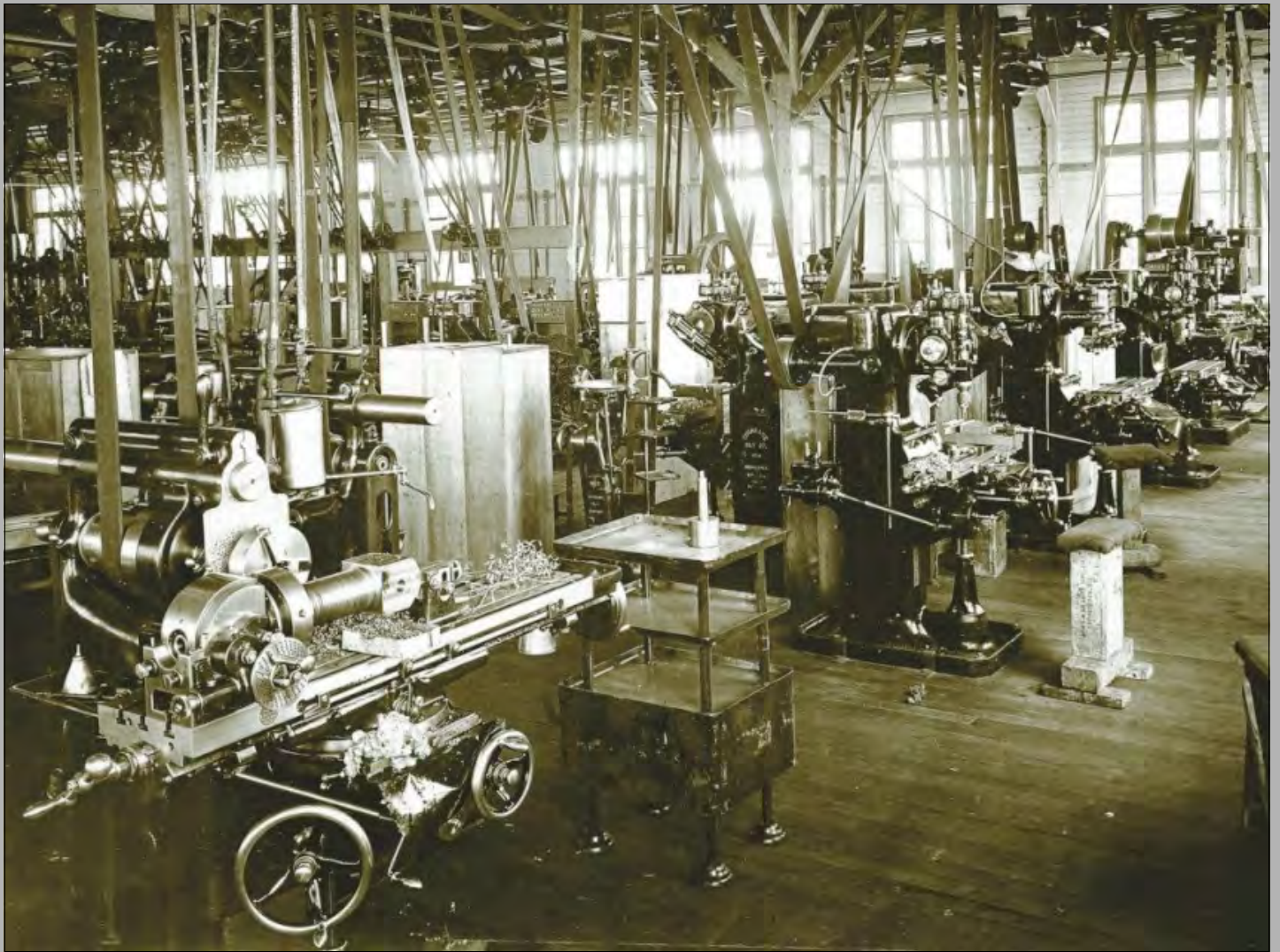




ENGINEERS
AUSTRALIA

EHA MAGAZINE



Engineering Heritage Australia Magazine

ISSN 2206-0200 (Online)

May 2019
Volume 3 Number 2

EDITOR:

Margret Doring, FIEAust. CPEng. M.ICONOS

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 on the email address above.

If you wish to be removed from the EHA Magazine subscriber list, please contact the Editor at the phone number or email address below.

Subscribe: Readers who want to be added to the subscriber list, or those wishing to submit material for publication in the Engineering Heritage Australia Magazine, can contact the Editor at: (03) 5729 7668 or by email at: doring.belgrano@bigpond.com

Cover Images:

Front: The Tool Room of the Lithgow Small Arms Factory in 1914.

Photo: From the SAF Museum Archives.

