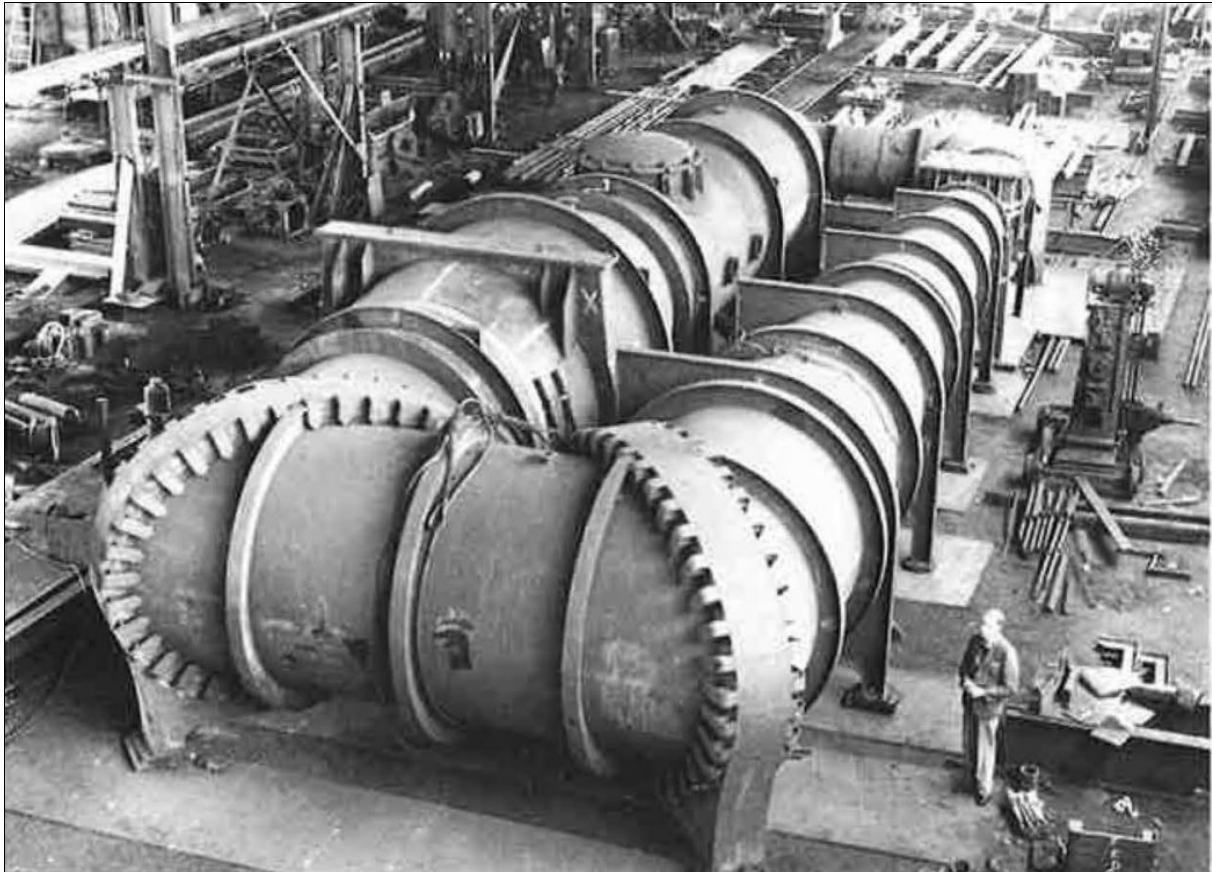
Wind Tunnel testing of a Boomerang model at CSIR Division of Aeronautics (1942).
Source: Aeronautical Research Laboratory.

¹² Weston, B. (2008), *The Australian Aviation Industry: History and Achievements* Guiding Defence and Aviation Industry Policy, Air Power Development Centre, Royal Australian Air Force, Working Paper 12, pp. 16-17.

¹³ The CSIR was a forerunner of the CSIRO, the Commonwealth Scientific and Industrial Research Organization.

Fred David – Refugee Aeronautical Engineer

When Lawrence Coombes retired in 1964, he saw fit to record his appreciation for the many contributions Fred David made at the ARL. These included reconstruction of the 9ft x 7ft low speed wind tunnel for duplex working, developing the variable pressure tunnel into a modern transonic tunnel, fostering the Mathematical Assessment Group into a powerful unit, and initiating Human Engineering at ARL.



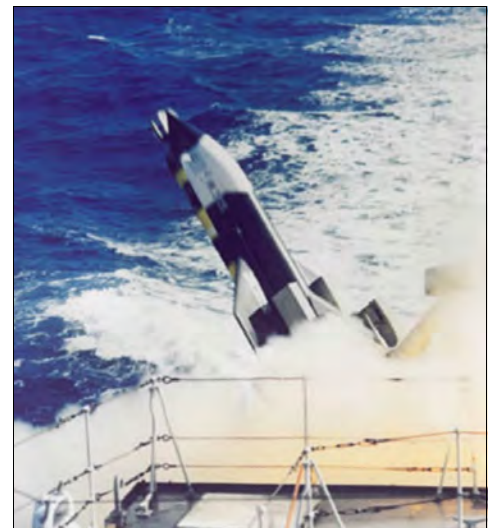
The 9 ft x 7 ft Wind Tunnel at the Division of Aeronautics at Fishermans Bend (1944).

Source: Aeronautical Research Laboratory.

Coombes singled out the transonic tunnel as an example of Fred's tenacity of purpose. After encouraging Fred David to visit the US, the Americans withheld the vital design information so that he and his staff were compelled to work out the whole problem again. With meagre funds at his disposal, they made skilful use of discarded equipment, and the ARL workshops, to create a first-class piece of apparatus.

In 1959, Fred moved to the Department of Supply headquarters in the city as Assistant Controller (Guided Weapons) where he had oversight of the Ikara project, an Australian designed long-range, anti-submarine guided weapon conceived at the ARL. As the project got underway, he spent two weeks in the UK and four weeks in the US exchanging information with our allies. The Ikara system entered service in the Royal Australian Navy in 1966 and was later adopted by the Royal Navy as well as the navies of New Zealand and Brazil.

Fred David retired from the Department of Supply on February 16, 1967, his 67th birthday. His plans for retirement included studying wave motion, and lecturing at what is now RMIT University. He ended up collaborating with a former colleague from the CAC, Lionel Stern, to work on the development and promotion of medical equipment from Germany.¹⁴ Stern had had a very successful career post-war as a designer, transforming Repco Research into a powerful R&D organisation in the automotive industry.



Ikara Missile (late 1960s)

Source: Defence Science and Technology Group.

¹⁴ Meggs, K R. (2020), *Australian-built Aircraft and the Industry (Vol 2): Commonwealth Aircraft Corporation, Books 1 and 2*, Echelon Starboard Publications, Nimbin, NSW. p. 756.

