



# The Australian Aviation Industry: History and Achievements Guiding Defence and Aviation Industry Policy

by Air Vice Marshal Brian Weston, AM FRAES

## FOREWORD

The aircraft manufacturing industry was a key vehicle in the industrialisation of Australia and its development largely parallels the maturing of the country as an independent nation. This paper traces the development of the Australian aircraft manufacturing industry from its commencement at the RAAF Experimental Station at Randwick, through the establishment of the Commonwealth Aircraft Corporation, the Beaufort manufacturing project, and many significant post war aircraft manufacturing projects up until 1985.

In World War II alone, and from a shaky foundation, the Australian aircraft industry eventually manufactured 755 Wirraways, 705 Beauforts, 250 Boomerangs, 365 Beaufighters, 104 Mosquitoes, 16 Mustangs and almost 2000 aircraft engines. The manufacture of the Beaufort is generally regarded as Australia's greatest manufacturing achievement. This was achieved from a very low industrialised base consisting of the Broken Hill Proprietary, some munition factories and a collection of small motor body and farm equipment assemblers.

The establishment of the Commonwealth Aircraft Corporation in 1936 was the foundation stone on which the Australian aircraft industry was built. With support from Sir Richard Williams, the RAAF Chief of Air Staff and with its committed shareholders and the indefatigable Lawrence Wackett as its General Manager, CAC not only became Australia's first aircraft producer but also Australia's first aircraft engine manufacturer.

The ultimate demise of the industry is a story of failure to adapt to changing times. Fundamentally it fell away not so much through a lack of capability but through an inability to reshape the industry to meet the changing demands of the post World War II environment.

There are two enduring lessons to be drawn from this history. The first comes from the early years - if someone says something cannot be done in Australia, do not believe them. The second comes from the post World War II industry - continual change and improvement is essential for any industry to survive the varying imperatives that occur with the passage of time.

Group Captain E.E. (Ric) Casagrande  
Director, RAAF Aerospace Centre

### Disclaimer

This working paper was originally published as an A5 booklet in September 2003 (ISBN 0642265852) and is presented here as a re-formatted printer friendly version. This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without permission from the publisher. The views expressed in this work are those of the author and do not necessarily reflect the official policy or position of the Department of Defence, the Royal Australian Air Force or the Government of Australia. This document is approved for public release; distribution unlimited. Portions of this document may be quoted or reproduced without permission, provided a standard source credit is included.

## ABOUT THE AUTHOR

Air Vice-Marshal Brian Weston retired from the Royal Australian Air Force after 34 years of commissioned service as Assistant Chief of Defence Force for Operations. His Air Force career included five overseas postings and three major commands including No 75 Squadron, Base Support Wing RAAF Base Richmond and the Tactical Fighter Group.

In 1998, along with John Faulkner (Deputy Chair of Air Services Australia), he conducted an 'Independent Review of ADF Airworthiness'. Since his retirement he has been involved in major industry representative organisations and was the inaugural 'Industry Deputy Chair' of the Defence Capability Advisory Forum from 1999 to 2003.

He is a graduate of the United States Air Force Air Warfare College (1983) and the Royal College of Defence Studies, London (1994). He holds a Bachelor of Science from University of Melbourne and a Master of Business Administration from Auburn University.

In October 1991 he joined the Board of National Air Support as non-executive director and is also Chairman of the SAI Global Certificate Board of Standards Australia.

## INTRODUCTION

The development of aviation and the evolving use of air power as an instrument of national power mark the 20<sup>th</sup> century as the 'Aviation Century'. This paper will review the achievements of the Australian aviation industry and comment on the national policy that shaped the Australian aviation industry.

In 1924 Lawrence Wackett designed, built and flew his first aircraft at the RAAF Experimental Station at Randwick. The Station had been established with the strong support of the Air Board and its Chief of the Air Staff (CAS), Air Commodore Richard Williams. It was closed in 1929 on the recommendation of Air Marshal Sir John Salmond, RAF. The Australian Government had commissioned Salmond to report on the RAAF, although the genesis of his review had as much to do with being a political response to press criticism about the state of the RAAF as to a desire to develop a future plan for the RAAF.<sup>1</sup>

Wing Commander Wackett blamed the Society of British Aircraft Constructors (SBAC) for suggesting such a recommendation to Salmond and, disagreeing strongly with the decision, resigned from the RAAF.<sup>2</sup>

About this period there were a number of other aviation activities in Australia but the only enduring activity was the establishment by de Havilland of a subsidiary company in Melbourne in 1927. The de Havilland subsidiary was focused on the sale and support of de Havilland products in the recreational, sport and emerging air transport sectors.

In 1934 the Seagull V was constructed in Britain by Vickers Supermarine to a detailed RAAF specification drawn up by Williams. The unusual metal-hulled amphibian aircraft provided Williams a valuable insight into military specifications, Australian unique requirements, aircraft manufacturing and project management. The aircraft was an operational success being ordered into RAF service as the Walrus.<sup>3</sup>

This paper takes up the story in 1936 when the first moves towards an Australian aircraft manufacturing industry occurred. The paper examines the decisions and policy behind the founding of the industry and traces the rise of the industry through the history of the Commonwealth Aircraft Corporation (CAC), the Beaufort manufacturing project and other World War II developments.

After World War II, the industry built to a peak with notable achievements such as the Avon Sabre, Canberra, Winjeel and Jindivik aircraft, but then it fell away not so much through a lack of capability but through an inability of both the Government and industry to reshape the industry to meet the changing demands of the post-World War II environment.

However, in starting this historical review in 1936, the political, economic and geo-strategic circumstances that pertained to Australia in this period must be borne in mind. The Great Depression had hit Australia harder and longer than either Britain or the US. Australian Governments had great difficulty coping with the economic and

public policy issues of the time. Inspiration was lacking and governments had difficulty discerning Australia's national interests, let alone determining coherent policy solutions.

Strategically, Australia had not thought for itself and had allowed itself to indulge in the self-delusion of 'Imperial Defence' and the 'Singapore Strategy'. The threat from Japan was recognised by some but not acted upon by Australian Governments. This period is summed up by Paul Kelly in his book *100 Years* as the low point of Australian national leadership.<sup>4</sup>

Not a good time to commence addressing issues of national interest, defence and defence industry.

## THE AUSTRALIAN AVIATION INDUSTRY

### The Establishment of CAC

#### *Industrialists Act while Government Doodles*

In this environment, a small group of industrialists who were gravely concerned about the emerging threat from Japan and Australia's lack of defence preparedness opined that as a matter of self interest, Australia must develop an aircraft industry.

The group was led by Essington Lewis, who in 1921 became the first Australian-born General Manager of the Broken Hill Proprietary (BHP) Company Ltd. Lewis is Australia's greatest industrialist.<sup>5</sup> Lewis travelled widely and was perceptive, meticulous and factual in observing and researching industrial development. In 1934 he toured Europe, the US, Germany and Japan.

From that tour he observed that Britain's steel industry was on the wane, although the British seemed unaware of this. He doubted that Britain could defend Australia. He was also uneasy with this concept of defence as he held the view that it was Australia's responsibility to defend Australia, not someone else's. He was particularly alarmed by the industrial strength of Japan and the menace evident in their aggressive outlook. He also concluded that aircraft would play a major role in any new conflict and when back in Australia, he expressed concern about Australia's inadequate security preparations.<sup>6</sup>

In 1934, Lewis discussed his ideas for an Australian aircraft industry with Sir Harry McGowan of Imperial Chemical Industries (ICI)—a British corporation with growing interests in Australia.<sup>7</sup> ICI had been sensitised to Australian security interests as they had already been prevailed upon by the Australian Government to establish an explosives industry in Australia as a basis for an Australian munitions industry. ICI had been reluctant to do so as they concluded it was more economical to ship explosives to Australia from Britain. But ultimately, they invested in explosives manufacture in Australia and in turn sought to protect and develop their business.

Lewis found support in William Robinson, Joint Managing Director of the Zinc Corporation, which was part of the 'Collins House' group of companies, including Broken Hill Associated Smelters (BHAS).<sup>8</sup> Lewis and Robinson both agreed the need for local production of aircraft and Lewis continued to push his ideas, particularly in his capacity as President of the Australian Institute of Mining and Metallurgy.

Laurence Hartnett of General Motors-Holden (GMH) was soon drawn in.<sup>9</sup> Hartnett had been pre-conditioned by an approach in 1934 by Richard Williams, the RAAF CAS regarding the DC-2 aircraft that in the 1934 England–Australia air race had so impressed Williams. At the time General Motors (GM) was a shareholder in Douglas Aircraft. Lewis realised that GMH, as the leading light engineering practitioner in Australia, would be a key element in building aircraft locally. In Hartnett he also had the services of another extremely able industrialist. Hartnett signed up for a 20 per cent stake of the new aircraft syndicate. Subsequently, Robert Menzies, the Federal Attorney General suggested that GMH reduce its stake to 10 per cent to lessen British sensitivities about the involvement of the American-owned company.

Robinson, worried that nothing positive about the initiative was coming from the Commonwealth Government, spoke with Prime Minister Joseph Lyons. Lyons informed Robinson that although he was very supportive of local production of aircraft, the British Government was strongly opposed. They believed that all of Australia's aircraft requirements could be provided from Britain. Robinson notes that the emotive British reaction to the

small GM interest in the Australian aircraft syndicate was farcical, and he states that the establishment of CAC was one of the most strenuous fights he was ever involved in.<sup>10</sup> Months were lost before the Australian Government could give its support to the syndicate.

Richard Williams records that BHP, BHAS, ICI and GMH each subscribed £10,000 to investigate further the local production of aircraft. Hartnett asked Williams who should manage the venture and without hesitation Williams recommended Wackett, the former RAAF wing commander who had headed the RAAF Experimental Station before it was closed down in 1929.<sup>11</sup>

After leaving the RAAF, Wackett moved to Tugan Aircraft (owned by WR Carpenter, later Burns Philp) and continued his ventures in aircraft design and construction. By the time he joined the BHP syndicate, Wackett had produced seven aircraft types. Williams provided an unqualified reference for Wackett. 'Here was a man who could take a clean sheet of paper, design an aircraft, supervise its construction and test it in the air. I suggested that the number of people in the world who could do that could be counted on one's fingers.'<sup>12</sup>

On 22 January 1936, the syndicate decided to send a mission overseas to study manufacturing techniques and select a suitable modern aircraft for production. Hartnett who had served in the Royal Naval Air Service in 1914–18 was planned to lead the mission but was unable to do so. After Hartnett's discussion with Williams, Wackett was selected to represent the syndicate; in the interim, Hartnett negotiated the buy out of Tugan Aircraft from Sir Walter Carpenter for £15,000 thus securing the services of Wackett and his small team.

After attending a full Board meeting of the syndicate to ensure that he understood his riding instructions and reporting requirements, Wackett led a three person team on a visit to the US, Britain, France, Holland, Germany and Czechoslovakia. This was an excellent opportunity for the enthusiastic and dynamic Wackett and from his account of the trip he did not waste it. Wackett was surprised by Britain's lack of preparedness for war; interested by the innovation of the French; resistant to the sophisticated sale pressure from the Dutch; impressed by the small but advanced factory in Czechoslovakia; taken aback by the capabilities of Junkers and the German production methods copied from the United States; and amazed by the advances in US aviation and production technology.<sup>13</sup>

Before the team left, Williams states that he provided guidance on the sort of aircraft and engine required by the RAAF and added that it was the policy of the Government to use British equipment if available, but this was not binding.<sup>14</sup> This discussion was the guidance Wackett received as to the RAAF 'Operational Requirement'. It reflected more a general-purpose aircraft, and was consistent with Williams' views on air power. For his part, Wackett was to blend in the requirement that Williams had articulated with some of the technical and engineering considerations that were pertinent to the manufacture of the aircraft in Australia.

On his return, Wackett recommended to Williams the building of a modern monoplane with enclosed cockpit, stressed metal mainplane, and powered by a radial engine with a variable pitch propeller. Wackett recommended the North American Aviation (NAA) NA16, with the option of the retractable undercarriage version, the NA33.

Williams marshalled his arguments and Minister Sir Archibald Parkhill took the matter to Cabinet, which rejected the recommendation on the basis that there was insufficient justification to countenance the purchase of an American aircraft in preference to a British product. A second submission was made and apart from matters as to the adequacy of the type, critical to the argument was that British manufacturers had failed to provide the team with adequate costing, licensing and royalty data, as well as not being able to assure the team about the availability of adequate drawings, jigs and machine tools.