Back: Two paintings by "Brendorah", The "Nom de Brush" of a Sydney artist who worked at the Lithgow Small Arms Factory in WW2. See page 27 for details.

Top: Woman's Night Shift.

Bottom: Morning After Night Shift.

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
Towrang Bridge and Culverts near Goulburn NSW	4
Connections – Big Stuff	8
Avalon Airshow	9
Peter Behrendt	10
A Melbourne Docklands Cargo Crane	15
The Black Box Flight Recorder	16
The Lithgow Small Arms Factory & Museum	20

"Wonders Never Cease"

"100 Australian Engineering Achievements."

Engineers Australia (EA) is celebrating its centenary year in 2019. To mark this occasion, Engineering Heritage Australia has produced a book of 100 significant Australian engineering achievements, from the Stump Jump Plough, to the Sydney Harbour Bridge, to the Snowy Mountains Scheme. A celebration of our rich engineering heritage, these stories will appeal to engineers and non-engineers alike, and are accompanied by an array of remarkable images. Engineers have taken often visionary ideas and turned them into practical realities, and the pages of this book highlight the combination of toil and genius which has shaped the Australia we live in today.



For the price of the book, to EA members & non-members, and how to buy it, see a link to EA Books on the next page.

Lithgow Small Arms Factory & Museum

a microcosm of Australian values, ingenuity and history.

by Renzo Benedet, President & Secretary of the SAF Museum.

Introduction

It was the 7th April 1908 when the Commonwealth Department of Home Affairs placed an advertisement in the Commonwealth Gazette advising of the purchase of lands for defence purposes at Lithgow, NSW for a sum of £2776-17s-6d (valued at A\$602,000 in 2019 dollars). That land purchase subsequently led to the design and construction of the Lithgow Small Arms Factory (the Factory), an industrial icon of massive proportions in Australia's history.

Lithgow became the birthplace for precision manufacturing in defence applications in Australia. It introduced mass production with world class production techniques. It developed and sustained the Lithgow region for 70 years, economically and socially. In 1942 it was leading the way in equality of working conditions and pay for women and men. It gave Australian troops firearms suited to varying operating conditions in various war zones. At its opening in 1912, the Factory was a smallish complex but it 'grew and grew' with production facilities being added in short bursts over a 20 year period.

This story traces some of the essential features of the Factory: the decision for choosing Lithgow; the engineering challenges and triumphs experienced in WW1 and WW2; the key figures in the making of the Factory; and the rising of the Lithgow Small Arms Factory Museum (the Museum) and its development.

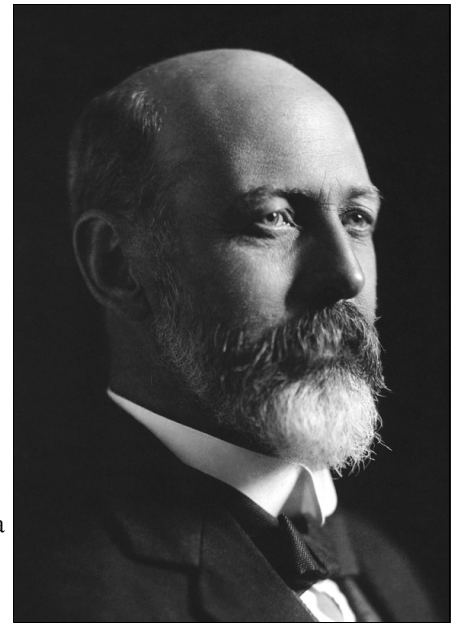
Choosing Lithgow

Lithgow is located 140km west of Sydney and is on the fringe of the Blue Mountains. In the early 1900s, Lithgow was primarily farmland, co-existing with the coal mines, railway works and the iron and steel industry.

Federation was a mere 6 years old when the Australian Government began to seriously think about self-reliance in terms of military effort. It had 113 years of English rule prior to 1901 – its customs and traditions were very much geared to the 'mother country'. It seemed 'the colonies' were just that, an offshoot of England that would never cease. The experience of Australians in the Boer War planted a seed in the minds of the first Australian Parliament and Defence hierarchy that 'self-reliance' should be considered. In fact, the concept of Australia having its own 'central arsenal' was first raised in 1881 but was not acted on until 1907, when Prime Minister Deakin resolved to make Australia's defence supply independent of Britain.

But Australia had no expertise in defence production. Its secondary industry was embryonic. Despite this, it was the local Member of Parliament, Joseph Cook, and the Lithgow Progress Association which, in the years preceding 1908, lobbied hard for Lithgow as the site for a possible small arms factory. At the time, Lithgow was an industrial (iron & steel making), railway and coal mining district with ample farmland. But the Lithgow site had a strong rival in the Victorian based Colonial Ammunition Company (the nation's first modern ammunition factory), located in Footscray, a suburb of Melbourne. Joseph Cook and Lithgow industrialists prevailed over Victoria because of Lithgow's industry, its railway access and plenty of available land.

