The Early Development of the Aviation Industry

*The Early Development of the Aviation Industry: Entrepreneurs of the Sky* provides an introduction to the world of the early aviation industry and the business endeavours of the original aviators.

Many of the first pioneers who flew heavier-than-air planes went on to develop considerable industrial concerns. In doing so they exhibited a number of entrepreneurial qualities, which provide useful case studies for those interested in studying how successful entrepreneurs create or develop opportunities at the inception and emergence of high-tech industries. This book looks at the careers of pioneer aviators in the United States, the United Kingdom and France such as A.V. Roe, Thomas Sopwith, Glenn Curtiss and William Boeing. It examines this group of entrepreneurs during the start-up and early development stages of an emerging industry undergoing considerable technological change, and relates this experience to contemporary studies and experiences of entrepreneurship. The book explores what made these men successful in their entrepreneurial endeavours to help promote a better understanding of what makes an entrepreneur and what business and economic conditions are needed to allow such men to be successful.

This book makes a major contribution to our knowledge of the development of the twentieth-century economy and is essential reading for students and academics who are interested in the development of aviation and the nature of entrepreneurial behaviour.

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“This book presents a comprehensive overview of early pioneers in the aviation industry and how they achieved many successes against challenging odds. This book is a recommended read for those interested in early aviation. Perhaps there are lessons to be learned that can be applied to modern day aviation entrepreneurship.”

— John Wensveen, Ph.D., Vice Provost, Miami Dade College, USA
The Early Development of the Aviation Industry
Entrepreneurs of the Sky

Malcolm Abbott and Jill Bamforth
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Part I

Themes and method
In recent years, considerable interest has arisen about the nature of entrepreneurship and what creates it. This has led to a number of books being written which discourse on the theoretical reasons for entrepreneurship and on the individual achievements of notable entrepreneurs (i.e. Richard Branson, Steve Jobs and Bill Gates). Business academics also are showing a growing interest in the nature of entrepreneurship and there is even some interest in the lives of prominent entrepreneurs by the general reading public. What is lacking, however, is a detailed analysis of how early entrepreneurs in the past successfully negotiated the early stages of development of a highly dynamic industry to establish organisations that went on to shape the future development of that industry. The work’s purpose, therefore, is to examine such a group of entrepreneurs, during the start-up and early development stages of an emerging industry, undergoing considerable technological change, and to relate this experience to contemporary studies and experiences of entrepreneurship.

Case studies such as these provide readers and researchers with an opportunity to understand and to further evaluate the impact of events and the dynamics of individual organisations. These types of case studies can also help to advance knowledge and contribute to theoretical developments by bringing to light concepts and ideas that can then be empirically tested (Gummerson, 1991; Nagel, 1961; Yin, 1989; Eisenhardt, 1989). The case studies presented in this book, which concentrate on the early aviation industry, are particularly striking ones and therefore of considerable interest.

Industries undergoing rapid technological change often attract individuals with an entrepreneurial frame of mind, as they offer opportunities to develop ideas and vision. These industries can also generate a degree of excitement that attracts an adventurous type of person. The industry under study in this book is that of the aviation industry, focusing on aircraft manufacturing rather than air travel, which began in the 1900s with the first flights of a heavier-than-air aircraft. In the years up until 1945, this industry saw the start-up of a number of famous aircraft manufacturing companies, assisted by some of the great names in pioneering aviation. Although a number of these men are well known in history, they are generally known more as either pioneers of aviation or as aircraft designers (or both) rather than as entrepreneurs. This is unfortunate because many of them, such as the
Wright brothers, Glenn H. Curtiss, Glenn L. Martin, Louis Blériot, the Farman brothers, Thomas Sopwith, Geoffrey de Havilland, William Boeing, Frederick Handley Page and Robert Blackburn were the creators of huge industrial empires, and the aircraft that their companies produced went on to become household names (for more comprehensive lists of the aviation pioneers/entrepreneurs in the United Kingdom, France and the United States see Tables 1.1, 1.2 and 1.3). These individuals not only had a taste for the excitement of early flight and a great flair in aircraft design, but they also possessed the organisational and entrepreneurial abilities that enabled them to build up considerable industrial concerns. In doing so, some of these individuals found the change in the industry over time too much to handle and struggled to adapt to the demands of managing large enterprises.