Fred David – Refugee Aeronautical Engineer

Quiet Achiever

Fred David did not blow his own trumpet nor seek publicity. He was always modest about his contributions to projects, and quick to attribute successes to the team. With his obvious intellect, he could have easily been overbearing but he wasn't.¹⁵ Those who worked with him were impressed with his pleasant and gentle manner.¹⁶ Fred David had a good sense of humour and everyone seemed to like him.¹⁷ He was so well-liked and respected at the ARL that there was no opposition to his acting as deputy to Coombes over a period of years even though he was not the most senior person who could have assumed this role.



Fred David (c. 1940s)
Source: Commonwealth Aircraft Corporation

Outside of engineering, Fred David's passion was chamber music, part of his Viennese heritage. He played the cello in a quartet and sang in a choir. A very private man, Fred David kept his thoughts to himself, revealing relatively few insights beyond the essential parts of his story. During the hectic schedule to deliver the Boomerang fighter in early 1942, what did he feel when he heard the news that Aichi D3A 'Val' bombers, which he had helped design, took part in the first air raid on Darwin? How did the soul of the musician sit with the exacting precision of the design engineer?

Fred David passed away in June 1992, aged 92. He and Else did not have any children.

Acknowledgements

The author wishes to thank the following people for their assistance in helping to gather information about Fred David and his family;

Matt Denning, Greg Batts, Derek Buckmaster, Paulus Ebner (TU Wien),
Heather Powell (Friends University), Rodney Eisfelder, Judith Levron,
and Karen Rogers (Monash University).

15 Knightly, J. (2020), *Fred David: Boomerang Designer*, Flightpath, Vol 31, No 2 (Nov 2019/Jan 2020), p. 67.

16 Meggs, K R. (2020), *Australian-built Aircraft and the Industry (Vol 2): Commonwealth Aircraft Corporation, Books 1 and 2*, Echelon Starboard Publications, Nimbin, NSW. p. 756.

17 Knightly, J. (2020), *Fred David: Boomerang Designer*, Flightpath, Vol 31, No 2 (Nov 2019/Jan 2020), p. 67.

The Mysterious Bradfield Cylinder

By Bill Phippen

In 2019 The author came to an arrangement with NSW State Archives and Records to scan the photograph collection they hold from the former NSW State Rail Authority. This project, to scan all of the 32,409 pictures, took more than two years, with time lost to Covid-19 closures of the archives.

Within that collection, four of these photographs, reproduced here, were particularly notable and what they portray is puzzling.

On close examination, two of the images show what is clearly a (full scale) drawing of a cross section of the lower chord of the great Sydney Harbour Bridge, which was at that stage still in the planning process. Although the images give a wonderful illustration of the immense size of the section of the steel chord at its greatest dimensions, they are clearly contrived as no such view is possible. The three persons shown standing between the four webs of the chord in the first image are John Bradfield, Chief Engineer for the bridge, R T Ball, NSW Secretary for Public Works and Minister for Railways responsible for the project, and Kathleen Muriel Butler, Bradfield's able and well-trusted Confidential Secretary.¹

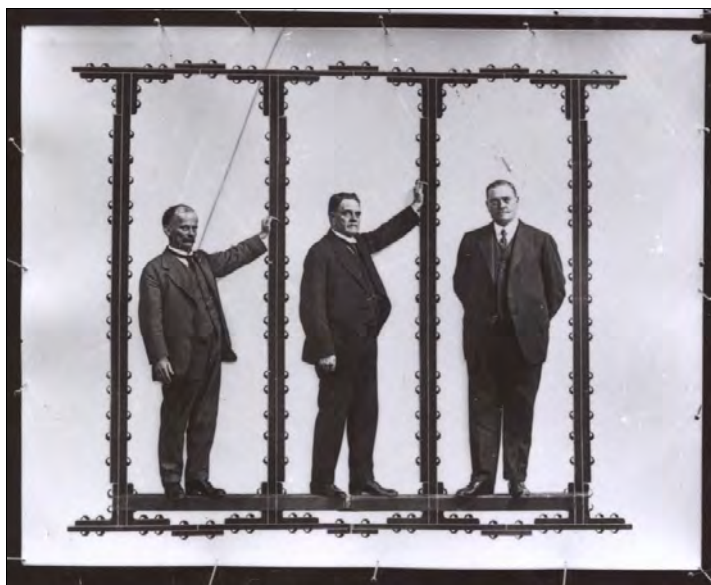


John Bradfield, R.T.Ball and Miss Butler, all appearing to stand within a cross section of the lower chord of the Sydney Harbour Bridge.

Source: NSW State Archives NRS17420_2_433_011a

It is perhaps appropriate to note here that in 2019 and 2020 the tunnel boring machine creating the sub-harbour tunnels for the second stage of the Sydney Metro was named Kathleen in Butler's honour.²

The second photo shows Bradfield, Ball and Lawrence Ennis, Director of Construction for Dorman Long and Company Limited of Middlesbrough, England, the newly appointed contractors for the bridge. The third photo is of a large cylindrical object, while the fourth image is of the same object with five people standing in front of it. They are Georges Camille Imbault, the contractor's consultant engineer who devised the erection scheme for the bridge, Butler, Bradfield, Ball and Ennis. Considering the people included in the image, it must be



Bradfield, Ball and Ennis, posed against the same cross-section drawing — Bradfield and Ball with left arms raised as if to lean against the steel webs of the chord.

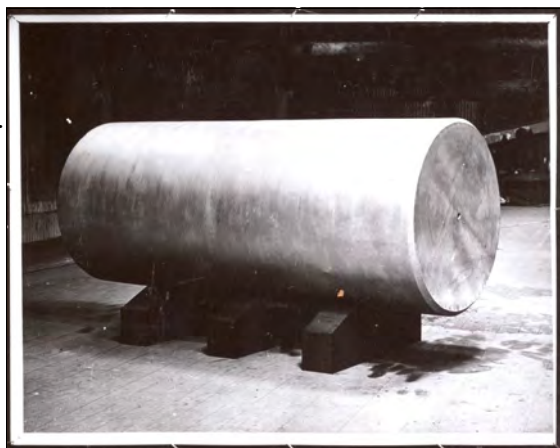
Source: NSW State Archives NRS17420_2_433_011b.

associated with the Sydney Harbour Bridge.

The most obvious part of the bridge which the cylinder could be is a bearing pin or perhaps a pin in a joint. The actual bearing pins for the arch are 14½ inches in diameter and 14 feet long, so the cylinder is not one of them, even if presented at a false enlargement. Later research suggests that the cylinder displayed has a diameter of 4ft 4in and this appears correct. So it cannot be the bearing pin.

Image at Right: The cylinder, resting on wooden floor boards of what appears to be the upper floor of some warehouse.

Source: NRS17420_2_433_011c.