On November 11, 1908, the Department of Defence called tenders for supply of a plant for manufacture of small arms, bayonets and scabbards, to be built at Lithgow.



Sir Joseph Cook, 6th Prime Minister of Australia.
Crown Studios, 1914 - from Wikipedia.

The 1908 decision without the prospect of war

The question that is often asked is why the Australian Government made plans for a small arms factory in 1908, when there were no obvious threats of war – World War 1 was six years away. Well, it wasn't just about war, although some threats were emerging. In fact, it all began with the plans of Prime Minister Deakin to create an Australian defence force by overhauling the collective forces of the States. He was adamant that Australia needed a defence force that could stand on its 'own two feet'. But behind the scenes and from British intelligence, military mobilisation was beginning in some parts of the world. In 1906, Deakin had warned that 'leading nations are arming themselves with feverish haste'. He felt it was incumbent on Australia to take greater responsibility for its defence and to play its part in the defence of the Empire, 'to be a source of strength and not of weakness'.

At that time, Britain was concerned about Germany's naval build up and Australia was concerned by Japan's rise and quick defeat of the Russian navy in 1905. Australia had always been conscious of its geographic isolation from Britain. The increasing international tensions were a concern but not at a level that impacted the proposed Factory. The expectation of war was not on the horizon. Developments in Europe were distant to Australia and any needed support to the 'mother country' would be honoured perhaps in a similar vein to that during the Boer War.

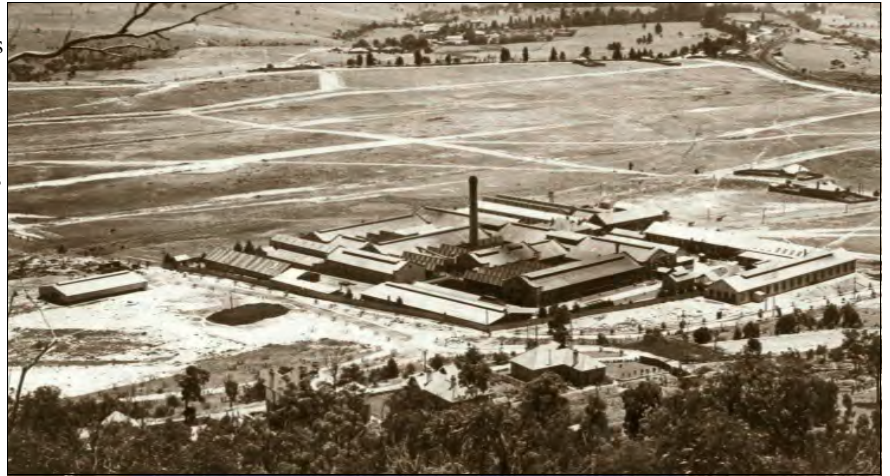
Lithgow Small Arms Factory & Museum

The tender for the Factory issued in 1908 was responded to by four overseas groups. But the choice was really between two companies – Pratt & Whitney (US) and Greenwood & Batley (UK). The tender prices were almost identical (between £68,000 and £69,000 – equivalent to A\$15million in 2019 dollars purchasing power). In 1909, the decision was taken to award the design and build of the facilities and production management to Pratt & Whitney. It was announced by the Minister for Defence, Joseph Cook, who as the Commonwealth Member of Parliament representing Lithgow, had been the architect behind the Lithgow site selection a year earlier.

A Factory triumphant in overcoming engineering & operational challenges

The decision to go with Pratt & Whitney met with expected British criticism and there was considerable consternation as to how could 'a colony' do this to England. The 'writing was already on the wall' after an exhaustive international tour by Australian Defence officials of military industrial plants in the US and UK revealed the superiority of US production techniques, with a lesser need for skilled personnel.

The Pratt & Whitney decision suited Australia's primitive manufacturing base and its lack of skilled people. Pratt & Whitney had perfected a production regime which not only involved precision mass production and the interchangeability of parts, its workforce needs were less, with lesser skills as the machines did the 'repetitive work'. In contrast, the British model required a much greater workforce with higher skills.



The Lithgow Small Arms Factory in 1919.

From the SAF Museum Archives.

The challenges facing the Factory were intense, starting from a 'blank sheet of paper'. The fact that Pratt & Whitney had never built and supplied an entire factory complex anywhere outside the US and that they had no experience whatsoever in their machines 'punching out' parts to comply with British War Office specifications, didn't go unnoticed in both political circles and the media. The Lithgow plant was to be Pratt & Whitney's showpiece internationally – and it was to be, at the time, Australia's largest arms factory. Construction got underway in late 1909. Usual construction-related issues emerged in terms of insufficient labour, material supply issues and the Lithgow weather conditions.