Although Williams had marshalled the arguments to convince the Government to order the NA16, Wackett believes that Parkhill deserves much credit for the decision—particularly in view of the strong political lobbying for a British solution.<sup>15</sup> Subsequently it was ironic that Parkhill lost his parliamentary seat in November 1937 before the Wirraway was to fly.

With the aircraft order in the offing, the syndicate agreed the establishment of a company and CAC was registered on 17 October 1936. Essington Lewis was Chairman of the company and Lawrence Wackett was appointed Manager. The authorised capital was £1,000,000 paid up to £600,000. The shareholders were:<sup>16</sup>

Broken Hill Proprietary Company Ltd	£200,000
Broken Hill Associated Smelters Pty Ltd	£150,000
Imperial Chemical Industries of Australia and New Zealand	£90,000
General Motors-Holden's Ltd	£60,000
The Electrolytic Zinc Company of Australasia Pty Ltd	£50,000
Orient Steam Navigation Company Ltd	£50,000

The Government placed an order with CAC for 40 NA16 aircraft (later amended to the NA33) and 50 engines in January 1937. The decision was received with bad grace by the British Air Ministry. The British aircraft industry periodical *The Aeroplane*, which was linked to the SBAC, greeted both the announcement of the establishment of CAC and the order of the NA16 with editorials of scorn and sarcasm.<sup>17</sup>

An open sandy site at Fishermen's Bend, Melbourne was selected for the CAC factory and in May 1937 a contract for sale of land was finalised with the Victorian Government. Not one to be slowed by bureaucratic tardiness, Wackett had already commenced plant construction in April 1937. The plant initially comprised an aircraft factory, engine factory, light metal foundry and administration block.

Observers might note that the Fishermen's Bend plant showed some similarity to the NAA plant in California, even down to such matters as the art deco decoration on the masonry pillars. With time at a premium, Wackett had closely examined the layout of the NAA plant and assessed it as being well suited for CAC. He had already established a good working relationship with NAA and its Chairman, JH Kindleberger,<sup>18</sup> and had been given access to all the NAA plant drawings; the dynamic Wackett put them to good use.

Wackett also reviewed the operation of the Pratt & Whitney (P&W) engine plant at East Hartford, but it was designed for high rates of engine production on the basis of 'one part, one machine tool'. Wackett invested much effort in developing a cheaper machine tool layout for the CAC engine plant, with an emphasis on machine tool flexibility—the layout facilitated efficiency at the lower Australian production rates and was a feature of the engine factory that was to serve CAC well over the years.

In late 1937 NAA supplied a complete NA16 with fixed undercarriage (A20-1) and a NA33 with retractable undercarriage (A20-2). The first Australian manufactured P&W R-1430 Wasp engine performed a test run on 21 December 1938. The first Australian manufactured Wirraway (aboriginal for 'challenge') flew on 27 March 1939—a most significant achievement for a nation which did not yet have an automobile manufacturing industry. The achievement reflected great credit on Wackett, especially the more difficult task of manufacturing the nine cylinder radial aircraft engine. CAC went on to produce 755 Wirraways and their single row Wasp engines.

Having established an aircraft and engine factory from scratch, having gotten production of the first type underway, and bearing in mind the importance of planning and tooling lead times, one would have expected considerable planning effort by the Government and its advisers to determine what type of aircraft should be ordered into production to follow the Wirraway. In April 1939, with CAC only having some 10 months work outstanding, the CAC Board met with Government and was advised somewhat surprisingly, that the Government had no plans for the future production of aircraft from CAC.<sup>19</sup>

## **Australian Military Aircraft Acquisition Policy – 1937 to 1941**

### ***A Process and Policy Failure***

The January 1937 decision to order the manufacture of the NA16/33 in Australia had been preceded by an order for the Hawker Demon biplane fighter. Sir George Jones, Chief of the Air Staff (1942–1952), was to comment later that the Demon was a less than satisfactory recommendation by Williams as it was neither fighter nor bomber. He noted that Williams only seemed to consider that a fighter could be effective if it was fitted with rear armament—perhaps a reflection of Williams' two-seat operational flying in Palestine. Williams had also expressed an interest in the Boulton and Paul Defiant, a two-seat monoplane fighter with a rear turret.

Whatever the case, at a time when new monoplane fighters were potentially reshaping the balance of war in the air, the RAAF seemed to lack strong advocacy for fighter aircraft.<sup>20</sup>

In all roles, the NA33 was a far superior aircraft to the Demon, but it lacked the power, speed and armament of the latest fighter prototypes. The NA33 was envisaged to move to the training role once more advanced aircraft arrived. It should have been obvious to the Air Force, the defence bureaucrat and the parliamentarian that the rapid advance of aviation technology would soon require the selection of an advanced monoplane fighter which would follow the Wirraway down the CAC production line.

Fighter aircraft technology was rapidly advancing. German technology and tactical air power had been used in the Spanish civil war and advanced Japanese fighters had been in action against the American Volunteer Group's Curtiss and Boeing fighters in China in 1937. Britain had been alarmed by German developments and with great urgency set about developing the Hurricane, Spitfire and others. Wackett was aware of these advances and had inspected the prototype Hurricane and Spitfire in 1936.<sup>21</sup>

But the Australian Government seemed oblivious to these developments. The importance of Empire Defence and of Australia's reliance on the Royal Navy for security was reiterated in a parliamentary address by Minister for Defence Parkhill, following Australia's participation in the 1937 Imperial Conference in London. Parkhill used the opportunity to attack suggestions that aircraft would be a better proposition than ships. But he provided no evidence that Australia had any guarantees that the Royal Navy could satisfactorily undertake the task of securing Australia, that it had forces appropriate to the task, and that they would be in the region when required. Australia only had assurances and there is nothing to suggest that the Government had critically evaluated the credibility of those assurances.<sup>22</sup>

Broadly, the detail of the defence policy of the Lyons Government had three legs: a contribution to the naval defence of the Empire, including Singapore; defence against light raids; and an expeditionary force of one division. The development of the RAAF was guided by the 'Defence against Light Raids' leg of the policy—this being interpreted as a Japanese cruiser with an embarked float plane that had bypassed the naval defences at Singapore. It was assumed that the float plane would pose little threat to either the Wirraway or the twin-engine light bomber/reconnaissance aircraft so favoured in Australian thinking.

In 1938, Williams and CAC briefly toyed with the development of a Wirraway powered by the 1200 hp P&W R-1830 twin row Wasp engine as the follow-on to the Wirraway. But notwithstanding intelligence reports about Japanese fighter aircraft developments, the defence establishment and the Australian Government seemed blind to the developments in military aviation.

The standing of the RAAF and Williams in the eyes of the Government had also been eroded by a series of flying accidents, some involving Hawker Demon aircraft. The combative response to the Government from Williams, who had been CAS almost continuously since 1921, over this politically charged issue, lost him further credibility and in January 1939 on the direction of the Government, he left on posting overseas for two years 'further experience'.<sup>23</sup> Air Commodore Goble was appointed acting CAS with the temporary rank of air vice-marshal.

In this delusory policy environment, it must have been somewhat ironic for Williams—an independently minded Australian airman—when the Government nominated him as the official Australian representative to attend the opening of the Singapore naval dry dock on 14 February 1938.<sup>24</sup>

On 23 March 1939, following the failure of the 'Peace in Our Time' Anglo-German Munich Agreement and the German occupation of Czechoslovakia, Lyons addressed the nation and outlined the new three year defence plan. Lyons stated that the strength of the RAAF was now 132 front line aircraft—he did not note that most of these were obsolete Demon and Anson aircraft. He stated that the Wirraway was shortly to fly—he did not note that the Wirraway had been superseded by more modern combat aircraft. Apart from noting the imminence of the previously announced Beaufort project, the three year plan announced no decisions on future combat or fighter aircraft.<sup>25</sup> The Australian Government continued to avoid the question of fighter aircraft for the RAAF.

In June 1940, with Britain mounting a desperate defence against the Luftwaffe, Cabinet approved a 32-squadron structure for the RAAF Home Defence Air Force. This plan included provision for 54 long-range

two-seat fighters,<sup>26</sup> but by 7 December 1941 after 27 months of war in Europe, not only had no fighter aircraft been procured for the RAAF, but still no decision on the fighter aircraft type had even been made.

Certainly in that period, the case for a follow-on to the Wirraway had lost impetus when the Government appointed the RAF officer Air Marshal Sir Charles Burnett as CAS of the RAAF on 11 February 1940.<sup>27</sup> On 21 December 1939, after only one year as CAS, Air Vice-Marshal Goble had been pressured into resigning; the Government generously promoting Burnett to the rank of air chief marshal. The Menzies Government had now appointed British officers to head all three Australian Services.<sup>28</sup>

Burnett had no interests in the RAAF other than using it as a feeder service to the RAF through the Empire Air Training Scheme (EATS).<sup>29</sup> Although Burnett had selected the Bristol Beaufighter to satisfy the requirement for 54 long-range fighters in the Home Defence Air Force plan, none were secured. Under his direction the Air Board ignored issues vital to the RAAF and the Government denied itself an independent source of specialist military aviation advice through which to critique the advice it received from the British Air Ministry and the British High Commission.

As a consequence, young under-prepared Australians went to war in the Pacific in an outclassed, general-purpose Wirraway aircraft powered by a 600 hp engine.

## **The Decision to Manufacture the Beaufort Bomber in Australia**

### *Advice and Assurances, not a Rigorous Due Diligence*

To satisfy its light raids policy requirement for a twin-engine light bomber and reconnaissance aircraft, the Lyons Government selected in 1936 the Bristol Blenheim which had first flown in June that year. The Blenheim made it into RAF service but failed to arrive in Australia; Bristol then suggested the Bolingbroke (a Canadian licensed version of the Blenheim) but it also was not delivered. Finally Bristol suggested the new Beaufort.

These decisions seem to have been made on advice from the Air Ministry and British representatives in Australia, rather than from the RAAF. As already noted, Williams the RAAF CAS, came under pressure in 1937 following a series of flying accidents. The Government saw fit to direct a review of the RAAF by Air Chief Marshal Sir Edward Ellington, a recent CAS of the RAF. Ellington tabled his review in July 1938;<sup>30</sup> the report providing the opportunity for the Government to remove the forthright Williams from his post.

In late 1938, after continuing embarrassment arising from the non-delivery of British aircraft to meet the Government approved RAAF plan of 18 squadrons, Lyons intervened personally with the British Prime Minister, but only received an offer of chartered Avro Anson aircraft.<sup>31</sup> Ultimately, Lyons had to announce in November 1938 an order for 50 Lockheed Hudson aircraft as insurance against the non-delivery of the Beaufort. The Lyons announcement followed some embarrassment about Bristol having licensed the production of Blenheim aircraft to Finland and Yugoslavia but refusing to enter into licence discussions with CAC, a hangover from the affront of Australia ordering the NA33 and having a US company as a 10 per cent shareholder in CAC. Delivery of the Beaufort was also held back by development problems—the prototype Beaufort only flew in October 1938 and it needed much development work, and as the RAF wanted it urgently Australia would have to wait.

In 1938, Britain commenced the decentralisation of its armament and aircraft factories to Canada. This decision was taken to circumvent the US Neutrality Acts by exploiting the special relationship Canada had with the US. In this way a continuing flow of production and armaments from the US to Britain via the Canadian factories could be anticipated.<sup>32</sup>

In 1938, the GMH General Manager and CAC Director, Hartnett, visited London and met Australian High Commissioner Stanley Bruce. Bruce had been Prime Minister in 1929 and had accepted the Salmond Report's recommendation to close down the RAAF Experimental Section at Randwick. He was not a supporter of the Australian aircraft industry. Hartnett explained to Bruce, who had also been cynically opposed to the NA33 decision, the circumstances leading to the establishment of CAC and to the order for the NA33. Hartnett informed Bruce that Britain had now ordered the NA33 in its guise as the Harvard. In a marked change of tack, Bruce now sought to involve Australia and CAC in the decentralisation of British aircraft production.<sup>33</sup>

Notwithstanding the differing geopolitical circumstances of Canada and Australia, Bruce envisaged that Australia and CAC could be the recipient of a large British order for the Beaufort bomber. Bruce did not perceive that there was little of attraction in his proposal for the British, only an added burden on the British aircraft industry to ship thousands of drawings, jigs and a training liability to the other side of the world.