1 Butler has a fascinating entry in Wikipedia at: https://en.wikipedia.org/wiki/Kathleen_M._Butler

2 *The Sydney Metro is a fully automated rapid transit system serving the city of Sydney, New South Wales. Currently consisting of one line that opened on 26 May 2019, it runs from Tallawong (in north-western Sydney) to Chatswood (on the North Shore) and consists of 13 stations and 36 km of twin tracks, mostly underground.* Wikipedia.

The Mysterious Bradfield Cylinder

Searching around the bridge for an object of the right proportions, steel pins were used to connect the anchorage cables to the shore ends of the upper chords during the cantilever erection process. Although the chord is much wider, these pins were only 27 inches in diameter and 6 feet 1 inch long, two being provided to connect the four webs to the six link plates. Assuming some photographic connivance as to scale could the cylinder depicted be one of these pins?

Image at Right: The link plates between the bridge half-truss and the temporary cables. The large pin will be fitted through holes in the end of the top chord. Around the 8 smaller pins (only 2 are in place in this workshop image) 128 cables will be tied back to the rock.

Source: NSW SARA NRS 17420_2_809_030A



However, close inspection of the original high resolution scan of the supposed solid steel cylinder reveals intriguing details. There appears to be a circumferential joint at mid-length and a longitudinal joint along the nearer end. Just above the right-hand supporting block there appears to be a dent. The circular end also appears to be fixed with a row of rivets of the type used in light-gauge work. Thus, the object is not a solid cylinder of steel but rather a hollow piece of sheet-metal work.



Left to Right: Georges Imbault, Miss Butler, John Bradfield, R.T. Ball, and Lawrence Ennis, posed in front of the supposed Sydney Harbour Bridge "Bearing Pin".

Source: NSW State Archives RS17420_2_433_011d.

This is more in keeping with the apparent setting of the photo in a low-roofed warehouse with wooden floorboards, rather than on the strong floor of a heavy engineering machine shop. Plainly, if the object were to be solid steel, its weight would be immense. Although these observations rule out the possibility that the cylinder is a large solid steel pin they leave the question open as to what it is. The image is probably 'real' in that the five people were photographed in front of a such a cylinder – but for what purpose would they want to be recorded thus?

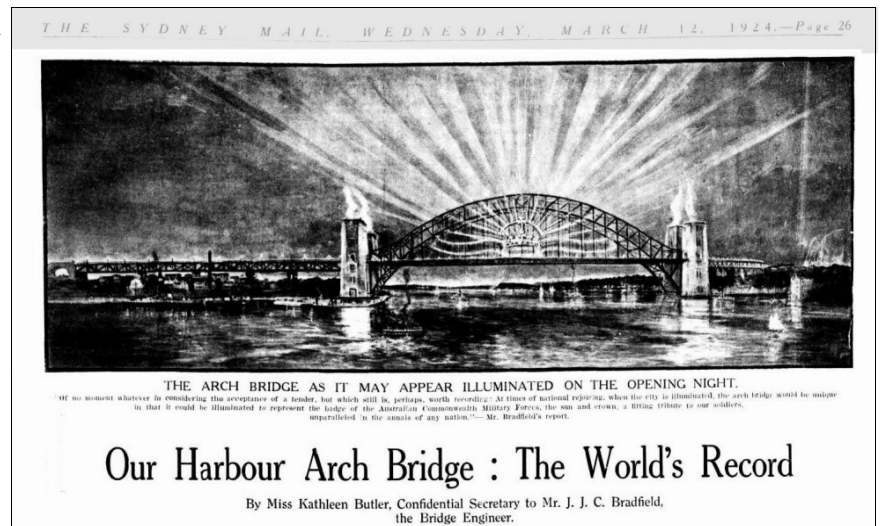
The Mysterious Bradfield Cylinder

The solution to part of this question came unexpectedly while the author was researching the life and work of Kathleen Muriel Butler. It was discovered that she had written, *from the notes of JJC Bradfield*, 29 articles about the Harbour Bridge in *The Sydney Mail* between 1922 and 1927. These were at first sought through Trove and then by viewing copies of the 29 newspapers – Butler’s own bound copies in the Mitchell collection of NSW State Library.

In Butler’s article published on 12 March 1924, titled *Our Harbour Arch Bridge: The World’s Record*,³ in which is documented the many superlatives of the bridge, the photos of Bradfield, Ball and Ennis supposedly standing inside a cross section of the bridge bottom chord, and the photo of the cylinder with the five people standing in front of it appear. The photos have captions and there is the answer, but more questions are raised.

Image at Right: The heading for Miss Butler’s article in the 12 March 1924 of the Sydney Mail. Source: Trove (See footnote 3).

In the article, the caption of the cylinder photo with the five people in it is:



THE END PIN.

The four main pins are each 10ft 6in long and 4ft 4in in diameter.

From left to right the figures are: Mr. G. C. Imbault, engineer, Dorman Long and Co.; Miss K. M. Butler, secretary to Mr. J. J. C. Bradfield; Mr. J. J. C. Bradfield, chief engineer, Sydney Harbour Bridge; Hon. R. T. Ball M.L.A., Minister for Public Works and Railways; Mr. L Ennis, general manager for Dorman Long and Co.

Thus, the mysterious cylinder is meant to be a bearing pin 4ft 4in in diameter, but it can't be because the actual bearing pins, used in the Bridge, are about a quarter the diameter of the cylinder in the photographs, and in March 1924 no physical work at all had been done on the bridge – the winning contractors had only been announced two weeks before! It must be a mock-up of what, at the time, was thought to be the size the bearing pins would be.

Tenders for the bridge had closed on 16 January 1924 and Bradfield, Butler and engineer Gordon Stuckey had worked seven days a week to assess them and prepare a report. In the last week of February Bradfield made his recommendation to Ball, and Ball endorsed it and presented it to Cabinet. This seems to have been common knowledge in the press, but it was not until 26 February that Cabinet accepted the tender and Dorman Long & Co became the contractors and their officers Ennis and Imbault became their representatives rather than just engineers in the crowd of people working for companies hoping to gain the contract. The two were certainly in Sydney at the time.

The presence of Ennis and Imbault in the photos must therefore date them after 26 February, but the publication of their photo in *The Sydney Mail* on 12 March means that the photos must have been created before that date. The proposed bridge of any other tenderer would have had a different cross section of the bottom chord and a different bearing pin if it had either at all.

So now the question is who, over such a short period of time, had the mock-up cylinder fabricated, arranged the photo-shoot and had the cross-section images compiled? In 1933 at the height of the controversy about who designed the Bridge, R.G. Ball issued a press release giving his views of the matter as an engineer. In the release, he states that in 1924 he was taken by Bradfield and Ennis to the Dorman Long factory in Mascot, Sydney, and there shown a model of the bearing pin. Dorman Long had steel fabrication shops in Sydney and Melbourne before 1924, but the bridge was built in its own new shops at North Sydney, immediately adjacent to the northern abutment tower of the bridge. The cylinder in the photo was built by Dorman Long as a prop to their tender.