The Factory was designed for a one-shift 48-hour working week, producing 15,000 rifles and bayonets a year. Pratt & Whitney supplied the various machine tools (340 in number plus 11 forge hammers and 22 oil furnaces), the jigs and fixtures for making, measuring and maintaining the cutting tools and gauges to check sizes after each machining operation (6370 gauges were ordered). 6500 tools and 9000 spares were ordered, including 2250 cutting tools – the remainder being tools used for making, measuring and maintaining the cutting tools.

Optimistically, full factory production was originally expected to be achieved in late 1910 – this pushed out to early 1911, then to late 1911. The Factory finally opened on June 8th, 1912.

When is an Inch not an Inch?

To retain operational and supply compatibility between the UK and Australian armies, the US-designed Lithgow plant was going to make rifles to the UK SMLE 303 design, ie the then British standard Short Magazine Lee-Enfield .303 inch bore, bolt action rifle, soon to be widely used by Britain and British-allied armies (like Australia) in WW1, and used again later in WW2.

The first major hurdle became evident during the production trialling phase at Pratt & Whitney, prior to the machinery being sent to Lithgow from the US. The issue was that, unbeknown to anybody outside of the Enfield Factory in England, the British were using two different measurement standards. Anything below 2 inches was measured against a local Enfield standard that was 'four tenths of a thou' (0.0004 of an inch) shorter than the true Standard Imperial Inch that was used for dimensions over 2 inches. (More details on this can be found in the book titled *The Enfield Inch & The Lithgow .303*, copies of which reside in the Lithgow Small Arms Factory Museum.)

The UK designed SMLE 303 required over 2250 special cutting and forming operations to make the 173 separate parts of the rifle. It soon became evident that due to the two different "standard" inches, and poorly chosen British manufacturing tolerances, interchangeability and compatibility of parts just couldn't 'come together'.

Lithgow Small Arms Factory & Museum

To overcome the problem, Pratt & Whitney designed and manufactured a perfectly toleranced version of the SMLE 303 rifle and used it to develop a whole new set of drawings, tolerances and specifications. The batch of compromise-design rifles which P&W along with Clarkson¹ developed in 1911, after knowing of the sloppy British specifications, were taken to the UK for inspection and approval. The P&W rifles had been modified to allow interchangeability of parts, and following approval, the P&W design was used subsequently. This 'blew out' the time it took to design and perfect the equipment to build truly interchangeable rifles at Lithgow. The Enfield Inch was never used after that and was abolished in 1924.



Lithgow SAF Machine Shop, Boring & Rifle Barrels Section in 1914. From the SAF Museum Archives. As was typical at the time, machines did not have individual electric motors, but were powered by flat leather belts run from overhead pulleys on lineshafts.

Time in making a rifle

Under the British Enfield manufacturing methods, between 48 and 72 man-hours per rifle were required, with virtually all of the time requiring skilled tradesmen. Such men were widely available in Britain – but not so in Australia.

With the more mechanised Pratt & Whitney production practices, 23.5 man-hours per rifle were needed to build an SMLE 303 rifle, of which only 10 minutes required a skilled tradesman (for barrel straightening). However, it should be noted that the practices used by Pratt & Whitney required skilled labour in terms of toolmakers and millwrights for making tools, jigs, gauges and undertaking machinery modifications. The Drawing Office also required skills. In fact, the Lithgow Factory had to supply a lot of its own production equipment beyond that supplied with the original contract. Much of the production equipment was managed by the Factory but supplied and installed by local and UK contractors, such as the major power plant – this being in 1910 to 1912.



The Lithgow SAF Polishing Shop in 1914.

From the SAF Museum Archives.

At the time and subsequently, the machinery-based production methods of the US proved their value. The initial annual volume of 15,000 rifles and bayonets was soon increased in 1913 to 20,000. This was further increased to 35,000 in 1914. The working week increased from 48 hours per week to 68 hours. Initially, this move was on a one shift basis – people were asked to work extended hours from September 1914 to July 1915. It soon became apparent that this was harming worker health and it was in July 1915 that a two-shift production process was introduced. Employee numbers soared from 120 in 1912 to 1300 in 1918.

At the end of WW1 and after, rifle production was ongoing but at a significantly reduced rate of 3000 per year. One-off defence requirements were in play such as producing spare

parts and converting rifle barrels for the new Mk VII ammunition. In the lead up to WW1 and during most of the WW1 period, the SMLE used Mark VI ammunition. As the war progressed, so did ammunition technology and in 1917, the new ammunition – Mark VII – with aerodynamically superior projectiles gave the rifle bullets a 24% higher muzzle velocity than the Mk VI version. And so, there were many rifles which needed to be updated to take the Mk VII ammunition.