A British Air Mission consisting of Sir Donald Banks (Permanent Secretary of the Air Ministry), Sir Hardman Lever and Air Marshal Sir Arthur Longmore, RAF visited Australia to recommend a way ahead.<sup>34</sup> The Mission reported to the Australian Government on 24 March 1939, just 27 months after construction of the CAC factory at Fishermen's Bend had commenced and three days before the first Australian manufactured Wirraway flew.

The Mission saw an opportunity to counter the influence of the US aviation industry in Australia by recommending the assembly of the Beaufort in Australia but it ignored the new, well-equipped CAC aircraft production facility with its growing trained workforce. Instead, the Mission recommended that a new organisation based on the state railway workshops in Victoria, NSW, Queensland and South Australia be established to assemble the Beaufort.<sup>35</sup>

The Mission's recommendation to set up a new manufacturing organisation when one had already been established two years previously, and with tacit government support, was unsound and risky. It was not as if the Beaufort was a well-established aircraft; it was still developmental and the Australian manufacturer could expect problems, particularly as Bristol had defaulted on the delivery of the Blenheim and Bollingbroke. It also made no sense from an Australian aircraft industry perspective as CAC, apart from the Wackett Trainer and Wirraway, had no follow-on orders. The Mission somewhat patronisingly rationalised their recommendation on the basis that CAC had expertise in training aircraft and therefore should continue to concentrate on building training aircraft. At least CAC had aircraft and engine building experience; the railway workshops had none.

Moreover, the railway workshops specialised in heavy and civil engineering activities, and were already earmarked for other armament activities. The production of the Beaufort in either the Ford or GMH assembly plants using their light engineering production expertise was not addressed, presumably because of their American ownership.<sup>36</sup> The International Harvester factory at Geelong was also ignored; in short, the recommendation was without a rigorous basis. The Air Board seemed surprised, but with its recent leader Williams having been shipped overseas and with Goble temporarily in charge, the Air Board went to ground. The industrialists and CAC thought it made no sense at all and approached Government, only to be told in April 1939 that Government had no plans for the manufacture of aircraft at CAC.<sup>37</sup>

The Mission proposed a joint order by the Australian and British Governments of 180 Beauforts with no guarantee of follow-on orders. The project envisaged assembly from imported parts, rather than manufacture. The production timetable was optimistic with the first Beaufort to be produced in 1940, despite the aircraft and its sleeve valve Taurus engine experiencing developmental problems.

The Taurus problems were well-known, for in January 1939 Wackett had already suggested that the Beaufort be re-engined with the P&W R-1830 twin row Wasp, a 20 per cent more powerful engine. The twin row Wasp could readily be manufactured by CAC and it was cheaper. The British Mission argued that the Beaufort already had sufficient power and that sleeve valve technology was the way of the future.

The Lyons Government ignored all the technical advice and accepted the recommendations of the British Air Mission. The only qualification was that CAC be allowed to manufacture the twin row Wasp as assurance against failure of the Taurus.

The British Mission was only interested in the re-establishment of British aircraft technology in Australia and they tapped into veins of similar thinking in the Australian Government and bureaucracy. The Mission played a hard game of self-interest by having nothing to do with CAC and Wackett in particular. Wackett was even made the subject of some discreet adverse comment.<sup>38</sup> The British Mission not unnaturally recommended a solution that was advantageous to British interests. The Australian Government and its advisers were foolish not to anticipate this. The Australian Government had a responsibility at least to analyse the proposal from a perspective of Australia's interests; it neglected this responsibility.

The Government decided to establish the Aircraft Construction Branch of the Department of Supply and Development to assemble the Beaufort. CAC, faced with being idle by mid-1940, sought orders for whole Beauforts. This was denied although CAC was offered the prospect of orders for sub-assemblies.

The Menzies Government came to power following the death of Lyons in April 1939. One of its early tasks was to consider on 23 May a submission from the new Minister for Supply and Development, Richard Casey, for CAC to build only the twin row Wasp for the Beaufort. Casey, who had some insight into technical matters, accepted the logic that the 1200 hp twin row Wasp, which used 50 per cent of the parts from the single row Wasp already being built by CAC, was the best operational and engineering solution.

The Menzies Government, apparently on the advice of the British High Commissioner, rejected the approach and determined that CAC was to build the 1000 hp sleeve valve Taurus. Casey was embarrassed, the Air Board again went to ground and CAC was put further out on a limb.

At a CAC Board meeting on 17 June 1939, the Chairman of CAC, Harold Darling<sup>39</sup> who had replaced Essington Lewis, pointed out to Casey that: ‘The Company had built up a technique which CAC considered was very desirable from the Australian point of view. All Australian materials were used except aluminium ingot. The whole engine can be built in Australia except magnetos... It took two and a half years to build up this technique and CAC now feels that all their efforts are now discounted. Gear cutting machines are useless for the manufacture of sleeve valve engines; fully 50 per cent of the engine plant will be useless.’<sup>40</sup>

The ironic situation facing CAC was that after production of the 130 Wirraways, its only order was for the Taurus engine—an engine that CAC did not presently have the capacity to build.

The Air Board monitored the routine Air Ministry technical summaries, which continued to report the problems with the Taurus. But prior to re-approaching the Government, the Air Board astutely had the Air Ministry agree that it would be desirable to manufacture the twin row Wasp in Australia. The British soon advised that they could only supply 100 of the 250 Taurus engines promised. Prime Minister Menzies agreed the decision on 31 October 1939 to manufacture the twin row Wasp at CAC. Notwithstanding, some in the Aircraft Construction Branch still attempted a rearguard action to stick with the Taurus.

In this ill-informed and incoherent way, the Australian Government arrived at the decision to embark on Australia’s largest and most difficult manufacturing project—the manufacture of the Beaufort bomber complete with its Pratt & Whitney twin row radial engines. It did not bode well for the success of the project.

## **Aircraft Production in Australia – 1939 to 1941**

### ***Disorganisation and the Early Consequences of the Beaufort Decision***

As previously noted, the Aircraft Construction Branch of the Department of Supply and Development was established in June 1939. The former Chief Commissioner of the Victorian Railways, Harold Clapp, was appointed General Manager. Ross states that Clapp was a friend of Prime Minister Menzies and had negotiated a salary 60 per cent more than the Departmental head, Daniel McVey.<sup>41</sup>

With this as a start, not surprisingly, Clapp soon fell out with McVey and refused to cooperate with other Departmental activities. Clapp duplicated the Contracts Board arrangement within the Department of Supply by establishing a contracting organisation through each state railways commission.<sup>42</sup> Seven months later, in an attempt to rectify an unworkable situation, the Government established the Aircraft Production Commission (APC) with Clapp as its Chairman with the status of a departmental head. Commissioners O’Shea and Storey completed the three-person Commission.

The APC had wide powers covering full control over aircraft production, repair and overhaul (excluding RAAF establishments), supply of materials and tools etc, and the development of the aircraft industry. But the APC still had little in the way of production resources. In June 1940, when all Bristol support for the Beaufort Project dried up, the APC attempted to buy CAC.<sup>43</sup>

This was an unusual proposal, which reflects the unsound nature of the initial advice to the Australian Government by the British Air Mission only 13 months previous. But the proposal begged the question, if the APC could not manage the Beaufort project how could the APC aspire to manage CAC competently. It was a

desperate proposal, which offended the industrialist backers of CAC and all those involved with the company. A better option would have been to subcontract the production of the Beaufort to CAC but this would have shown up the inadequacy of the initial advice.

In September 1939, Menzies appointed Essington Lewis as Director General of Munitions (Head of the Department of Munitions reporting direct to the Prime Minister, and with unprecedented powers). Lewis, who had relinquished his chairmanship of CAC, acted as a go-between and advised Menzies that CAC was not for sale. Menzies declined to acquire CAC compulsorily—it would have created a major political backlash from the industrialists at a time when Menzies was deeply indebted to the industrialists for their support of Australian mobilisation. For instance, Essington Lewis had co-opted Australia's best industrialists into the Department of Munitions where under his leadership they mobilised Australia's resources for war. Lewis even worked on an unpaid basis, using BHP aircraft, cars and his BHP personal staff in his role as Director General of Munitions.<sup>44</sup>

This did not end the matter. When the Curtin Labor Government took power in October 1941, Clapp had a new Minister for Aircraft Production, Senator Cameron—a prominent socialist who had some empathy with nationalised industries. On 12 December 1941, at a combined CAC Board meeting the APC again proposed to buy out CAC.<sup>45</sup> The CAC Directors again declined and, subsequently, three CAC Directors—Harold Darling (who was also Chairman of BHP), Sir Colin Fraser (also Chairman of BHAS) and Wackett—called on Prime Minister Curtin.<sup>46</sup>

Curtin convened a meeting of the Advisory War Council on 18 December 1941 to resolve the matter. Curtin, who after assuming the prime ministership had retained Lewis as Director General of Munitions, invited Lewis and the APC to attend.

The Advisory War Council acknowledged that the Beaufort project had suffered from continued failures of supply from both Britain and the US, but this was insufficient justification for the APC to takeover CAC. It was acknowledged that the APC was also hampered because it had no aircraft design and production expertise. Lewis observed that the APC was not a success as it attempted to be both a manufacturing body and an overriding industry controller—the two roles were in conflict.<sup>47</sup>

The outcome was that the APC was abolished. Curtin appointed Essington Lewis as Director General of Aircraft Production as well as Director General Munitions. Lewis who reported to two Ministers—Norman Makin, the Minister for Munitions and Senator Donald Cameron, the Minister for Aircraft Production—had unprecedented statutory powers under the war emergency legislation.

An Aircraft Advisory Committee was established to assist Lewis coordinate the activities of the Australian aircraft industry, which now had three major manufacturing organisations: CAC, the Beaufort Division of the Department of Aircraft Production (DAP) and de Havilland Australia (DHA). The Aircraft Advisory Committee included the RAAF, CAC, the Beaufort Organisation, de Havilland Australia and, of course, Treasury. Wackett was appointed as the Technical Adviser to the Aircraft Advisory Committee.<sup>48</sup>

Finally in December 1941, some organisational order had been introduced into aircraft production. The question now was whether the RAAF still under the leadership of the British officer, Burnett, who had so foolishly advised the Australian Government that the Wirraway was a match for the best Japanese fighters,<sup>49</sup> could articulate some clear, long-sighted aircraft operational requirements for Australia's industry to build to.

## **Implementation of the Australian Beaufort Manufacturing Project**

### *A Manufacturing Phoenix from Strategic Ashes*

The implementation of the largest aircraft production project in Australia was to be conducted by the Aircraft Construction Branch of the Department of Supply and Development—often referred to in its various organisational guises as the 'Beaufort Organisation'. The Beaufort Organisation was entirely dependant on the Bristol Aeroplane Company for technical and training support, yet the Government had conducted no due diligence on Bristol to validate whether Bristol could meet its obligations.

Under the agreement developed by the British Air Mission, which was essentially a 'Government to Government' agreement for the purchase of 90 aircraft each, the Air Ministry directed Bristol on 26 January 1939 to supply all technical data and drawings, and to ship to Australia some 33,000 jigs and tools etc. By 31 December 1939, Bristol was to supply 10 sets of fabricated parts and 10 sets of raw materials for the first 20 aircraft.<sup>50</sup>

The first Australian made Beaufort was planned for completion in October 1940, with production ramping to 20 aircraft per month by July 1941. The Air Ministry was to supply the first 250 Taurus engines for the project.<sup>51</sup>

Australian technical personnel went to Britain and Bristol specialists came to Australia. In October 1939, Bristol and the Air Ministry agreed to redesign the aircraft to take the twin row Wasp. The redesign was estimated at six months but took 12, with most of the work being done by the Australian specialists in Britain and the Bristol personnel in Australia.

When the first batch of tools and data were found to be inaccurate, APC Commissioner O'Shea went to Britain in February 1940 to sort the problem. Largely through his efforts some 7000 tools/jigs were eventually shipped. Matters got worse when in May 1940, with the war in Europe now a threat to Britain's survival, the Minister for Aircraft Production, Lord Beaverbrook, prohibited the export of aircraft or aircraft parts from Britain. Finally in August 1940, Menzies announced that Australia would have to manufacture the outstanding 26,000 tools/jigs. Given that Bristol was making 30 Beauforts a month for the RAF, O'Shea had concluded that Bristol was not according any priority to the Australian project.<sup>52</sup>

Australia was being given a lesson in what happens when the national interests of close allies diverge.