Have these four images ever been published since *The Sydney Mail* of 12 March 1924? The author has never seen them but is willing to stand corrected. The photos of the bare cylinder and the cross section view including Butler may never have been published. How did they get into the SRA Railway Reference Photo Collection?

3 Miss Butler’s Sydney Mail article of 12th March 1924 can be read at: <https://trove.nla.gov.au/newspaper/article/166152089?searchTerm=butler>

A Crossley Model XA Gas Engine now at Swift's Creek in East Gippsland

By Malcolm W. Smith

Malcolm Smith is a Forest Fire Officer, located at Swift's Creek in East Gippsland, Victoria, and employed by the Victorian Department of Environment, Land, Water and Planning (DELWP). He has been fascinated with this enormous old engine for a very long time, and has been involved in a restoration project, set up to "SAVE THE WORLD'S LAST CROSSLEY MODEL XA GAS ENGINE". He says this story is an edited, updated version of a story by him, originally printed in "The Old Machinery Magazine", issue No.166, May 2013.

Malcolm is hoping to find someone in the engineering heritage community, possibly in Gippsland, or Melbourne, or further afield, who would be able to help the restorers with technical advice - or even 'hands on' assistance in the restoration work. Someone out there might know where original Crossley XA parts might be sourced, or know how to find technical drawings or specifications of missing parts to aid reproduction of them. If you are interested in helping in any way, get in touch with Malcolm at DELWP, Tambo District, East Gippsland at Email: malcolm.smith@delwp.vic.gov.au

From the Editor.

The History of the Swift's Creek Crossley Model XA Gas Engine

I first saw the magnificent old gas-fired Crossley engine when I was a skinny, pimple-faced teenager during the early 1980s, while on a 4WD trip with friends. The engine was almost intact and in good condition considering the many years it must have lain idle in the harsh Australian bush. It was as if the miners had just packed up and left everything in situ.

The Crossley sat ready to run its gold ore crushing stamper battery, with the gas producer and various mine shafts nearby. The remains of a miner's hut, with the fireplace intact, still held crude cooking utensils, with old boots and bottles scattered nearby. A straight 8 motor engine, of unknown origin, used to winch the miners and gold encrusted ore up from the bowls of the earth had been lifted up by a large Manna Gum and was now embedded into the tree!



The Crossley XA model Gas Engine, where it was abandoned in the bush, not long before the author first saw it. Photo - Bob Rankin 1978.



My youthful imagination visualised being swept back through time to witness this monster engine ticking over noisily, the huge flywheels that towered over my head spinning slowly. Along with friends, I made regular field trips back to visit the site on my clapped-out old Yamaha motorbike to explore and ponder what once was. But then it was gone. In 1988 I met some of the Army personnel during the exercise to extract the Crossley, but I didn't fully understand why it was being moved from its forest haven until years later.

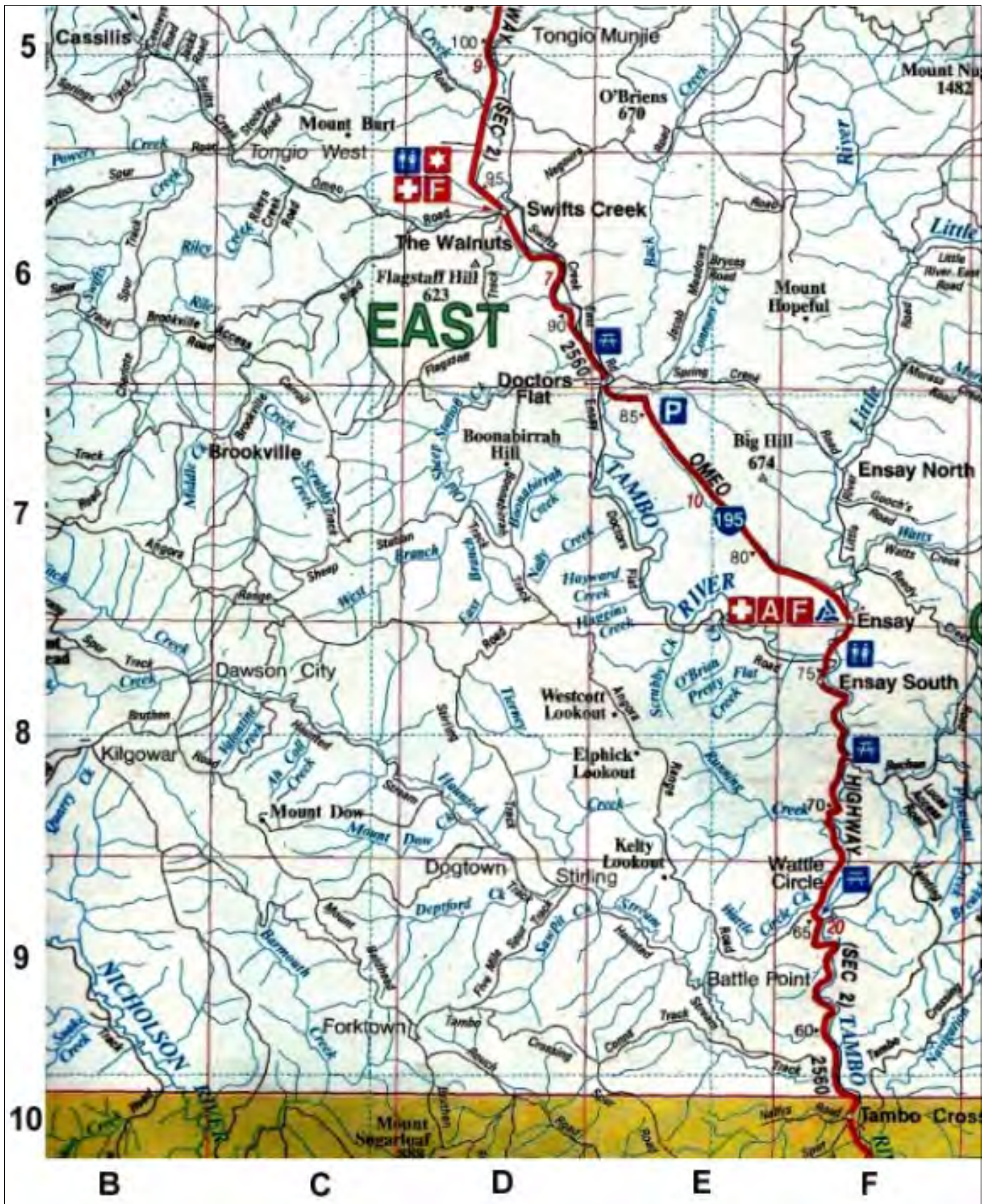
I often thought of the Crossley and was concerned our community had lost an important piece of our local history. I tried to trace its whereabouts unsuccessfully on several occasions. Over time its location became lost, even to the authorities that had endeavoured to preserve and protect the engine. Twenty-three years later, while enquiring about missing files on the engine, I received a call that would ultimately reunite me with the Crossley and the golden opportunity to help restore and preserve the very same engine of my youth.