¹ Wm Clarkson - see Movers & Shakers below.

Lithgow Small Arms Factory & Museum

Kicking in commercial production

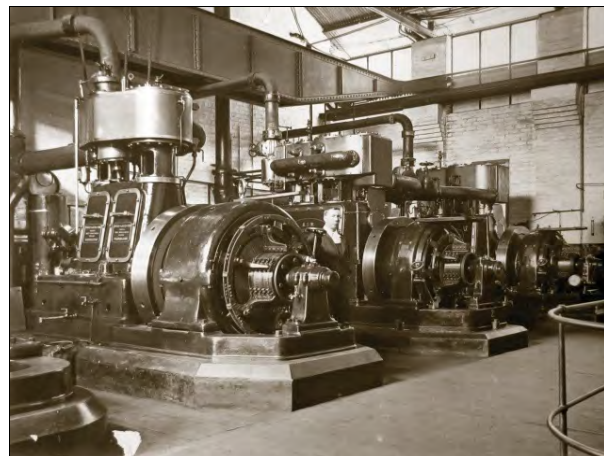
Commercial manufacture began in 1920 and continued through to 1986. In the 1920s, commercial works made up about 3% of total production, rising to 31% in 1930, to 80% in 1932, and falling to 7% in 1939. Commercial work was less than 1% in 1942 but gradually rose to 6% 1945, and flourished in the 1950s and 1960s.

With WW1 behind them, the Defence hierarchy had not been too keen on the Factory taking on commercial work. They didn't want a Government run establishment competing against private industry. But keeping the Factory open was a necessity to preserve valuable skills and keep the machinery ready for when it would be needed again. It transpired that commercial work could be done as long as it related to products which otherwise were not or could not be made in Australia. And so began the transition. There was uncomplicated commercial work including toasting forks, washers, air brake parts for trains, artificial limbs, aircraft parts and hand tools. The workforce numbers slipped to around 300 to 350 during the 1920s.

As the Depression hit, the Government changed its position and encouraged the Factory to seek more commercial work. This resulted in profitable and long-lasting work on shearing handsets, combs and cutters, parts for cinema projectors, sewing machines, golf clubs, spanners and sophisticated handcuffs. This commercial work flourished and was the mainstay of the Factory until WW2 started.



The first Pinnock Sewing Machine, made in the Factory in 1949.
From the SAF Museum Archives.



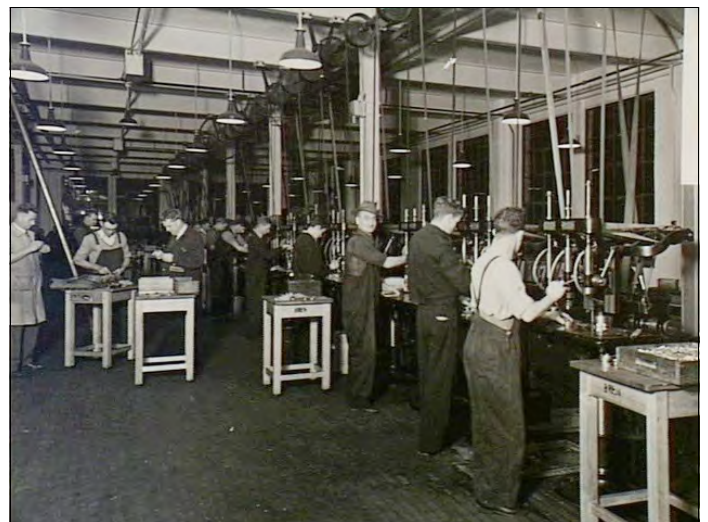
Bellis & Morcom steam engines and power generators in the SAF Powerhouse, 1920. Photo from the SAF Museum Archives.

Both the Vickers and Bren machine guns were complex firearms (compared to the simple bolt-action SMLE rifles) as they had many more complex parts, with closer dimensional tolerances. The Bren gun alone required 4074 different types of tools. As a result, the degree of skill required from the workforce was higher, particularly in assembly where the machine guns were put together. However, semi-skilled labour continued to be used in doing fine tolerance machining work. Production philosophies in the mid-1930s were vastly different to those 20 years earlier.

Production volume during 1914-1918 was 133,600 rifles. This increased to 439,000 for 1939 to 1945. As a result, higher capacity required more machinery, more buildings and more power. WW2 weapons required many orders of accuracy and complexity compared to that of weapons used in WW1. Production philosophy was not only about volume but more so about productivity. The issue was that as the weapons were more engineered, the calibre of staff was not always adequate to the task and so techniques were implemented to minimise long or expensive machining operations and simplifying or deleting complex parts, thus requiring modifications to tooling.