Table 1.1 Aviation entrepreneurs in the United Kingdom

<table>
<thead>
<tr>
<th>Name</th>
<th>Life</th>
<th>Company</th>
<th>Founded (taken over) ceased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geoffrey de Havilland</td>
<td>1882–1865</td>
<td>de Havilland Aircraft Co. Ltd.</td>
<td>1920–(1960) 1964</td>
</tr>
<tr>
<td>Montague Napier</td>
<td>1870–1931</td>
<td>D. Napier &amp; Son Ltd.</td>
<td>1808–(1942) 1906–</td>
</tr>
<tr>
<td>Frederick Henry Royce</td>
<td>1863–1933</td>
<td>Rolls-Royce Ltd.</td>
<td></td>
</tr>
<tr>
<td>George Holt Thomas</td>
<td>1869–1929</td>
<td>Aircraft Manufacturing Co. Ltd. (Airco)</td>
<td>1912–1920</td>
</tr>
<tr>
<td>Thomas Sopwith</td>
<td>1888–1989</td>
<td>Sopwith Aviation Co.</td>
<td>1929–1964</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hawker Aircraft. Hawker Siddeley</td>
<td>1912–1920</td>
</tr>
<tr>
<td>Robert Blackburn</td>
<td>1885–1955</td>
<td>Blackburn Aircraft Limited</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Still.</td>
<td></td>
</tr>
<tr>
<td>George White</td>
<td>1854–1916</td>
<td>British and Colonial Aeroplane Co.</td>
<td>1910–(1959) 1966</td>
</tr>
<tr>
<td>Neville Shute Norway</td>
<td>1899–1960</td>
<td>Airspeed Ltd.</td>
<td>1931–(1940) 1951</td>
</tr>
<tr>
<td>Sam Saunders</td>
<td>1857–1933</td>
<td>S.E. Saunders (Saunders-Roe)</td>
<td>1896–1929</td>
</tr>
<tr>
<td>Noel Pemberton-Billing</td>
<td>1881–1948</td>
<td>Pemberton-Billing Ltd. (Supermarine Aviation Works Ltd.)</td>
<td>1913–(1928) 1960</td>
</tr>
<tr>
<td>Hugh Burroughes</td>
<td>1884–1985</td>
<td>Gloucestershire Aircraft Co. Ltd. (Gloster)</td>
<td>1917–(1934) 1963</td>
</tr>
<tr>
<td>John Davenport Siddley</td>
<td>1866–1953</td>
<td>Armstrong Siddeley</td>
<td>1919–(1935) 1960</td>
</tr>
<tr>
<td>James Martin</td>
<td>1893–1981</td>
<td>Martin Baker Aircraft Co.</td>
<td>1934–</td>
</tr>
</tbody>
</table>
### Table 1.2 Aviation entrepreneurs in the United States

<table>
<thead>
<tr>
<th>Name</th>
<th>Life span</th>
<th>Company</th>
<th>Founded (taken over) ceased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frederick B. Rentschler</td>
<td>1887–1956</td>
<td>Pratt &amp; Whitney Aircraft Co.</td>
<td>1925–</td>
</tr>
<tr>
<td>Allan Loughead</td>
<td>1889–1969</td>
<td>Alco Hydro-Aeroplane Co., Loughead Aircraft Manufacturing Co.</td>
<td>1912–1920</td>
</tr>
<tr>
<td>William E. Boeing</td>
<td>1881–1956</td>
<td>Boeing Co.</td>
<td>1916–</td>
</tr>
<tr>
<td>Larry Bell</td>
<td>1894–1956</td>
<td>Bell Aircraft</td>
<td>1935–</td>
</tr>
<tr>
<td>Gerard Freebairn Vultee</td>
<td>1900–1938</td>
<td>Vultee</td>
<td>1939–(1943)</td>
</tr>
<tr>
<td>Reuben Hollis Fleet</td>
<td>1887–1975</td>
<td>Consolidated Aircraft</td>
<td>1923–1943</td>
</tr>
</tbody>
</table>