Image at Left: The remains of an old miner's hut, seen by the author in the early 1980s and photographed by him in 2005. All that survives is the fireplace, with the chain from which an iron kettle used to hang, and a rusted enamel wash-dish. Photo: Mal Smith 2005.

A Crossley Model XA Gas Engine

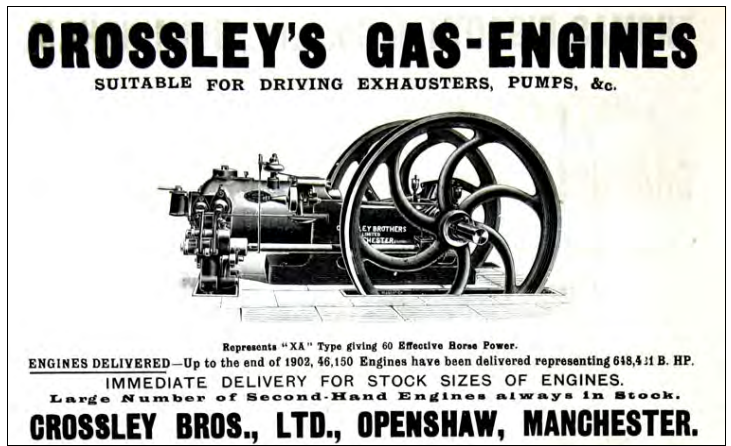
On first reading this story, I could easily visualise where, in a landscape I have known well for many years, all the places mentioned in the story are, and what many of them look like. But on getting into the editing, I soon realised that very few readers indeed would have any idea of where these places are – perhaps not even where East Gippsland is (a region in the far east of Victoria). They would need a map. The best maps I know, which show all the mountains, and bush tracks, and streams, and long-vanished villages, are in the VICROADS State Directory. The map below is a detail from Map 66 of this book (with grid). Some locators – Cassilis is at 5-B, Swifts Creek is at 6-D, and Stirling is between 8-9 and D-E.

The Editor



A Crossley Model XA Gas Engine

Historically the engine was dispatched from Manchester in England, to Alex Cowan and Son Pty. Ltd., in Melbourne, Victoria, in November 1907. From there it made its way to East Gippsland and was believed to have been used on the Haunted Stream Gold Field, in rugged country between Bairnsdale and Omeo and west of the Omeo Highway (latterly, known as the Geat Alpine Road). Alluvial gold was first discovered along the Haunted Stream in 1863 and by the 1880s reef mining was established. A detailed geological description of the Haunted Stream Goldfield, was written by R.A.F. Murray, the Government Geological Surveyor, and published in the *Bairnsdale Advertiser and Tambo and Omeo Chronicle* in 1887.¹



A 1903 advert. for a Crossley XA Model Gas Engine. Source: Grace's Guide.



A straight 8 motor engine, embedded in a Manna gum, as seen by the author in the early 1980s where the tree had grown up through it. Photo 1976, source not provided.

The first location of the Crossley on the Haunted Stream Gold Field, was probably at a mine site somewhere near the township of Stirling, on the junction of Tierney's Creek and Haunted Stream, which flows into the Tambo River. The population of Stirling was booming during the 1890s with hotels, Post Office, School, Butcher, Bakery, General Store, Police Station and a Recreation Reserve used for cricket, football and other sporting events. Other small satellite settlements including Dog Town, Dawson City, and Bayliss Flat became established around major gold mines.

Gold supported the population well with the Ernestine, Rob Roy and Hans Gold Mines being the top producers. Dozens of batteries operated to crush gold-producing ore, and the thunderous roar of the machinery echoing through the valley would have been deafening to the local residents.



The straight 8 motor engine, still caught in the Manna gum, in 2007, after the Great Divide Fires had passed through the region. Photo: Mal Smith.

By 1913 gold production was slowing down, and with the outbreak of the Great War, the township of Stirling and other nearby settlements were almost deserted, with only a handful of miners left by 1917.

In the 1920s the Crossley was moved again for use by the Ensay South Gold Mining Syndicate to somewhere on Tierney's Creek, west of the township of Ensay, Victoria. It's believed a small engine (the straight 8 motor engine maybe?) was fixed in place on the Crossley with enough power to winch the estimated 8 tons of the Crossley from tree to tree until it was in place at its new site along Tierney's Creek.

¹ *Bairnsdale Advertiser and Tambo and Omeo Chronicle*, Tuesday November 29th 1887, pages 2 and 3 – *The Haunted Stream Goldfield*, by R.A.F. Murray, Government Geological Surveyor <https://trove.nla.gov.au/newspaper/article/84687506>

A Crossley Model XA Gas Engine

The Crossley engine was used solely to provide power for a five head Stamper Battery, made by Langland's Foundry in Melbourne, to crush gold-bearing quartz ore from the many gold mines in the vicinity.

Image at Right:

The Langland's five head gold ore stamper battery, abandoned at the mine site on Tierney's Creek with the Crossley engine, as seen in June 1976. Source: David Coy.

During the Great Depression of the 1930s, almost all machinery along the Haunted Stream was broken up for scrap, leaving little evidence of what had once existed. Today the township of Stirling and other former settlements are deserted and have reverted back to forest as they once were.

In the late 1980s the former Department of Conservation Forests and Lands (CF&L), had decided to extract the Crossley engine to stop vandalism and theft, as parts had been pilfered in the past. The last straw was when three people had been found trying to remove the entire engine from the Tierney's Creek Battery site.



Army Reserve personnel removing the fly wheels from the Crossley engine, while a bulldozer waits on. Photo: Ian Martin, 1988.

The engine block, crank housing, and fly wheels were delivered to an engineer's work shop in Sale, Gippsland where they stayed for over two decades. The piston, conrod, external camshaft and other smaller component parts were stored by the CF&L at Swift's Creek. The aim of moving the engine was to protect and preserve the rare beast so that future generations could enjoy it being publicly displayed. Despite best intentions, things started to go awry.

As the years flew by, the engine was all but forgotten, and the departmental staff involved in moving the engine in 1988 had retired, moved away, or couldn't recall where the Crossley was delivered to in Sale. All records and files relating to the matter may have been inadvertently destroyed in 2005 or had been relocated to archives in Melbourne. Despite best efforts the original records have not been located.

In 1988 a cooperative venture between Swifts Creek CF&L and the Army Reserve 3 Recovery Company (Comm Z) based at Warragul and Korumburra in Gippsland, was organised to try to recover the Crossley from the steep inaccessible country. During the exercise two Army Reserve members were injured when one of the unit's trucks failed to negotiate a sharp bend and rolled down a very steep embankment.

The accident happened prior to the successful recovery of the engine. An Army Bulldozer was used to extract the Crossley from the steep, fern-lined gully and clear mountain stream that had been its home for so many decades.