New weapons

The late 1930s saw a rise in military aggression in Europe. The Factory was 'humming along'. Building works on the site continued to accommodate the planned manufacture of the Vickers machine gun and the Bren light machine gun. But the dimensions and layout of the various Factory facilities, designed for a much earlier era, were not well suited to Bren gun production. A new building, specifically designed for Bren gun manufacture was built between 1941 and 1942 and new machinery brought in. The Bren gun building was large and square in layout as it accommodated a series of machines with individual small electric motors, unlike the earlier machines. Those were driven by flat belts and overhead line-shafts, which dictated a longitudinal layout and which derived their power from a few centralised large electric motors, or from steam engines in the earliest times.



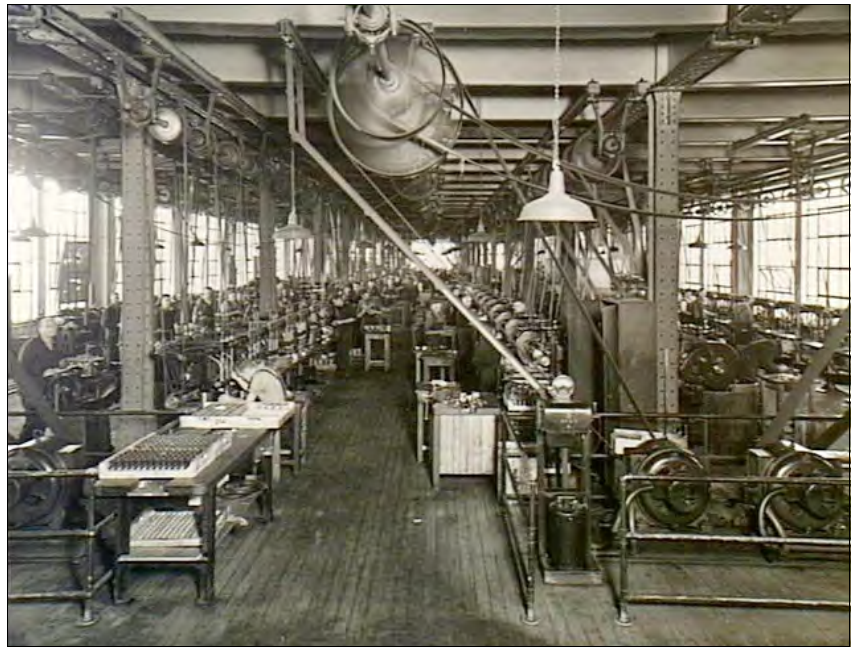
Making Bren Guns, SAF, May 1940. This early production line in the drilling section was driven by flat belts from overhead lineshafts.
Photo No. 001759 from AWM.

Lithgow Small Arms Factory & Museum

The looming war

The Factory was soon to discover what it meant to be overwhelmed. As WW2 broke out and gathered pace, demands on the Factory went 'sky-high'. The WW1-style SMLE rifles were still in production, and were now peaking at 200,000 units a year (in WW1 it had reached 35,000 per year). The Vickers machine guns and Bren light machine guns were being churned out at peak, in 1942 and 1943, of 2,900 and 6,900 units per year, respectively. Bren gun production first started in 1939, with 1942 through to 1945 being the period where production was ramped up. In those years 1942 to 1945, there were 17,110 Bren guns produced at the Factory. Correspondingly, Vickers gun production for the 1942 to 1945 period was 10,130.

The Factory could not cope with the extreme volume. It just didn't have the capacity nor the people.



The Vickers Machine Gun department at SAF in May 1940.

Photo No. 001763 from AWM.



Bren Gun Dept., Turret Lathe section, SAF May 1940.

Photo No. 001760 from AWM.

New manufacturing facilities were needed. It fell on the Lithgow Factory management to establish a series of eleven feeder factories within 3 hours drive of Lithgow, recruit and train the workforce, and achieve the exacting quality required for armaments. The feeder factories were in the Central West of NSW, at Forbes, Orange, Wellington, Mudgee, Cowra, Young, Dubbo, Parkes and Portland.

It was a horrendously arduous task given the demanding war effort requirements. In all, during peak production in 1942, there were 5,700 employees at the Lithgow Factory with a further 6,000 across the feeder factories. But the pleasing fact was that as the men 'went to war', many women took their places and did a resoundingly good job – in fact, 40% of the workforce at the time was female. A case in point in support of female labour was that women barrel setters in Orange were found to be more skilled than many of the men, rightly earning them an increase in wages.