In an attempt to save the project from failure, the APC sought parts from the US but this was complicated by the different US engineering standards and material specifications. Had the full gravity of the situation been comprehended, the APC would likely have recommended termination of the project. Clapp, Chairman of the APC, had been shown to be an inappropriate appointment.<sup>53</sup>

The APC continued to struggle on and received considerable assistance from the new government CSIR aeronautical laboratories, overseas suppliers, BHP, CAC, Australian industry, and the Australian Aluminium Company, which had been established in late 1939. But relations between the APC and CAC were poor with ongoing disputes.

A particularly disruptive dispute took place over the twin row Wasp engine. The APC, acting on advice from Bristol, placed orders with CAC for twin row Wasp engines with a 16:9 'bevel' reduction gear. Bevel gears were difficult to cut and CAC recommended a 3:2 'spur' reduction gear as used in the twin row Wasp fitted to the Lockheed Hudson. CAC argued that the better take-off, climb and cruise performance at the expense of top speed would be a good compromise. The APC stuck with the Bristol advice, CAC did not meet its engine quota for the year and engines had to be imported from Pratt & Whitney. Pratt later dropped the use of bevel reduction gears in the twin row Wasp.<sup>54</sup>

The Beaufort required many thousands of modifications, major and minor, including an increase in fin area by 15.5 per cent—a modification Bristol later incorporated on RAF Beauforts. The Australian prototype flew on 5 May 1941 and the first production aircraft in August 1941—amazingly, only 12 months late despite all the bad policy, naivety, disorganisation, and personal animosity. In service, the aircraft experienced a high initial accident rate. Many accidents resulted from inexperience in piloting the powerful Beaufort, although a major problem with the elevator trim caused a number of fatalities until it was resolved—the Beaufort finally maturing into a sturdy and reliable aircraft.

By December 1942, 12 months after the abolition of the APC, the Beaufort Division of the Department of Aircraft Production (DAP) had produced 208 aircraft. John Storey, the former GMH executive initially appointed as a commissioner of the APC, had been retained as General Manager of the Beaufort Division. By August 1944, the DAP had delivered 705 Australian built Beauforts and CAC Lidcombe had built 870 R-1830 twin row Wasp engines for the program.

Monthly deliveries peaked in September 1943 when 39 Beauforts were delivered. Major structures were built at NSW Railways Chullora, Victorian Railways Newport, SA Railways Islington, GMH Woodville with final assembly at DAP Fishermen's Bend and DAP Mascot.<sup>55</sup>

Some criticise the program on the basis that the Beaufort was the wrong aircraft for the RAAF, but there was not much available in 1939—especially after disregarding the modern German twin-engine bombers. The stopgap Lockheed Hudson carried only 25 per cent of the Beaufort bombload. The USAAC design competition that would lead to the robust NAA B-25 Mitchell and the complex Martin B-26 Marauder was only announced in January 1939—but both these types warranted at least some examination.

The most obvious oversight was not to consider the Douglas A-20 Boston light bomber, which first flew in December 1938. The Boston proved a fine aircraft well suited to the attack role; it was conveniently powered by the twin row Wasp and the Douglas Aircraft Company was at the forefront of aircraft design and production. It was in Australia's national interest to examine these alternatives, or at least to benchmark the British Air Mission proposal against other options. Ironically, all three US types were good enough to be ordered into RAF service. As to the Boston, reputedly the aircrew of No 22 Squadron RAAF expressed much regret when their Bostons were replaced with DAP manufactured Beaufighters in 1944.

The decision-making that led to the Beaufort program was not the result of a rigorous analytical process. There was no detailed examination of aircraft options against a requirement; it was the end of a long drawn out process starting with the Blenheim. There was no Australian mission sent overseas to investigate the aircraft available. There was no due diligence on candidate companies. The fact that the Beaufort was not an easy type to mass-produce and that Bristol was not well-placed to support Australian production was overlooked. Finally, the decision by Government to place an order for aircraft production in Australia with a new organisation without any aviation competence was laden with risk.

The March 1939 order for 90 Australian Beaufort aircraft should have been placed with CAC, Australia's only manufacturer of stressed metal aircraft. CAC had already established a network of subcontractors and manufacturing standards; it had a new world-class plant, which provided an excellent basis for expansion; it had management experienced in licensing and manufacture; and it had a training system for newly recruited workers. As a result, the already difficult task of manufacture of the Beaufort was made much more difficult. That post-1942, the Australian Beaufort manufacturing program under the guidance of the Department of Aircraft Production so turned around that it is rightly ranked as Australia's greatest manufacturing achievement, is as outstanding as the original strategic decision-making was naive.

## **Post-1942 Developments – Boomerang, Beaufighter and Mosquito**

### ***The Australian Aircraft Industry Gets Rolling***

Prime Minister Menzies returned to Australia in June 1941 after spending four months in Britain. One outcome of his visit was that it brought home the pragmatic realisation that British defence priorities were, not unexpectedly, in places elsewhere than Australia. Political crisis followed and the Curtin Labor Government came to power in October. Japan attacked Pearl Harbor and in this increasingly desperate environment, CAC management unilaterally made the decision on 21 December 1941 to go ahead and commence design of the Boomerang fighter.<sup>56</sup> It seems a sensible, self-interested and well overdue decision, noting that Australia had already been at war for 27 months. It begs the question as to why Government and its advisers had done nothing regarding a Wirraway follow-on.

CAC started work on the tail and rear fuselage of the Boomerang before receiving the order for 105 'Wirraway Interceptors' on 2 March 1942.<sup>57</sup> Post-Pearl Harbor, the Government was trawling the globe for fighter aircraft and the Boomerang was the fallback should the 250 Curtis Kittyhawk fighters ordered from the US be delayed.

Although the Boomerang used some 65 per cent of the parts from the Wirraway, it was more than a shortened Wirraway. The addition of a twin row Wasp engine, two cannon and four machine guns produced a stubby, robust and manoeuvrable fighter. It handled well and, while RAAF tests showed it lacked the speed of the Kittyhawk and Bell Airacobra, it was more manoeuvrable than either of the US fighters. The Boomerang had a

slight edge in rate of climb at lower altitudes, although the two US fighters had greater diving speed; essentially it was a 'stopgap' fighter that later found a niche in army cooperation work.<sup>58</sup>

The Boomerang prototype first flew on 29 May 1942. It went into production with few modifications and ultimately 250 were built for the RAAF. Fortunately for Australia, the Kittyhawks arrived for the 'seventy series' squadrons with the Boomerangs generally going to the 'eighty series' squadrons.

The Boomerang's main design limitation was the thick wings inherited from the Wirraway. Had CAC received an order for a developmental fighter sometime in the 33 months between the first flight of the Wirraway and Pearl Harbor, it is likely that Wackett would have designed a lighter more aerodynamic wing. But even though it was derivative, the Boomerang and its short gestation period showed that CAC had matured into a most able aviation engineering organisation which had been underutilised in the critical period 1939 to 1942.

Much time had been lost and the RAAF now needed to clarify quickly its thinking about requirements. Following Pearl Harbor, it had rushed through a requirement to arm the Beauforts with torpedoes; none were available and so local production was approved by the Curtin Government in December 1941. Essington Lewis quickly built and equipped the RAN Torpedo Factory on the site of the North Sydney Gasworks to meet this requirement.<sup>59</sup>

A new CAS was appointed in May 1942, Air Vice-Marshal George Jones (the rank of air vice-marshal being two ranks lower than that given to his predecessor Air Chief Marshal Burnett). Jones advised that Beaufort production needed to be increased from 20 to 40 aircraft per month, but soon he countered this by advising that the Beaufort was not a good torpedo platform and the RAAF now wanted only 217 Beauforts.<sup>60</sup> The DAP said 'too late'; they were committed to a production run of 450 Beaufort aircraft and the RAAF needed to advise of plans for the production of a follow-on aircraft.

This was typical of the dysfunctional nature of the Air Board under Burnett; the RAAF had been too focused on the EATS and had not been paying attention to the matter of combat aircraft.<sup>61</sup> In the absence of any other plans, the industry had made long-term commitments to the Beaufort. The War Cabinet seemed to have little option but to approve in December 1942, the production of 705 Beauforts and 345 Beaufighters. Strategic decisions such as this were vital to allow industry to perform effectively—yet regrettably, the focus on the EATS meant they were made far too late.

The Beaufighter proved an outstanding aircraft for the RAAF but its acquisition owes more to it using the wings, undercarriage, empennage and many other parts from the Beaufort and it being the easiest manufacturing follow-on for the DAP, rather than to RAAF operational requirements. The RAAF, like the RAF, had been attracted to the Beaufighter as a general-purpose fighter as early as 1939, but the war in Europe had demonstrated that the Beaufighter could not survive air-to-air combat with German single engine fighters. Fortunately, the innovative piece of improvisation that was the Beaufighter turned into an excellent tactical combat aircraft well suited to the South-West Pacific, where its high speed at low altitude enabled it to escape combat with the Japanese Zero fighter, which was not as fast as the German fighters.

The RAAF initially operated British built Beaufighters, which had some adverse stability and handling characteristics—there were many accidents on take-off and landing. The Australian built aircraft included a steerable tail wheel, fully feathering DHA Australian made propellers, heavier armament, aerodynamic refinements and the 1725 hp Bristol Hercules engines. As insurance against the non-delivery of the Hercules, the DAP prototyped and flew a Beaufighter with Wright Cyclone engines; a contingency plan which ultimately was not needed.<sup>62</sup>

The first Australian built Beaufighter flew in May 1944, 14 months after receipt of the first drawings. The DAP now had its act together and 365 Australian built Beaufighters were finally delivered to the RAAF. Beaufighter manufacture was undertaken at Chullora NSW Railways, Newport Victorian Railways, Islington SA Railways, DAP Mascot and DAP Fishermen's Bend.<sup>63</sup> The Bristol Hercules engines were imported.

Following the initial success of the Mosquito in RAF service, de Havilland proposed the building of the aircraft in Australia and Canada. The RAAF had expressed interest in the Mosquito as a substitute for the Beaufighter and in March 1942, de Havilland sent plans and a pattern aircraft to their subsidiary company DHA.<sup>64</sup> Strong doubts were raised as to the durability of the wooden aircraft in tropical conditions; advice was received that the

airworthiness of the aircraft depended on a high quality of manufacturing; and Wackett thought a single engine fighter more appropriate. The whole plan hinged on the importation of Packard-built Rolls-Royce Merlin V-12 liquid cooled engines from the US.

On 2 September 1942, the War Cabinet formalised the process with an order for 150 Mosquito aircraft with provision for a further 120. In July 1943, the War Cabinet increased the order to 370 aircraft, which included the building of a new Commonwealth-owned plant at Bankstown.

The first Australian built Mosquito flew on 23 July 1943, but the program experienced many teething problems. Although DHA had built more than 1000 Tiger Moths it had built no combat aircraft and the manufacture of the Mosquito, with its novel wooden laminated construction, was a step into the unknown. Australian metals, woods and glues were used and DHA employed extensive subcontracting around the Sydney area with the wings being made at GMH Pagewood. Final assembly took place at Bankstown. Glue problems, manufacturing standards, a lack of skilled woodworkers and subcontracting quality caused several fatal accidents, and achieving the required structural standards with the wings was a major difficulty.

Geoffrey de Havilland visited Australia to investigate the problems.<sup>65</sup> DHA began a training program with subcontractors and brought more manufacture in-house. By August 1945, 104 Mosquitos had been delivered to the RAAF, with 212 aircraft delivered by program end in 1948. The RAAF gained an excellent combat aircraft, although the durability and longevity of the aircraft meant it would have a short operational life. It was a huge step forward for DHA, who had underestimated the complexities of the wooden laminated construction and of the difficulties of achieving the necessary quality control over the manufacturing processes.

## **The CAC CA4 Woomera Bomber**

### *A Contingency Plan or Unnecessary Diversion*

CAC had been liaising with the RAAF about the medium bomber and reconnaissance requirement prior to being sidelined by the British Air Mission in March 1939. When the Beaufort project started attracting adverse comment in the Parliament following the arrival of incorrect drawings and the late delivery of parts, CAC proposed an Australian solution to the RAAF bomber requirement. The RAAF responded to the CAC approach in April 1940, with a Development Specification for a long-range aircraft capable of carrying out dive-bombing, torpedo-bombing, level bombing and reconnaissance.<sup>66</sup>

Dive-bombers had not previously been on the RAAF agenda. They had also been ignored by the RAF and the USAAC in the inter-war years and it was not until Germany, Japan and the US naval air arm developed dive-bombers that their utility and accuracy was apparent.