The Crossley flywheels are removed from the site, strapped to the blade of the Army Reserve International TD15 Bulldozer. Photo: Ian Martin, 1988.

A Crossley Model XA Gas Engine

Unfortunately, the Crossley parts stored at Swifts Creek were flooded in 1998, and shortly after someone made the decision to relocate those parts to the Cassilis Historic Park, another former gold mining area not far from Swift's Creek, but less secure. Fortunately, most of these parts were promptly recovered by members of the Omeo Historical Society and stored in Omeo, a larger town further north. Only the piston and external camshaft were left behind as they were too heavy to lift without heavy machinery. Some other parts had been removed from the Historic Park prior to this and remain missing to this day.

More misfortune struck the Crossley's former resting place at Tierney's Creek in 2007, when the Great Divide Bushfire burnt through the Tierney's Creek battery site. The Great Divide fire was the third largest bushfire in Victoria's recorded history, burning over 1.2 million hectares of public and private land. The timber that supported the Langland's Foundry Battery had been burnt away. To this day the battery hangs on a dangerously precarious angle defying the laws of physics – but gravity always wins in the end.



Above: Parts from the Crossley engine lie forlornly at the Cassilis Historic Park in 2011. Photo: Mal Smith.



Image at Left: A photograph of the Langland's Battery taken a few years after the one on the previous page. Note that the big pulley wheel that drove the stampers has already disappeared. Photo: Ben Rankin, 1978.



Image at Right: The Langland's Battery in the aftermath of the 2007 Great Divide fire, leaning at a perilous angle, with its wooden frame burned away. Photo: Mal Smith, 2007.

Through my employment with Forest Fire Management Victoria, I was given the task of completing a site assessment in the aftermath of the fire. Armed with GPS, maps and a camera we surveyed the area surrounding the battery site. Everything that survived was clearly visible with most dense vegetation being burnt away.

Several years later I contacted Parks Victoria about the missing Crossley files. By luck I learned that Heritage Victoria had had an enquiry from a Brad Pitt who had located the engine in Sale, Victoria. Brad had researched the history of the engine and helped me to contact the elderly gentleman who had kindly stored the key component parts of the Crossley for 23 years. That gentleman was happy for the Department to remove the engine.

A Crossley Model XA Gas Engine

The East Gippsland Tilt Tray Service very kindly donated a truck to move the major component parts from Sale back to Swifts Creek. Thank you!

The Crossley engine that was stripped ready for the restoration that never occurred, had finished up being spread throughout East Gippsland - from Sale, to Swifts Creek, Omeo, and Cassilis. Original parts that had been removed from the Crossley in the past have now been returned. Some parts have been returned from Heyfield in Gippsland, and as far away as South Australia! Almost everything has now been reunited in the one location ready for the restoration project to begin.



The Crossley Engine delivered to its new home in Swift's Creek from Sale by the "East Gippsland Tilt Tray Service" in 2011. Photo: Mal Smith.



The Crossley Restoration Committee meeting in the engine's new home at Swift's Creek in 2012. Photo: Graeme Devison.

A non-profit Crossley Restoration Committee was formed with representatives from the Department of Environment, Land, Water and Planning (DELWP), East Gippsland Shire, Omeo Historical Society, Parks Victoria, The Benambra & District Historic Machinery Club, The Corryong Historical Machinery Club Inc., and other interested parties. The Antique Machinery Restoration Society of Queensland has also kindly offered technical information and advice for restoring the Crossley.

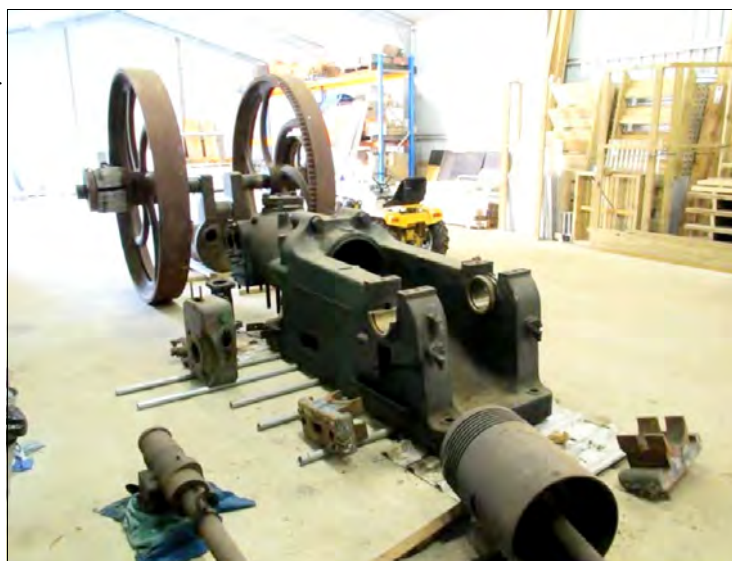
The Restoration Committee unanimously decided to restore the Crossley to working condition and once it is complete, it will go on permanent public display at Ensay, Victoria, near where it originally worked. A large five head battery will also accompany the display. Original paintwork and coarse patina will be kept on this rough diamond.

Unfortunately, the sad passing of engineers and committee members – John Leadoux and Vic Antonoff – who had volunteered their assistance to restore the Crossley has meant the restoration committee lacks the technical knowledge to complete the work.

Is there an engineer out there who is willing to help with this project?

When the Crossley is restored to working order, the Restoration Committee intends to maintain it and run it several times a year, and it is hoped that these events will help the community of Ensay, and surrounding district. The Committee set up an appeal for funds to help pay for the restoration, and the Omeo Historical Society kindly donated \$500 to kick start the project, but a lot more is needed. The estimated cost of the project in 2013 was thought to be

as high as \$28,000, for the engine to be returned to operational condition and securely housed. Disappointingly, those who had promised to donate to the restoration project via a GoFundMe appeal did not. But a big thank you to all who have contributed to the project in any way thus far – your efforts are much appreciated.



The Crossley Engine in pieces on the floor of its shed in Swift's Creek, gathering dust and cobwebs, waiting for original parts to be returned. Photo: Mal Smith 2013.

A Crossley Model XA Gas Engine

It is 2022 now – my how the years have flown! The Crossley is still sitting in the shed in bits, and another fire has burnt through Tierney's Creek and most of East Gippsland. The waning committee members last met in October 2018, and decided that the Crossley will still go to Ensay, but will be on static display only. At least the Crossley will be on view to the public and it may enliven public interest in getting the old timer going once again. I can only hope....