Movers & Shakers

The early days of the Factory were crucial to its longevity. The 'eyes of the world' were on Lithgow to either perform or perish – the British said it was not possible to do what Pratt & Whitney proposed. But there was a handful of people who 'went out on a limb' to make it all happen. They were the entrepreneurs. They were the risk-takers. They were the true movers and shakers. While there were many involved, four individuals stand out.

William Clarkson was associated with the factory from 1908 to 1911. It was on his recommendation that US technology was used, alienating his British masters no end. Despite some fundamental reservations, Clarkson's technical instincts (although he was a Navy man) foresaw the benefits of the US technology in terms of production philosophies and work practices. He was proven right.

John Jensen – a Cost Accountant by training, Jensen was more than just a 'bean counter'. He was one of the longest serving senior managers and was the 'go to man' since his remit was extensive, covering industrial relations, employment, production planning and control, stock control and office administration. He by-passed Government procedures where he could. He took on the unions. He revolutionised work practices with resultant high productivity. He was the innovator of the Factory and made the US mass production process work for Lithgow.

Lithgow Small Arms Factory & Museum

John Jensen was directly involved with the Factory from mid-1911 through to late 1914. But he remained close to the Factory and its operations in his various roles within the Department of Defence overseeing ordnance production. He became the Secretary of the Department of Supply and Development from 1942 to 1948.

Frederick Ratcliffe worked at the factory from 1909 through 1927. It was 1916 when Ratcliffe was appointed Factory Manager after serving his 'apprenticeship' under Clarkson. He was an Engineer who had worked at Pratt & Whitney in the US, where he specialised in planning arms factories. It was his efforts to commence non-defence work that stamped his mark on the Factory,



The Rifle section at SAF in one of the new buildings, long after WW2. Note these machines have individual electric motors - no lineshafting. Note also the women operators. Photo details - see top right.



One of 12 female apprentices in 1975. From SAF Museum Archives.

After a rather lengthy period in Government control, the Office of Defence Production (capturing all Defence production facilities across Australia, including the Lithgow Factory) was corporatised under the Australian Defence Industries Pty Ltd (ADI) banner which took effect in April 1989. The decision had its detractors and those impacted by it did not fully realise the impending consequences. At the time, the Factory was embarking on trialing and manufacturing the F88 Steyr rifle, while its workforce was around 600 people.

The Small Arms Factory name disappeared and in its place ADI emerged. In late 1999, ADI was sold to the commercial interests of Transfield and Thompson-CSF. Ownership changed again when in 2006, the French based Thales Group acquired the facilities and assets, which remain in their hands to this day. The Thales Group at the Lithgow site continues to manufacture the F90 Steyr rifle (an upgraded version of the F88), and almost 200 people are employed there by Thales.

together with his unflinching desire to overcome a dreadful housing shortage in Lithgow which had worked against the recruiting of people. On both counts, his legacy was profound.

Jack Findlay was connected with the factory from 1909 to 1947. He was the Factory's specialist (senior Foreman) on heat treatment and steel properties, a role which became ever so important as WW2 hit. His technical nous was instrumental in ensuring the stringent quality control across the SMLE 303 rifles and Bren and Vickers machine guns of both the Factory and feeder factories during WW2 when production was at its highest. He became General Manager of the Factory post WW2 and served the Factory for over 40 years.

From Government owned to private ownership.



A 1986 aerial photo of Lithgow SAF.

From Trip Advisor website.

Lithgow Small Arms Factory & Museum

Birth of the Museum.

The birth of the Lithgow Small Arms Factory Museum was the brainchild of a few ex-employees and local community members. In the early 1990s, ADI was downsizing and/or rationalising its production facilities, including Lithgow. Its intention was to sell off assets and the like, without any regard to leaving a legacy for the people of Lithgow.

From 1990 through to 1995 was when many of the Australian munitions factories were rationalised. During the latter part of this period ex-employees in particular voiced their concerns to ADI not to dispense with the various machines. ADI management did not take any notice initially and its 'fire sale' mentality continued.

Lithgow Council bought into the act in 1994 and along with the ex-employees, persuaded ADI to leave a legacy. In 1995 ADI gifted the Administration building (the current Museum facility) along with many artefacts to the City of Lithgow. A special committee was formed to decide how the history of the Factory could be preserved. Council did not want any direct involvement in this. It happened that a group of ex-employees and some locals would establish the museum.



Main rifle room of the Museum.

Source: SAF Museum.



A display of small guns in the SAF Museum.

Source: SAF Museum.

The rationale for having a Museum was to preserve the history of the Factory and tell the story of ingenuity, adversity and community mateship to current and future generations. The Factory meant so much to Lithgow. It was the mainstay of the township for many years. Generations of families were indebted to the Factory. Skills learned were of world class. Trades were inspired. Unionism evolved. Serving one's country during the wars through precision manufacturing was an honour. The bold step into commercial production showed the fortitude and innovation of management and workers.