Wackett would have known of the German Ju-87 and Ju-88 dive-bombers, having visited Junkers in 1936. He grasped the operational utility of the concept and matched it with the geographic demands of the Australian theatre to design a fast aircraft with two R-1830 twin row Wasp engines with a range and bomb load well superior to the Beaufort. The aircraft had heavy fixed forward firing armament, large dive-brakes, twin remotely operated gun turrets at the rear of the engine nacelles, and integral fuel tanks—the latter two features being ahead of their time and the source of much developmental difficulty.<sup>67</sup>

The APC saw the CA4 as a threat to the Beaufort and it immediately became a bone of contention between CAC and the APC. The APC questioned the claimed performance of the CA4 and attempted to exert a close control over the project. Wackett resisted any interference. The APC was still jousting vigorously with CAC over the CA4 when the APC was abolished in December 1941.

Wackett quickly went to work and the prototype CA4 flew on 19 September 1941. Impressed with the initial promise of the aircraft and with the prototype Beaufort having only flown in May 1941, the RAAF ordered 105 production aircraft (the CA11). After company testing and development the CA4 was handed over to the RAAF for evaluation in February 1942.

The project began to experience difficulty. CAC was both tooling up for production while rectifying development problems. Testing and modification was slow. While some development problems were overcome, Wackett was reluctant to employ simpler solutions to some of the aircraft's innovations and complexities. He seems not to

have realised that by persisting with complex solutions he risked missing the window of opportunity available to the CA4.

At this critical stage of the project, it was vital that strong strategic oversight be given to the project. The only body that could give unambiguous direction to Wackett was the customer, the Air Board. But with the tour of duty of the undistinguished Burnett coming to an end, the Air Board was not functioning well. The problem was not immediately solved when on 5 May 1942, the junior substantive Group Captain acting Air Commodore George Jones was appointed CAS, and the experienced senior RAAF officers, Williams and Bostock, were posted off the Board. It took some time for Jones and others to adjust to these moves. With the Air Board otherwise occupied, it seems that the CA4 project was not under close scrutiny and it was allowed to drift at a crucial period.

For instance, it was immediately apparent that the sealants and the integral fuel tanks were a serious problem, as was the remote nacelle-mounted rear turrets and their aiming system. The fitting of self-sealing bladders was the obvious solution to the fuel problem but at a cost of reduced fuel capacity. The RAAF would have accepted fuel bladders and would have happily discarded the remote turret system by substituting a normal turret.<sup>68</sup>

The fuel leakage problem remained with the aircraft and was the cause of the prototype exploding in midair in January 1943. The loss of the prototype saw the window of opportunity for the CA4 close. Vultee Vengeance dive-bombers arrived in large numbers in 1943, although the RAAF soon declared them obsolete and withdrew them from service. B-25 Mitchells and A-20 Bostons were coming into service with ultimately B-24 Liberators and Australian built Beaufighters and Mosquitos to follow.

The CA4 production order was reduced to 20 aircraft, although cancellation of the aircraft and its more powerful CAC R-2000 engine was inevitable—coming in September 1944 to allow CAC to focus on the Mustang fighter project. The early promise of the project was lost by an inability to focus the development of the CA4 to meet RAAF needs in the window of opportunity available. A critical review of the project should have occurred in early 1942 to right the CA4 project, or have it cancelled.

It is unclear as to how serious the RAAF was about the CA4 specification. Certainly in 1940, the manufacturing workload for CAC was tapering off. This lack of work was embarrassing. Perhaps one aim of the RAAF Development Specification was to keep Wackett and his new factory busy; the ease with which Wackett had his CA4 design concept accepted suggests that this may well have been so.

The fact that the CA4 had many initial problems should not be held against it. The Martin B-26 Marauder was an aircraft with many similar problems. Among other things, it needed a bigger wing; but CAC did not have the resources of Martin to get the CA4 right. As to Wackett, there is no mention of the CA4 in his autobiography, which suggests that he ranks the CA4 project as a 'bridge too far'; certainly his lack of progress with the CA4 is at odds with his success in the Wirraway, Boomerang and Wasp engine projects.

## **The CAC Engine Plant at Lidcombe**

### *From Radial to Merlin*

As a consequence of the Beaufort decision, the Government agreed to construct two new factories in addition to those already existing at CAC. The APC was to manage the bomber plant, which was to be built adjacent to CAC at Fishermen's Bend. CAC was assigned the responsibility for the Beaufort engine factory.

Although CAC was building the single row Wasp at Fishermen's Bend, the new engine factory was to be located in the Sydney area where a pool of skilled engineering labour was available. The plant was built and financed by the Government on 20 acres at Lidcombe.<sup>69</sup>

In November 1939, CAC was formally given the task of managing the plant and building the twin row Wasp. Wackett was to organise the plant, secure the licensing rights, procure the machine tools and manage the production of the engine. He recounts that initially he did much of this personally, using his good relationship with P&W executives to advantage.<sup>70</sup> Wackett asked James Kirby, a successful Sydney businessman who was already subcontracting to CAC, to manage CAC Lidcombe. Kirby agreed and managed the plant for the duration of the war. As his personal contribution to the war effort, he did this on an unpaid basis.

With the rapid expansion of the workforce, the plant experienced a number of labour disputes, followed by a range of technical problems. The labour problem was not untypical of the period and seems to have related to work practices and some friction with seconded P&W personnel. The plant was also hampered as castings were still made at Fishermen's Bend until the Lidcombe foundry opened in late 1941.

The factory was opened on 4 March 1941, with the first Australian assembled engine completed on 28 October 1941. CAC arranged for the purchase of 50 engines to precede Australian production. Ultimately, the plant manufactured 870 R-1830 engines and overhauled 700 R-1830 engines. In addition, the factory supported Allied forces by overhauling a total of 1071 R-1830 and R-2800 engines for the US forces.<sup>71</sup>

In November 1943, the decision to manufacture parts for the Rolls-Royce Merlin engine was taken and in January 1945, the decision to fully manufacture the Merlin was taken. The Merlin program tapered off following the end of the war, although 108 Merlins were manufactured, albeit with some dependence on imported parts. The plant ran down gradually after the war, manufacturing tooling for CAC's jet engine program, supplying tooling and components for the automobile industry, and manufacturing the FN rifle. When CAC consolidated all engine work at Fishermen's Bend in 1958, the lease for the plant was transferred to DHA.

The Lidcombe plant made a major contribution to the Australian war effort. It also was responsible for introducing a range of precision engineering skills, metallurgical expertise and production technologies into Australia. As with many other Australian World War II industrial ventures, the expertise of BHP was critical to resolving a range of metallurgy, quality and supply issues. BHP was the cornerstone of Australian World War II industrial capability; this capability having been established with the perception and foresight of Essington Lewis, the BHP General Manager from 1921 to 1939.<sup>72</sup>

## **The 1943 McVey Overseas Mission**

### ***Setting a New Direction for the Aircraft Industry***

In December 1942, a joint Cabinet submission by Jones and Lewis addressed the question of future aircraft production in Australia. Cabinet agreed that both a fighter and bomber type should be produced in Australia to meet the needs of the RAAF post-1944. The selected aircraft were to be proven 'best of type'.<sup>73</sup>

In early 1943, the capable McVey, Secretary of the Department of Aircraft Production, led an overseas mission, including Wackett and RAAF representatives, to recommend the most suitable fighter and bomber for production in Australia. At last, the Government was to base its strategic decisions on a process of analysis and investigation, factoring in both RAAF requirements and key production issues.

But it was not to be as simple as that. Wackett states that four members of the mission had already preselected the Spitfire as the fighter type before departing from Australia. After inspecting both Mustang and Spitfire, the mission was not agreed on a recommendation. Wackett favoured the Mustang on the grounds that the Merlin powered Mustang was a better fighter than the Spitfire; that the Mustang had much greater range, which was particularly relevant to the RAAF; that the Mustang had the ability to carry underwing stores and fuel tanks; and that the Mustang was easier to manufacture than the Spitfire. But it was not until the mission met with the Air Ministry in London and heard the recommendation of Air Marshal Sir Ralph Sorley, RAF who recommended against the British fighter, that the mission could unanimously recommend the Mustang for production by CAC.<sup>74</sup>

The mission recommended the Avro Lancaster (later the Lincoln) for manufacture by the Beaufort Division of the DAP. Both aircraft were powered by the Rolls-Royce V-12 liquid cooled Merlin, which was also recommended for manufacture by CAC at the Lidcombe plant. The Government agreed the recommendation of McVey and ordered 350 Mustangs.

The Mustang project was a substantial challenge for CAC, whose manufacturing capacity had been underutilised after the Wirraway and Boomerang projects had run down. In the interim, much of the CAC engineering effort had been diverted onto the unproductive CA4 Woomera project. By August 1944, it was confirmed that CAC would assemble the first 80 Mustangs from largely imported parts and the remaining 270 aircraft from locally manufactured parts. The first Australian Mustang subsequently flew on 26 April 1945, with the manufacturing program being hampered by the delayed supply of machine tools and parts, and by an investigation into the

project by the USAAC Headquarters in Australia. The lack of imported parts resulted in the first 80 Mustangs containing a much higher content of locally manufactured parts than initially envisaged. In addition to local production, 298 crated Mustangs were delivered to Australia, with the first arriving in 1945.<sup>75</sup>

At the close of the war, the order was reduced to 200 Mustangs. The wisdom of manufacturing the Rolls-Royce Merlin engine in Australia was validated when many second-hand Merlins were landed in Australia for fitment to Australian aircraft. CAC Lidcombe had to undertake major refurbishment of these engines, something that could not be done without the skills and tools acquired from setting up for Merlin production.<sup>76</sup>

In November 1943, the Government approved the manufacture of 50 Lancasters (Lincolns) by the Beaufort Organisation. It made this decision in the knowledge that the program was not supported by General Douglas MacArthur, Supreme Allied Commander South West Pacific—an indication that Australia was now making decisions on the basis of its perceived national interests, not what its allies were saying its interests were.

The Lincoln with its Merlins was a substantial step forward for the Beaufort Organisation and the first Australian manufactured Lincoln emerged from the renamed Government Aircraft Factory (GAF) at Fishermen's Bend for its first flight in March 1946.

The McVey mission represented the high watermark in the strategic decision-making processes regarding RAAF aircraft requirements and the Australian aviation industry, but regrettably it occurred too late. Wackett had gone overseas in 1936 with a much narrower charter to McVey. The 1936 mission led to the Wirraway decision and the establishment of CAC. Something along the lines of the McVey mission should have taken place in 1939 and 1941 to assist the Government in making critical aircraft and industry decisions. Had this been done, and given what the Australian industry achieved on the back of some ill-conceived decision-making, one can only wonder what the industry might have achieved if the earlier strategic decisions had been more critically founded on the basis of Australia's national interests.

## **The Australian Aircraft Industry – 1946 to 1958 – Sabre and Canberra**

### *A Technical Zenith under the Shadow of Industry Overcapacity*

The decade 1936 to 1946 saw the Australian aircraft industry grow from nothing to close to world benchmark—with only the US, British, Russian and Canadian industries ahead. The challenge was how to keep these skills in an era where the capacity of the Australian industry far exceeded the requirements of Australia for both military and civil aircraft, and to prepare to withstand the inevitable competition as the European nations resurrected their war-damaged industries.

In the aftermath of World War II, DHA commenced work on the Vampire, ultimately producing 190 Vampire fighter and trainer aircraft between 1949 and 1957. GAF had work for 73 Lincoln aircraft. CAC had established a strategic relationship with Rolls-Royce and moved into the manufacture of Merlin piston engines and Nene jet engines, with Wackett mischievously noting the Rolls-Royce relationship for the purposes of refuting earlier criticisms that he was anti-British.<sup>77</sup> In 1948, Rolls-Royce enhanced this relationship by purchasing GMH's 10 per cent foundation shareholding in CAC.

At GAF, the Lincoln manufacturing program ran until 1951. In 1945, the Government decided to include the manufacture of 12 Avro Tudor aircraft in the Lincoln program, although the manufacture of the large four-engine transport aircraft was cancelled in 1948 when the Tudor ran into development troubles. The first five Lincolns were assembled from imported components in 1946, with the first wholly Australian manufactured Lincoln being handed to the RAAF in November 1946.