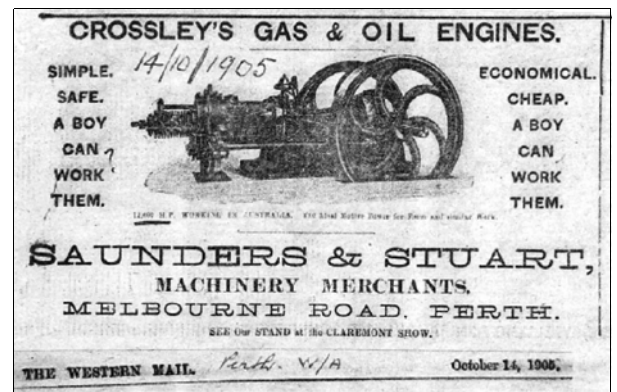
From information I have sourced, this engine is believed to be the last of its kind worldwide, signifying its rarity and the importance of restoration and preservation. The Crossley is said to be listed in the Heritage Victoria database as part of the *Tierneys Creek Battery and Mine Site* and to be of National Estate Significance, but no specific details could be found via the Internet.

We are still looking for: original Crossley XA Parts ~ Pictures ~ Information ; contributions of time and materials to reproduce parts ; and, donations or sponsorship to help purchase or manufacture parts.

Of the 26 Crossley Model XA and XAE (with electric flywheel fitted) engines dispatched to Australia this one at Swift's Creek is believed to be the only survivor. Perhaps if anyone knows where any of the other 25 Crossley XAs or XAEs ended up, there might be some remnants surviving which could help with the restoration.

Here is a list of the various importers, in Sydney, Melbourne, Brisbane, Adelaide and Perth.

- 8 to Alex Cowen & Sons Ltd
(4 to Sydney Office & 4 to Melbourne Office.)
- 5 to Saunders & Stuart, Perth,
- 3 to James Hill & Son, Adelaide,
- 1 to Webster & Co, Brisbane,
- 1 to D. & J. Fowler, London for Australia.



Connections

Victoria's Mining History: a bibliography



While trying to find out more about the Haunted Stream goldfield in East Gippsland, where the Crossley engine was found, I came across a comprehensive bibliography of Victoria's mining history in, of all places, the University of Exeter website. It covers the mining of various minerals (gold, tin, silver & lead), energy sources (coal, oil & gas), even precious stones, as well as social history, equipment & structures, people & organisations, and finally, heritage surveys. The earliest

entry is probably S.T. Gill in 1854. Find it at: <http://projects.exeter.ac.uk/mhn/new/bibau07.html>

"The Life Scientific": Ailie MacAdam, Engineer.

I learned about this BBC4 podcast through the Newcomen Society. *Engineer Ailie MacAdam talks to Jim Al-Khalili about working on some of the biggest construction projects in Europe.* See <https://www.bbc.co.uk/sounds/play/b09sn7yk>



Adaptive re-use of the Balls Head Coal Loader – a Webinar.



Remember the story about the former Balls Head Coal Loader in the January 2022 EHA Magazine? The author organised this seminar with his two main consultees on the story. It happens on 20th June and registration closes at 11:59pm on the 18th June. Find out all about it at: <https://www.engineersaustralia.org.au/node/71011>

Connections

The Gladesville Bridge & Tony Gee, its designer.

John Muirhead, who worked on the bridge construction, wrote us a story about the construction which was published in this Magazine in the September 2019 issue. He hardly mentioned Tony Gee in that story, but always admired him, and was delighted to re-meet him when Gee returned to Sydney in 2014 to take part in the “recognition by the American Society of Civil Engineers of the bridge as an International Historic Civil Engineering Landmark and also the highest award of the Institution of Engineers, Australia of an Engineering Heritage International Marker”. Muirhead even consulted Tony Gee on the contents of the Magazine story, getting Gee’s approval before he allowed it to be published. Sadly, Anthony Francis Gee died only a year later, in 2020. I didn’t hear of Gee’s death until much later again, but my interest in him was sparked by finding Rob When’s obituary of him from the SMH, and I started searching for more. But first – the obituary at:



<https://www.smh.com.au/national/engineer-designed-gladesville-bridge-at-the-age-of-22-20201031-p56abs.html>

When gives a link to a *Video of a special harbour cruise under the Gladesville Bridge organised by Roads & Maritime Services.*

That purports to be an interview with Gee, but it is much, much more – see: <https://youtu.be/y3UXKYiw3FY>

There is a nice piece by Tony about his *15 minutes of fame* in a Cambridge Dept. of Engineering Alumni News of 28 September 2015 - see: <http://www.eng.cam.ac.uk/news/alumni-news-tony-gee-designer-gladesville-bridge>

Two scientific papers by Gee evaded me – one is *The Use of an Electronic Digital Computer in The Detailing of an Arch Bridge*, by A. F. Gee, M.A., A.M.I.C.E. – in Vol.56, No.654, January 1961 of *Journal Civil Engineering, London*. The other is *Gladesville Bridge*, by John Walter Baxter, Anthony Francis Gee, and Howard Baikie James, in Proceedings of the ICE, Vol.30, Issue 3, pp.489-530, London, March 1965, if you can access them.

If you are an ardent fan of the bridge, there is so much more fascinating stuff on line, but the oddest is perhaps <https://roads-waterways.transport.nsw.gov.au/documents/about/environment/protecting-heritage/oral-history-program/construction-of-the-gladesville-bridge-summary-report.pdf> Well worth a look.



Broadmeadow Loco Depot in Hunter Living Histories

I have to declare an interest in this one. In 1995 we, Carl & Margret Doring, completed a substantial Heritage Study of the Broadmeadow Loco Depot in Newcastle NSW, soon after it was said to be closed (although there were still plenty of locos and people there). For many years, our report was available in a couple of collections as a comb-bound paper copy, but in 2021, I was approached by Shane Blatchford, a long time employee at Broadmeadow, who has spent many years in mighty efforts to save the depot from imminent demolition and site clearing.

I was pleased to be able to help him by providing a digitised copy of our report in PDF format, and he and his heritage colleagues have used it to help them prepare a magnificent blog, posted on the Hunter Living Histories Site, which aims to persuade the powers that be to support *the sympathetic development of the Broadmeadow site for rail heritage* and the public benefit. And I am delighted that he has made our report available for downloading - all 284 pages of it - by any interested member of the public. Find the Broadmeadow Hunter Living Histories post, in Uni of Newcastle Special Collections at: <https://hunterlivinghistories.com/2021/11/26/broadmeadow-loco-depot/> The Title is: ***Broadmeadow Locomotive Depot: A Proposal For Its Conservation and Adaptive Reuse*** and: *This post honours the memory of the late Dr Bernard (“Bernie”) Curran AM. Bernie, at the time of his passing, was working with the rail heritage community to establish the Broadmeadow Locomotive Depot as a Newcastle regional heritage centre. This post has been compiled with his help, and that of his fellow colleagues Shane Blatchford, Paul Battle, Bill Storer AM and Peter Scaife.*

All power to their arms!!

Pan Am’s Pacific Clipper, Boeing 314, ‘flying boat’: The world’s first around-the-world commercial flight.

I thought some of you might enjoy this little story from a distant world.