The current Factory operates alongside the Museum, which is associated with the Factory, and occupies the former Factory Administration Building, and soon, the former General Machine Shop.

The Museum has an extensive and significant archival collection that documents the history of the Small Arms Factory and its role in pioneering precision manufacturing in Australia. The conservation of such industrial archives is so rare, it is worth providing some detail about the collection. It contains an extensive run of the American Machinist magazine, dating back to the early years of the twentieth century; plans and blueprints for machines in the original Pratt & Whitney 1910 contract; building plans; and specifications for munitions manufactured at the Small Arms Factory. It also holds records relating to executives and employees of the SAF; wartime posters; publications on industrial safety; an in-house newspaper produced in the Orange feeder factory during WW2; and an extensive photographic collection that documents not only the SAF, its employees and industrial processes, but also the SAF sporting teams, and de facto community facilities such as the Factory Dam. The archive collection is the only collection of its kind providing a glimpse of history from the early 1900s through to the 1980s at Australia's primary ordnance/weapons production facility in the lead up to and during both World Wars.



The Ron Hayes room in the Museum. In 2006, Mr Ron Hayes donated a large collection of handguns to the Museum Source: SAF Museum.

Over the past 22 years, the Museum has amassed an array of historical, educational, research and scientific objects and artefacts that make it the largest Museum of its kind in Australia. It is renowned internationally for its collection. The Museum collection was recognised in February 2019 by UNESCO and now forms part of the Memory of Australia World Register. We are the first organisation in Lithgow to be awarded this prestigious accolade and the first in Australia for the type of collection we have. The UNESCO award is significant as it demonstrates the value of history held by the Museum depicting a time in Australia's past where a community was forged and grown on the back of what would become the start of precision manufacturing in Australia.

Lithgow Small Arms Factory & Museum

Staffed by volunteers, the Museum has today some 35,000 archived records, almost 3000 firearms and over 50 precision metal working machines dating back to the early 1900s and formerly used by the Factory. The metal working machines are located in the General Machine Shop building, having been brought in from other parts of the site. The oldest machine dates to the early 1900s – being the Pratt & Whitney rifling machine. The vast majority of the machines were used at the Factory – many imported (from the US and UK), some made by the Factory and others made in Sydney. We also have one of the first Computer Numerical Control (CNC) machines which the Factory used. We are in the process of ‘cleaning the machines up’. Some have electric motors but many no longer have any power source, having formerly been operated by lineshafting.

Our aim is to convert the General Machine Shop building (which measures 60m by 25m) into a precision engineering display area plus a workshop and presentation area. We plan to include other machines (not used at the Factory) depicting machinery technology, such as typewriters and possibly the early computer age.

We are in the process of spending some \$200,000 on improving the Museum and adjoining General Machine Shop. Museum improvements cover rust proofing and painting the external windows, placing a metal mesh cover across the front of the building and installing a series of internal panels to ‘dress up’ the building and use as painted murals. Monies on the General Machine Shop are going towards rust proofing the roof, fixing the many skylights, fixing the guttering and downpipes, painting all exterior windows, fixing the wooden floor and putting reinforced glass surrounds around the rifling machine at the entrance of the building.

Over 105,000 people have visited the Museum since its opening. Looking ahead, the Museum will become a prized precinct hosting an international precision engineering and firearms collection in honour of the Factory and its resilient people.



This "Rising Sun" display appears to have become the de facto emblem of the SAF Museum.

The Brendorah Paintings at the Lithgow SAF Museum

From the Editor

From <https://www.lithgowsafmuseum.org.au/collection.html> the Brendorah Paintings :

*During World War II when men heeded the call to war many women were employed at the Small Arms Factory. An eccentric but talented artist **Heliodore (Dore) Hawthorne**, worked at the Small Arms Factory in the Bren [Gun] Section from 1942 to 1945. During her time at the factory Dore drew many sketches of scenes from the Factory and was later encouraged to produce a series of paintings from those sketches. These paintings, under the pseudonym "**Brendorah**", depicted the daily incidents of factory life and reflected her deeply felt commitment to social justice. The paintings were shown and sold in Lithgow and Sydney in two exhibitions entitled "Factory Folk".*

There is much more to be found on various websites about Brendorah. I have reproduced here three of her paintings from the Museum collection. I just loved these ones!

At right is *The Verticals*, depicting men and women workers in the Bren Gun section.

On the next page, the top one is *Woman's Night Shift*, showing the weariness of those long all-nighters at the lathes.

Underneath is *Morning after Night Shift*, with the girls, shattered after a long night's work, hiding from the strong morning light and trying to sleep on the train trip home to Sydney.