As with the Beaufort, GAF used extensive subcontracting with only the final assembly being completed at Fishermen's Bend. The aircraft production rate failed to meet early planning figures, peaking at 13 aircraft in 1948. Although productivity and efficiency issues were emerging as a factor in slow production, the main cause of the slow production rate was the need to implement the large number of modifications the RAAF required to suit local conditions and roles. The Australian Lincoln was a much different aircraft to the Avro Lancaster Mk 4, first envisaged for production in Australia. The various marks of GAF Lincoln were continually modified and subsequently, GAF remanufactured 12 of the aircraft into 'long nose' Lincoln Mk 31 maritime reconnaissance aircraft in 1953.<sup>78</sup>

The Lincoln also experienced problems with the Merlin 85 engine. These engine problems were wide-ranging and were not solved until the delivery of the Australian made Merlin 102 engine. CAC Lidcombe manufactured 108 Merlin 102 engines to meet the Lincoln specification and overcome the problems experienced with the imported Merlins.<sup>79</sup>

But despite the Mustang and Lincoln projects and the imminent programs for jet bombers and fighters, the industry was clearly heading into difficult times. However the Government, the Department of Defence, the Department of Supply, the nationalised industry and the private companies all showed a reluctance to address the industry sustainability and structural issues.

Perhaps the levels of work were sufficient for all entities to disregard the longer term issues and just muddle through. Certainly GAF had reasonable levels of work with Lincoln, Canberra and Jindivik; and prior to the Chifley Labor Government losing power in 1949, largely on an agenda of nationalising the banks, there was no strong advocacy to break up the cosy arrangements between the Department of Supply and the nationalised GAF. Nor was there any advocacy for Government to exit aircraft manufacturing despite what ultimately was exposed as a most inefficient arrangement.

On the commercial side, DHA had ongoing work with the Vampire program and had the advantage of being a wholly owned subsidiary of de Havilland, a successful and innovative British aviation company. CAC was neither owned by the Government nor a foreign aerospace manufacturer; it was under the most pressure to make ends meet. Despite its strong hold on jet engines, the Sabre and the Winjeel, CAC was soon making 'Comair' buses, fibreglass boats, pressure cookers, vitreous coated bathtubs and other household items.

CAC and DHA also benefited from some government funding which required them to maintain levels of 'strategic capability' as a basis for expansion. In short, the long-term structural problems were pushed aside; perhaps it was not the culture of the day to tackle ruthlessly what should have been obvious—gross industry overcapacity, with the expense and complexity of three organisational overheads.

But technically, the industry was doing well. The two major programs of the day saw 111 Avon Sabre fighters and 48 Canberra bombers built by CAC and GAF, with CAC manufacturing the world's most advanced jet engine, the Rolls-Royce Avon for both types.

The selection of the Canberra bomber for the RAAF and its licensed production in Australia was relatively straightforward. The twin-engine jet bomber was designed by the English Electric Company at Warton to Air Ministry Specification B.3/45. Although a large industrial conglomerate, English Electric had little aviation heritage until it commenced manufacturing large numbers of Handley Page Hampdens and Halifax bombers and de Havilland Vampire fighters. English Electric augmented its acknowledged production expertise by recruiting capable personnel for a new design team, which promptly produced the world's finest jet bomber.<sup>80</sup>

The prototype English Electric Canberra flew on 13 May 1949. The Canberra/Avon combination demonstrated a level of performance well in advance of any contemporary challengers and it soon received the ultimate accolade when the USAF ordered it into licence production as the Martin B-57.

On a visit to Britain in 1949, the RAAF CAS, Air Marshal Jones, and his technical team selected the Canberra for the RAAF. It was an excellent choice although for some inexplicable reason the Australian specification failed to insist upon the procurement of the aircraft with any of the electronic warfare aids that had evolved with the British bomber force during World War II. The purchase of an 'all-weather' jet bomber without the British H2S bombing radar seemed odd.<sup>81</sup> There was no airborne interception radar warning system, no air search radar warning system, no chaff dispenser, there was not even an electronic navigation system until the 'Green Satin' doppler navigation set was retrofitted to the aircraft. The lack of the electronic warfare aids so necessary to the role was a sign of the immaturity of the RAAF. The lack of electronic equipment for the Canberra held back the entry of both the RAAF and Australian industry into the avionics systems era by a decade or more—until the manufacture of the 'all-weather' Mirage 111O.

The Canberra was manufactured in the new GAF factory at the Department of Supply airfield at Avalon. The Australian built Canberra included more powerful generators, internal cartridge jet engine starters, a two-crew cockpit instead of three, the addition of wingtip auxiliary tanks, and many other modifications. The GAF subcontracted construction of the Canberra extensively to both large and small firms.

Major subcontractors included the NSW and SA Railway Workshops. Chrysler Australia in Adelaide, an established subcontractor to GAF, alone invested in 15,000 new tools and assembly jigs to construct major subassemblies for the fuselage, wings, tailplane and fuel tanks. Although some parts such as specialist forgings were imported, the Canberra was manufactured, not assembled. Most problems were overcome in an orderly way, and despite an ongoing shortage of skilled labour, the first Australian built Canberra flew on 29 May 1953, some three years after the Cabinet approval of the project—about six months late. Production peaked at 14 aircraft in 1955.<sup>82</sup>

The Canberra project advanced Australia's aviation and metal technologies considerably and as a project it must be rated a notable success which amply demonstrated the new levels of technical competence that GAF had achieved. However, given the capabilities of the aircraft, the strategic situation, and the importance of the role it was to assume, the production run of 48 aircraft seems somewhat small; a larger production run with the addition of some of the important electronic warfare systems seems justified.

Apart from the Lincoln and Canberra programs, GAF embarked on the unmanned Jindivik target aircraft, an unlikely project but one that built on the close links between GAF and the Defence Weapons Laboratories. Almost 600 Jindiviks were manufactured mostly for export to Britain, US and Sweden. GAF followed this with the Malkara anti-tank missile, the Ikara torpedo carrying guided missile and the Turana drone.

Unlike the Canberra, the selection of a new jet fighter for the RAAF caused much controversy. Jones had initially selected the Hawker P1081 on his 1949 visit to Britain.<sup>83</sup> He had not included any US fighters in his evaluation; the Government had directed him to exclude US aircraft on the grounds of a lack of US foreign exchange.<sup>84</sup> The Hawker P1081 was a development of the straight winged Hawker/Armstrong Whitworth Sea Hawk fighter for the Royal Navy.<sup>85</sup> The P1081 development featured a swept wing, a Rolls-Royce Tay engine replacing the Nene, and a single jet pipe replacing the bifurcated tailpipe of the Sea Hawk.

At this juncture, Wackett was clearly unimpressed as neither he nor CAC, who were to build the aircraft, had been invited into the P1081 selection process. Why would the RAAF select an aircraft for licence production without any input from the prospective licensee? Was this due to tensions between the RAAF and CAC, or was it a way for Jones to try and keep the dynamic and strong-willed Wackett at a distance?

Wackett may have put himself offside with Jones and the RAAF when much earlier he suggested that the Grumman Panther was a good candidate RAAF aircraft; it was a Nene powered US Navy fighter.<sup>86</sup> While Wackett was clearly put out, he also knew that CAC desperately needed a contract for a fighter aircraft—he somewhat disdainfully records that he was indifferent to the fighter selection decision as long as the aircraft satisfied the RAAF.<sup>87</sup>

CAC and the Department of Supply commenced the contracting process for the P1081 but it was soon evident that Hawker could neither supply the required production drawings nor conclude a satisfactory licence agreement. Wackett and the experienced Victor Letcher from the Department of Supply went to Britain. Hawker agreed that the P1081 was not a licence proposition; indeed it seems that Hawker were already working on a successor fighter and were anticipating cancellation of the P1081 by the Air Ministry.

Although there was an expectation that Australia would rollover their £30,000 deposit on the P1081 to the Hawker F3/48, Wackett foresaw a long development path in front of the F3. He also noted that the Avon engine proposed for the F3 was a later development from that in the Canberra; it would complicate the manufacturing and support arrangements for the Avon in Australia.

Wackett unilaterally commenced discussions with NAA and Rolls-Royce about purchasing the Sabre with an Avon engine. Both Rolls-Royce and NAA were keen on this proposal, which sought to combine the generally acknowledged best fighter in the world with the best jet engine in the world.<sup>88</sup> Wackett convinced Jones of the merits of the Avon Sabre and to put the proposal to Government, but the newly elected Menzies Government rejected the Cabinet submission. A second Cabinet submission was successful but only after Rolls-Royce was co-opted into lobbying the Government on behalf of both the RAAF and CAC.<sup>89</sup>

Although the F3 saw service as the Hawker Hunter—an acknowledged classic jet fighter—Wackett was correct in assessing that Australia could not afford to wait for Hawker to complete the development of the Hunter. Even the RAF was forced to order some 400 Canadair Ltd licence built F-86E Sabres for interim service in

the RAF fighter squadrons garrisoning Germany until the Hunter came on line. The only other fighter that might have merited examination was the Grumman Cougar, a swept wing development of the Panther, which was ordered by the US Navy on 2 March 1951 and first flew on 20 September 1951.<sup>90</sup>

The development of the Avon Sabre was a demanding exercise for CAC with some 60 per cent of the fuselage frames needing change. Different engine mountings and a relocation of the 'field break' in the rear fuselage of the aircraft were also necessary. The later RAAF requirement to substitute two 30 mm Aden cannons for the 50 calibre armament posed more difficulties. The Aden was a new and immature gun, which was still undergoing development while CAC was attempting to integrate it into the Sabre. CAC also later introduced the NAA F-86F wing leading edge extension to the Avon Sabre, which improved high speed handling and added fuel capacity.

Cabinet approved the Sabre project in April 1951; the Avon Sabre first flew on 3 August 1953, three months after the GAF Canberra. CAC built 218 Avon jet engines for both Canberra and Sabre. The RAAF was in the 'jet age' with two outstanding aircraft and neither CAC nor GAF could be accused of undue dalliance. But aerospace was advancing rapidly; could both the RAAF and the industry keep pace with the new developments?

Over this period, CAC also designed and built the Winjeel trainer for the RAAF. The prototype flew on 3 February 1951 and after resolving some problems relating to achieving an acceptable spinning regime appropriate for a basic trainer, the Winjeel entered production. It proved an exceptional trainer, which served the RAAF with distinction. The robust Winjeel could validly claim to be bettered by few other contemporary military basic trainers in the world.

With the Sabre, Canberra, Jindivik and Winjeel programs in full swing, the Australian aircraft industry was at its zenith. While the industry could never aspire to the design and development of advanced combat aircraft, it did have the ability to grasp emerging designs at the leading edge of the advancing wave of aerospace technology and bring them into production, resolve initial development problems and produce aircraft complete with the extensive range of modifications specified by the RAAF.

There was however a premium associated with local production. Some of this was attributed to the demands of the many Australian unique modifications that were always going to be a significant added expense, irrespective of whether the aircraft was built in Australia or overseas. But apart from the premium associated with small production runs and Australian unique modifications, a substantial component of the premium was due to the structural inefficiency and poor work practices in the post-World War II industry.

The industry had not adapted to the postwar environment in 1946. By 1958, and in the face of criticisms over the final cost of the Canberra, Sabre and Winjeel programs, it now had to change or face demise.

It was not just residual overcapacity in the industry. The nation could not afford the overheads associated with three aircraft manufacturers and their different cultures and methods. All needed to change their modus operandi to ensure that they were competitive and that the premium for local production was minimised. GAF in particular had to be weened off the continual drip of government subsidisation. Manufacturing in the world was changing rapidly and with the Sabre and Canberra programs running down, 1958 was the last window of opportunity to restructure the Australian aviation industry into a leaner, more focused and better organised industry.

## **Australian Aircraft Industry Contraction – 1958 to 1985**

### *A Failure to Adapt and Restructure – The Slide Steepens*

The industry did not restructure in 1958. The climate of its relationship with the RAAF had also changed. Previously it had generally operated with the support of the incumbent RAAF CAS; with Jones, Hardman and McCauley being supportive of the industry—although Wackett and Jones had their doubts about McCauley. But when Air Marshal Scherger became CAS, it seemed that the series of generally sympathetic RAAF chiefs had come to an end.<sup>91</sup>

Scherger became CAS in 1956, at a time when aerospace was still developing at a breathtaking pace. The life of a new military aircraft could be as short as a few years before it was superseded by a new and superior capability. This problem was not new—it had been with the RAAF since 1934—but now it was a more expensive and complex proposition. It is not clear what Scherger wanted of the industry; perhaps he was merely stating what with hindsight is clear—that the industry needed to change with the times and the industry needed to become more accountable for the premium that was always going to accompany local production. Scherger quickly moved on but the relationship between the industry and the RAAF was to enter a less harmonious era, particularly when taken in context with the retirement of Wackett in 1960.