Knowing my interest in WW2 Flying Boats, daughter Jessie sent me this one:

<https://www.traveller.com.au/pan-ams-pacific-clipper-boeing-314-flying-boat-the-worlds-first-aroundtheworld-commercial-flight-h208xs>



Connections



Great News from Ken McInnes

The March 2022 edition of the *Encyclopedia of Australian Science and Innovation* has been published online by the Centre for Transformative Innovation, Swinburne University of Technology, and it can be accessed online at <<https://www.coas.info/>>. Its aim is to provide a gateway to the history and archives of science, technology and innovation in Australia. The previous edition was published in December 2019, by the eScholarship Research Centre, University of Melbourne.

More information about the Encyclopedia can be seen on the ‘About’ page at: <<https://www.coas.info/about.html>> including its background <<https://www.coas.info/background.html>>; history and development <<https://www.coas.info/ackn.html>>; and current management <<https://www.coas.info/credits.html>>.

The Encyclopedia will always be a ‘work in progress’ as new bibliographical and biographical material is added, and as different ways of ‘exposing’ and presenting the data are explored.

In this edition, “Awards”; “Innovations”; “Expeditions”; and “Journals” are better exposed through new gateways via <<https://www.coas.info/>>

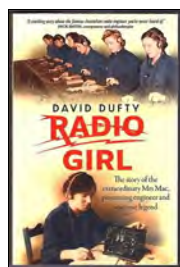
For those interested in researching engineering history, some of the foundation engineering societies and their proceedings have now been separately listed, with many links to online resources, and many of the engineering history publications such as the Engineering Heritage Australia (EHA) conferences and related papers, and magazines and newsletters that have been included in the bibliography have been grouped. For example, see EHA in <<https://www.coas.info/biogs/P006896b.htm>> and its related entries.

Earlier bibliographies, such as *A bibliography of Australian engineering history and heritage, prepared from the database ENGINE*, 1991, Cumming, D. A, Moulds, A. Wrigley, L. J., have also been included in the Encyclopedia.

Ken wants to point out that there are inevitable ‘typos’, errors, and omissions in the document, and he tells us corrections, comments and contributions are always welcome.

Parques Radio Telescope 60th Anniversary – 1961 to 2021.

I regularly receive email newsletters from the Australian Commonwealth Scientific and Industrial Research Organisation – the *CSIRO Snapshot: Science news highlights*. Usually it's full of recent projects and advances, but this issue, of February 2022, one thing caught my eye – a piece of history. It's a video: Celebrating sixty years of our Parkes radio telescope (Murriyang). I thought some of you might enjoy it. Go to <https://www.youtube.com/watch?v=Fe8GOLj8RvY>



Radio Girl: The biography of Florence Violet McKenzie (née Wallace)

This is a book recommendation - not a review. Guy Hodgkinson wrote to us EHV's a couple of months ago to tell us how much he enjoyed this book by David Dufty: *Radio Girl: The Story of the Extraordinary Mrs Mac, Pioneering Engineer and Wartime Legend*. A booksellers blurb says (in part) All around Australia, former WRANs and navy men regard the woman they know as Mrs Mac with a level of reverence usually reserved for saints. . . . A smart girl from a poor mining town . . . Violet McKenzie became an electrical engineer, a pioneer of radio and a successful businesswoman. As the clouds of war gathered in the 1930s, she defied convention and trained young women in Morse code, foreseeing that their services would soon be sorely needed. . . . Always a champion of women, she was instrumental in getting Australian women into the armed forces. Mrs Mac . . . came to be respected by the defence forces and the public too for her vision and contribution to the war effort. Available via lots of booksellers, or perhaps you can borrow it from your local library – like Guy did. he suggests an ABC program about her – <https://www.abc.net.au/radionational/programs/archived/hindsight/signals-currents-and-wires-the-untold-story-of/3287402> and her ADB entry – <https://adb.anu.edu.au/biography/mckenzie-florence-violet-15485>

Sydney Opera House gets the highest civil engineering recognition

The Sydney Opera House joins other leading historic landmarks after being awarded the world's highest civil engineering recognition. The story of this award can be read at: <https://createdigital.org.au/sydney-opera-house-recognised-for-its-brilliant-engineering/#:~:text=Breaking%20Engineering%20ground,Arup%20Chair%20Dr%20John%20Nutt.>



Connections

Now&Then Issue 109 October 2021



The NSW State Archives newsletter, *Now & Then* announced that Over 4000 digitised glass plate negatives from the Maritime Services Board (MSB) were available to browse and download in our catalogue, *Collection Search*. The images date from 1870 to 1960 and show Sydney Harbour as a working harbour and a centre of work and industry as well as a place of natural beauty. This link takes you to many of the images:

https://www.records.nsw.gov.au/archives/magazine/galleries/maritime-services-board?utm_source=Now%26Then+Newsletter&utm_campaign=fc9404867b-EMAIL_CAMPAIGN_7_23_2020_9_34_COPY_01&utm_medium=email&utm_term=0_1c5b511422-fc9404867b-261684629&mc_cid=fc9404867b&mc_eid=6326acb5ee

How Australia built the internet of the 19th century

Rex Glencross Grant sent me this link to a Conversation on ABC Radio:

<https://www.abc.net.au/radio/programs/conversations/overland-telegraph-line-nt-charles-todd-derek-pugh/13793392>

As early as 1856, Charles Todd had the idea to build an Overland Telegraph Line linking Adelaide to Darwin. He hadn't arrived in Australia yet, and the British still suspected an inland sea existed in the centre of the country. Northern Territory historian Derek Pugh tells the story of Todd's foresight and ambition to connect the colonies in Australia with each other, with Indonesia and with England. The completed Overland Telegraph Line spanned more than 2,000km. Workers used 36,000 poles, to hold an overhead telegraph wire. Station masters at every stop passed messages along the line in morse code. Before the line was constructed, news from London took two or three months to arrive. Sent via telegram, it took seven hours.



I.E.Aust. Transactions online from 1920-1928 Vol.1 to Vol.9

In my research, I have often needed to consult the early Institution of Engineers Australia (EA) Transactions, but in recent years they have been impossible (for me) to freely access via the EA website – or any other way. I now realise that a lot of other people researching Australian engineering history have had the same problem – but I now have one answer, from the ever resourceful Ken McInnes. He says, the Transactions used to be available on the EA website for free, but not anymore. However, the old EA website has been archived by the National Library Australia, through Pandora, so they are still able to be found and downloaded for free. Herewith a list of the web links for each of the Transactions for the years 1920 to 1928. A bit clumsy and long-winded for frequent searching, but once you've downloaded them, you'll be set for years:

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_9+1928.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_8+1927.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_7+1926.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_6+1925.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_5+1924.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_4+1923.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_3+1922.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_2+1921.pdf

http://pandora.nla.gov.au/pan/128542/20161003-0002/www.engineersaustralia.org.au/sites/default/files/shado/Member+Services/Library/I_E_A+Transactions+vol_1+1920.pdf