Industry and the Department of Supply made some minor changes; GAF was appointed prime contractor for the licence production of the Mirage, thus breaking the established convention that CAC was the fighter specialist and GAF the bomber specialist. DHA partnered with CAC to licence build the Macchi MB 326 trainer. But the industry was trending down. CAC remained unchanged, with jet engine work becoming its core activity. DHA became Hawker de Havilland (HdH) following the merger of its UK parent de Havilland with Hawker, Avro, Blackburn and others into the Hawker Siddeley Group. GAF remained a nationalised factory.

Defence work, which would necessarily remain the mainstay of the industry, could not be spread economically across three industry entities. The major impediment to restructure was the nationalised GAF. While Government retained ownership of GAF, industry wide restructure could not occur. The Government also showed no inclination to nationalise CAC or HdH, as was done in Britain. This would have succeeded in rationalising the industry but on what we know today about the performance of nationalised aircraft factories, it would not have been a productive solution. The Government would likely have done its investment.

A continuing bone of contention was that, as a nationalised factory, GAF operated on a different financial basis to both CAC and HdH. The private companies believed that GAF was excessively subsidised. The private companies were also wary that GAF was too close to supportive bureaucrats in the Department of Supply, thus gaining advantages in workshare and costing.

CAC and GAF were located either side of a wire fence at Fishermen's Bend—a merger between the two seemed an obvious option despite the somewhat prickly relationship between the two entities. That poor relationship went back many years and reached a new low when the licence manufacture of the Mirage was awarded to GAF. CAC mounted a *repechage* and recouped some airframe involvement building the wings and fin in addition to the Atar engine; but with Wackett retiring, CAC had lost its influence. GAF and its oversighting department were in the ascendancy, as illustrated again by GAF acquiring the lead workshare of the F/A-18 local production package.

Despite the obvious dysfunctional structure of the industry—amply illustrated by the 18 major reviews, inquiries and reports into the industry between 1958 and 1985—its structure continued to remain unchanged.<sup>92</sup> It gained a further injection of funds from the F/A-18 program, but it still remained unwilling to consolidate, reinvigorate and refocus.

The RAAF Wamira trainer project was the last manufacturing opportunity for the industry, but industry's organisational response was central to the further erosion of confidence that the RAAF and Government had in the industry. In 1981, the industry's obsession with workshare saw the creation of a fourth Australian aircraft entity when all three companies contributed to partnership in the Wamira consortium.

The consortium was an attempt to guarantee all three partners work, and survival. But the consortium entity had no corporate heritage, no corporate memory and no corporate culture. It had no organisational processes. Personnel from all three companies were seconded to the consortium, bringing with them their different cultures, loyalties and priorities. It was not a robust organisational model with which to tackle the focused and accountable task of building an aircraft. The better option was to select a prime contractor to project manage the Wamira and subcontract as required; a far more brutal, but effective business model. It probably would have generated a commercial response by the industry players which would have gone a long way towards industry rationalisation.

Finally in 1985, in a bid to save the industry and the Wamira trainer project, HdH bought out CAC and renamed it Hawker de Havilland Victoria. At this juncture, the industry still collectively had the expertise to design, manufacture and test the Wamira trainer, particularly in view of the considerable investment in the industry made as part of the F/A-18 Hornet program. But this partial rationalisation had occurred too late to save the project.

The RAAF was a significant contributor to the downfall of the project and had to suffer the irony of ending up with a lightweight tandem seat trainer instead of its uncompromising requirement for a ‘bulletproof’ trainer with side-by-side seating—a solution it had vigorously and inflexibly imposed on Australian industry throughout the project. The Wamira project was hardly a shining example of the new ‘Team Australia’ approach shortly to be articulated by Defence and Government as one of the new pillars of Australian defence industry policy.

In 1987, the Government corporatised GAF and renamed it Aerospace Technologies of Australia (ASTA). Shortly after, the Government made the decision that should have been obvious for decades; it sold ASTA. The US aerospace company Rockwell bought ASTA for little more than a song, with Government retaining ASTA’s exposures to past liabilities.

## **OBSERVATIONS AND CONCLUSIONS**

In the aftermath of the Great Depression, the Australian Government was challenged by a range of political, economic, financial and public policy issues which directly impacted on Australia’s national interests. By and large, the political leadership of the time responded to these challenges by making the judgement that what was good for Britain was good for Australia.

Notwithstanding the closeness of the two countries, this approach failed to discriminate between the respective national interests of both Britain and Australia. While this may have been an easy way for Government to address the issues of the time, it was an approach that failed to do justice to Australian interests. Perhaps a more independently minded approach to the problems of the day was beyond the leadership of the time. Whatever the cause, it ensured that Australia struggled to throw off the influence of the Great Depression and was chronically under-prepared to face the demanding challenges of World War II.

As a contrast to the indecisive leadership of the Australian Government, it is quite remarkable that a group of industrialists who were perceptive and confident about Australia’s place in the world, concerned about its lack of defence preparedness, and who foresaw the future utility of aircraft in war, decided to develop an aircraft industry. Matters of national self interest are normally decisions for Government.

That the syndicate followed through by funding the development of an aircraft and engine plant, on the back of an order for a mere 40 aircraft, is testimony to the strength of their convictions. That the political leadership was generally so unsupportive of the initiative shows how badly the Australian political leadership of the time coped with the demanding issues of the period.

A less critical view is that the Australian Governments of the time were simply naive. Their penchant to rely on assurances from Britain rather than think for themselves was amply illustrated by the uncritical acceptance by Government of the recommendations of the British Air Mission in March 1939. The recommendations regarding the Beaufort and its manufacture were accepted without technical analysis or due diligence.

Even accepting that the Beaufort was the right aircraft type for the RAAF, the decision to accept the recommendation that the Beaufort be manufactured by a new organisation without any aviation expertise, personnel, or facilities, rather than by the recently established ‘state-of-the-art’ plant at CAC, was flawed.

In those critical early days following the establishment of CAC, the Air Board, the principle adviser to the Government on matters of military aviation, did not make a strong contribution towards the future of the industry. After the demise of the independently minded Williams in 1938, the Air Board proved an ineffective advocate of Australian self interest.

It proved unable to look after Australia's interests beyond the Empire Air Training Scheme; it failed to prudently appreciate the threat from Japan; it failed to grasp the evolving potency of fighter and tactical aircraft and the role they might play in the approaches to Australia; and it failed to marshal the arguments to secure the manufacture of a follow-on aircraft to the Wirraway.

Perhaps these thoughts might have crossed Air Chief Marshal Burnett's mind when he personally inspected the damage at Darwin following the first Japanese air raid on 19 February 1942. This was not a particularly inspiring period of leadership for the RAAF and while it might feel good to blame Burnett who was then Chairman of the Air Board, and those who appointed him, the failure includes wider aspects of Australian culture and national governance.

Yet despite the unsteady foundation created by a sequence of inept founding higher policy decisions, the Australian aircraft industry eventually manufactured 755 Wirraways, 705 Beauforts, 250 Boomerangs, 365 Beaufighters, 104 Mosquitoes, 16 Mustangs and almost 2000 aircraft engines during the war years.

It did this despite starting from well behind scratch, and in a climate of machine tool shortages where the Australian war industry had to manufacture locally seven out of ten machine tools, and with untrained labour where 80 per cent of the workforce had no previous factory employment.

The role of Essington Lewis in achieving these results is less well-known today than it should be. As Director General of Munitions from 1939 to 1945 and Director General of Aircraft Production from 1942 to 1945, he orchestrated what proved to be essentially the industrialisation of Australia. What is also relatively unknown is the large degree to which this industrialisation was built on the foundation established by BHP under Lewis's leadership from 1921 to 1939.

For a nation whose industrial might in 1937 consisted of BHP, some munition factories, and a collection of infant auto body and farm machinery assemblers, this was a resounding achievement. One can only wonder at what might have been achieved had the early decisions about aircraft manufacture in Australia been better founded and the 27 months breathing space between war in Europe and the war in the Pacific not been frittered away.

As to the contribution of CAC, so presciently established by the industrialists in 1936, it seems clear that the nation failed to exploit fully the potential of CAC by not adequately consolidating on the industrial base created by the Wirraway program.

Post-World War II, the aircraft industry reached a technological zenith especially through its involvement in the Canberra and Avon Sabre programs. The technical achievements were world-class, and any criticism about timeliness of development is generally unfounded, particularly after taking into account the time taken by Government to decide on aircraft projects and the significant extra load caused by the need to integrate many 'Australian unique' modifications.

But the industry consistently failed to adapt to the new economic and defence environment. Defence and defence industry policy was generally not helpful in achieving such adjustment, particularly as the Government continued to hold ownership of GAF thus effectively precluding industry rationalisation. It now seems absurd that Government stayed in the business of aircraft manufacture via its ownership of GAF for 45 years after the close of World War II, and in so doing oversighted a continual wasting of assets, capital and technical expertise.

Central to this deterioration, industry, both nationalised and private, failed to reorganise its assets and capabilities and inculcate a new rigour of accountability. While the nation would always support a premium for the local production of aircraft, that premium would have to be contained by sound strategic decisions, which was a Government responsibility, and through efficiencies and accountability, which was an industry responsibility.

Although the industry often had to cope with untimely decisions and a demanding military customer, the industry and its supportive bureaucrats were generally indifferent to the need to contain premiums to an acceptable level. That inability, when combined with the failure to grasp earlier opportunities to restructure and adapt, caused the book effectively to close on the Australian aircraft manufacturing industry in 1985.

After traumatic commercial surgery, the vestiges of the aviation manufacturing industry that was DHA, CAC and GAF now reside in Hawker de Havilland. The Boeing-owned company now manufactures aerospace structural components for the world aerospace industry. It operates in a global market, competing for work in aerospace component manufacturing. It is the legacy company of a proud national heritage. It employs some 1500 people and exports more than 90 per cent of its product—one of many stark contrasts to its predecessors.

As aircraft manufacture declined in Australia, a new industry of outsourced repair, maintenance and support for Australia's military aviation capabilities has emerged. While essentially a product of the last decade of the 20<sup>th</sup> century, with its emphasis on outsourcing of military aviation support to commercial contractors, this industry plays just as vital a role in the support of the nation's military capabilities as did its predecessor industry half a century ago.

Hopefully as a more mature nation, Australians might reasonably expect a far more informed defence industry policy to guide the development of the outsourced defence support industry than that which guided, and eventually contributed to the demise of the Australian aircraft manufacturing industry.

## ANNEX A: AUSTRALIAN AVIATION INDUSTRY – OWNERSHIP AND MERGERS

**17 October 1936** – Commonwealth Aircraft Corporation (CAC) registered as a company, with authorised capital of £1,000,000 paid up to £600,000, with Essington Lewis as Chairman and Lawrence Wackett as Manager. The shareholders were:

Broken Hill Proprietary Company Ltd	£200,000
Broken Hill Associated Smelters Pty Ltd	£150,000
Imperial Chemical Industries of Australia and New Zealand	£90,000
General Motors-Holden's Ltd	£60,000
The Electrolytic Zinc Company of Australasia Pty Ltd	£50,000
Orient Steam Navigation Company Ltd	£50,000

**June 1939** – Aircraft Construction Branch of the Department of Supply and Development established, with the former Chief Commissioner of the Victorian Railways, Harold Clapp, as General Manager.

**February 1940** – The Aircraft Production Commission established with Commissioner Clapp as its Chairman, with the status of a departmental head. Commissioners O'Shea and Storey complete the three person commission.

**December 1941** – The Aircraft Production Commission is abolished. John Storey appointed General Manager of the Beaufort Division of the Department of Aircraft Production.

**1948** – Rolls-Royce buys the GMH shareholding in CAC.

**1960s** – De Havilland Australia (DHA) renamed Hawker de Havilland; following the merger of their UK parent de Havilland, with Hawker and others, into Hawker Siddeley.

**1985** – Hawker de Havilland buys out CAC and renames it Hawker de Havilland Victoria. The shareholders of CAC at the time of the sale were:

Broken Hill Proprietary Ltd	33.34%
North Broken Hill	12.5%
Imperial Chemical Industries of Australia and New Zealand	15%
Western Mining Corporation	12.5%
Rolls-Royce	10%
Electrolytic Zinc Company	8.33%
P&O Australia Holdings	8.33%

**1987** – Government Aircraft Factory (GAF) is corporatised and renamed Aerospace Technologies of Australia (ASTA). ASTA is sold to Rockwell. Boeing subsequently takes over Rockwell.

**1991** – In the UK, BTR Aerospace buys Hawker Siddeley and as a consequence owns Hawker de Havilland.

**1998** – BTR sells the rump of Hawker de Havilland to Tenix after selling off many of the component parts of HdH over the period 1991 to 1998.

**2000** – Boeing Holdings Australia buys the Tenix-owned Hawker de Havilland and merges with the Boeing-owned ASTA. Boeing-Hawker de Havilland now contains the heritage that once was DHA, CAC and GAF.

## ENDNOTES

- <sup>1</sup> See Douglas Gillison, *Royal Australian Air Force 1939–1942*, Australian War Memorial, Canberra, 1962, pp. 30–34; and Sir Richard Williams, *These are Facts: The Autobiography of Air Marshal Sir Richard Williams, KBE, CB, DSO*, Australian War Memorial and Australian Government Publishing Service, Canberra, 1977, pp. 181–85.
- <sup>2</sup> See Sir Lawrence Wackett, *Aircraft Pioneer: An Autobiography – Lawrence James Wackett*, Angus and Robertson, Sydney, 1972, p. 102; and Williams, *These are Facts*, pp. 182, 197.
- <sup>3</sup> Williams, *These are Facts*, pp. 209–11.
- <sup>4</sup> Paul Kelly, *100 Years: The Australian Story*, Allen & Unwin, Crows Nest, 2001, pp. 218–24.
- <sup>5</sup> See Geoffrey Blainey, *The Steel Master: A Life of Essington Lewis*, Macmillan, South Melbourne, Australia, 1971; and Clive Turnbull, *Great Australians – Essington Lewis*, Oxford University Press, Melbourne, 1963.
- <sup>6</sup> Blainey, *The Steel Master*, pp. 120–25.
- <sup>7</sup> Brian Hill, *Wirraway to Hornet: A History of the Commonwealth Aircraft Corporation Pty Ltd*, Southern Cross Publications, Bulleen, Vic, 1998, p 4.
- <sup>8</sup> William Sydney Robinson was an eminent Australian financial broker and trusted adviser to the Australian Government in both World Wars. In 1914, he was responsible for preventing the collapse of the Australian base metal mining and smelting industry following the loss of Australia’s European markets. He directed many of Australia’s mining companies and linked the industry to the capital markets in London. He was joint Managing Director of BHAS from 1915 and among many other initiatives, he founded the Western Mining Corporation in 1933. He was instrumental in the establishment of the Australian aluminium industry. He was an ‘international Australian’ constantly seeking to advance Australia’s interests. He was particularly concerned about how British financial policies could adversely impact Australia. In World War II, at the request of the Government, he travelled the world using his contacts and standing to facilitate the negotiation of Australian interests. He declined public honours and died in 1963. See WS Robinson, *If I Remember Rightly: The Memoirs of W.S. Robinson*, edited by Geoffrey Blainey, Cheshire Publications, Melbourne, 1967.
- <sup>9</sup> GMH was formed in 1931 by the merger of General Motors Australia and Holden’s Motor Body Builders of Adelaide. LJ Hartnett was an English engineer sent from Vauxhall Motors in 1934 to head GMH. He performed excellent service in the Department of Munitions under Essington Lewis during World War II and remained Managing Director of GMH until 1947.
- <sup>10</sup> Robinson, *If I Remember Rightly*, pp. 174–75.
- <sup>11</sup> Williams, *These are Facts*, p 226.
- <sup>12</sup> *Ibid*, p. 227.
- <sup>13</sup> Wackett, *Aircraft Pioneer*, p. 116.
- <sup>14</sup> Williams, *These are Facts*, p. 227.
- <sup>15</sup> Wackett, *Aircraft Pioneer*, p. 132.
- <sup>16</sup> The key backers of the syndicate were BHP and the ‘Collins Group’, with BHAS and Electrolytic Zinc both being part of that group headquartered at 360 Collins Street, Melbourne. See Hill, *Wirraway to Hornet*, p. 13.
- <sup>17</sup> See Hill, *Wirraway to Hornet*, p. 19; and Wackett, *Aircraft Pioneer*, p. 132.
- <sup>18</sup> Although not as well known as some other American aviation figures, such as Glenn Curtiss, John Northrop, Donald Douglas etc, JH Kindleberger was a significant achiever of the US aviation industry; he was central to the success of North American Aviation Incorporated.
- <sup>19</sup> Wackett, *Aviation Pioneer*, p. 149.
- <sup>20</sup> Sir George Jones, *From Private to Air Marshal: The Autobiography of Air Marshal Sir George Jones*, Greenhouse Publications, Richmond, Vic, 1988, p. 59.
- <sup>21</sup> Wackett was impressed with the Spitfire but ruled out its manufacture as being too complex a task for CAC, which had yet to build a factory let alone an aircraft.
- <sup>22</sup> Parliamentary Speech by Sir Archdale Parkhill, Minister for Defence, 25 August 1937.
- <sup>23</sup> See Gillison, *Royal Australian Air Force 1939–1942*, pp. 52–54; Williams, *These are Facts*, pp. 235–38; and Jones, *From Private to Air Marshal*, pp. 76–77.

- <sup>24</sup> Of note, Williams flew the Wackett designed Gannet from Melbourne to Singapore and return. He noted the satisfactory performance of the twin-engine monoplane light transport. See Williams, *These are Facts*, p 233.
- <sup>25</sup> Broadcast Address by Prime Minister JA Lyons, 23 March 1939.
- <sup>26</sup> Alan Stephens, *Power plus Attitude: Ideas, Strategy and Doctrine in the Royal Australian Air Force 1921–1991*, Australian Government Publishing Service, Canberra, 1992, pp. 72–75.
- <sup>27</sup> Burnett was an Inspector General, not an appointment usually occupied by up-and-coming, high calibre officers. He was shortly to retire until nominated by the British Government for duty as RAAF CAS. See Gillison, *Royal Australia Air Force 1939–1942*, pp. 76–78.
- <sup>28</sup> Admiral Sir Ragnar Colvin, RN was The First Naval Member; Lieutenant General Squires replaced the Australian officer, Lieutenant General Sir John Laverack, as Chief of General Staff. See Gillison, *Royal Australia Air Force 1939–1942*, p. 74.
- <sup>29</sup> Air Vice-Marshal Joe Hewitt, *Adversity in Success*, Langate Publishing, South Yarra, Vic, 1980, p. 2.
- <sup>30</sup> Gillison, *Royal Australia Air Force 1939–1942*, pp. 48–57.
- <sup>31</sup> *Ibid*, p. 52.
- <sup>32</sup> Andrew Ross, *Armed and Ready: The Industrial Development & Defence of Australia 1900–1945*, Turton & Armstrong, Sydney, p. 286.
- <sup>33</sup> *Ibid*, p. 286.
- <sup>34</sup> *Ibid*, p. 287.
- <sup>35</sup> *Ibid*, p. 287.
- <sup>36</sup> *Ibid*, p. 287.
- <sup>37</sup> Wackett, *Aircraft Pioneer*, p. 149.
- <sup>38</sup> Ross, *Armed and Ready*, p. 288.
- <sup>39</sup> Harold Darling was an Australian born industrialist who many considered to be the face of Australian capitalism. He had been intimately involved in the development of the Australian steel industry, having been Chairman of BHP since 1923. He was a Director of many companies, including the National Bank of Australasia and ICI Australia and New Zealand.
- <sup>40</sup> See Ross, *Armed and Ready*, p. 294; and Hill, *Wirraway to Hornet*, p. 45.
- <sup>41</sup> Ross, *Armed and Ready*, p. 296.
- <sup>42</sup> *Ibid*, p. 297.
- <sup>43</sup> Hill, *Wirraway to Hornet*, p. 76.
- <sup>44</sup> Blainey, *The Steel Master*, pp. 145–60.
- <sup>45</sup> Hill, *Wirraway to Hornet*, pp. 77–79.
- <sup>46</sup> Wackett, *Aircraft Pioneer*, p. 157.
- <sup>47</sup> Ross, *Armed and Ready*, p. 302.
- <sup>48</sup> See Ross, Blainey, Wackett and Hill.
- <sup>49</sup> Blainey, *The Steel Master*, p. 163.
- <sup>50</sup> Ross, *Armed and Ready*, p. 325.
- <sup>51</sup> *Ibid*, p. 326.
- <sup>52</sup> *Ibid*, p. 327.
- <sup>53</sup> *Ibid*, p. 328.
- <sup>54</sup> *Ibid*, p. 329.
- <sup>55</sup> Stewart Wilson, *Beaufort, Beaufighter and Mosquito in Australian Service*, Aerospace Publications, Weston Creek, ACT, 1990, p. 39.
- <sup>56</sup> Hill, *Wirraway to Hornet*, p 67.
- <sup>57</sup> *Ibid*, p 68.
- <sup>58</sup> Stewart Wilson, *Wirraway, Boomerang and CA-15 in Australian Service*, Aerospace Publications, Weston Creek, ACT, 1991, p. 144.
- <sup>59</sup> Blainey, *The Steel Master*, p. 169.
- <sup>60</sup> Ross, *Armed and Ready*, p. 334.
- <sup>61</sup> Jones, *From Private to Air Marshal*, p. 84.
- <sup>62</sup> Wilson, *Beaufort, Beaufighter and Mosquito*, p. 88.

- <sup>63</sup> *Ibid*, p. 88.
- <sup>64</sup> *Ibid*, p. 157.
- <sup>65</sup> *Ibid*, p. 164.
- <sup>66</sup> Hill, *Wirraway to Hornet*, p. 59.
- <sup>67</sup> *Ibid*, p. 62.
- <sup>68</sup> *Ibid*, pp. 62–64.
- <sup>69</sup> *Ibid*, p. 46.
- <sup>70</sup> Wackett, *Aircraft Pioneer*, p. 153.
- <sup>71</sup> Hill, *Wirraway to Hornet*, p. 49.
- <sup>72</sup> DP Mellor, *Australia in the War of 1939–1945: The Role of Science and Industry*, Australian War Memorial, Canberra, 1958, p. 72.
- <sup>73</sup> Stephens, *Power plus Attitude*, p. 77.
- <sup>74</sup> Wackett, *Aircraft Pioneer*, p. 163.
- <sup>75</sup> See Hill, *From Wirraway to Hornet*, pp. 94–97.
- <sup>76</sup> *Ibid*, pp. 94–97.
- <sup>77</sup> Wackett, *Aircraft Pioneer*, p. 184.
- <sup>78</sup> Stewart Wilson, *Lincoln, Canberra and F-111 in Australian Service*, Aerospace Publications, Weston Creek, ACT, 1989, p. 29.
- <sup>79</sup> *Ibid*, p. 29.
- <sup>80</sup> *Ibid*, p. 79.
- <sup>81</sup> Alan Stephens, *Going Solo: The Royal Australian Air Force 1946–1971*, Australian Government Publishing Service, Canberra, 1995, p. 363.
- <sup>82</sup> Wilson, *Lincoln, Canberra and F-111*, pp. 91–94.
- <sup>83</sup> Stephens, *Going Solo*, pp. 346–47.
- <sup>84</sup> Jones, *From Private to Air Marshal*, p. 143.
- <sup>85</sup> John Taylor, *Combat Aircraft of the World*, Putnam, New York, 1969, p. 392.
- <sup>86</sup> Wackett, *Aircraft Pioneer*, p. 183.
- <sup>87</sup> *Ibid*, *Aircraft Pioneer*, p. 186.
- <sup>88</sup> See Stephens, *Going Solo*, p. 346; and Wackett, *Aircraft Pioneer*, pp. 185–93.
- <sup>89</sup> Jones, *From Private to Air Marshal*, p. 144.
- <sup>90</sup> Taylor, *Combat Aircraft of the World*, p. 506.
- <sup>91</sup> Stephens, *Going Solo*, p. 190.
- <sup>92</sup> Hill, *Wirraway to Hornet*, p. 266.