### Table 1.3 Aviation entrepreneurs in France

<table>
<thead>
<tr>
<th>Name</th>
<th>Life span</th>
<th>Company</th>
<th>Founded (taken over) ceased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charles Voisin</td>
<td>1882–1912</td>
<td>Voisin</td>
<td>1905–1918</td>
</tr>
<tr>
<td>Henri Farman</td>
<td>1874–1958</td>
<td>Farman Aviation Works</td>
<td>1908–1936</td>
</tr>
</tbody>
</table>

(Continued)
Others, however, were able to negotiate the changes well, successfully remaining in the industry long into the twentieth century, and in the process becoming substantial captains of industry. One example, for instance, is that of the British flyer Geoffrey de Havilland, who was one of the very first aviators in the United Kingdom, initially flying an aircraft he built in 1909 (see Figure 1.1). He and his companies survived the complex World War I and World War II industry environments and his company became an important designer of jet aircraft in the post-war years (see for an example Figure 1.2). Understanding why some of the early aviation entrepreneurs were able to make the transition from aviation pioneer to industrial manager while others did not will be an important theme of this study.

Looking back on the careers of these entrepreneurs it is easy to forget that most of them began their companies in small workshops and garages tinkering with crude machines that they hoped would enable them to experience flight. In doing so they are to some degree an earlier equivalence of the computer enthusiasts of the 1970s and 1980s, who developed early computer hardware and software that went on to shape the later-day IT industry, and subsequently all of our lives. Insights can be found by examining the similarities between the small-scale workshop origins of the aviation industry and the early stages of the personal computer revolution of the 1970s and early 1980s, when individual entrepreneurs on shoestring budgets worked out of garages and other modest locations, developing path-breaking concepts and technologies that helped to create the information
Figure 1.1 The first aircraft designed by Geoffrey de Havilland (1909)

Figure 1.2 Preserved de Havilland Vampire T11 displays at the Cotswold Air Show at Cotswold Airport, Kemble, Gloucestershire, England
revolution. The pioneering period of aircraft manufacturing provides a rich illustrative history of the growth of a new industry, which involves the creation of a number of small firms, financed from individual, family or local resources, all edging their way into the unknown.

In observing the similarities between early aviators and computer enthusiasts, there are some differences. Perhaps the main one was that although the latter were prepared to risk their careers and finances on their IT obsessions, the pioneer flyers were prepared to also risk their lives to achieve their personal goals. To some degree, however, this is not really a difference in general attitude, but instead a difference in the degree of intensity of the risks they were prepared to take. The early aviation and IT pioneers were both enthusiasts of emerging technologies and fascinated by the possibilities for the future they promised, it was just that the aviators also took on a rather more personal, physical risk as well.

Not all of these enthusiasts in these two industries went on to found and develop great industrial concerns, but in the case of aviation, a number did so. To a degree, they formed these industrial concerns to support and develop their enthusiasms, but often these companies developed beyond that into large-scale enterprises. Understanding what made these men successful in their entrepreneurial endeavours will go a long way to helping to promote a better understanding of what makes an entrepreneur, and what business and economic conditions are needed to allow such men to be successful.

To begin with, it is important to be mindful of what exactly is an entrepreneur. Entrepreneurs are said to display a number of characteristics that differentiate them from conventional business managers. Entrepreneurs generally focus on the achievement of a long-term vision and use the resources available to them (networks, knowledge, experience and partnerships) to form and iteratively shape a path to that future. Non-entrepreneurs who manage businesses, in contrast, generally focus on identifying the causes of predictable outcomes that they might be expected to face and then try to manage their environment using existing frameworks and resources to deliver those outcomes. The early pioneers of aviation who went on to design aircraft and build up companies to support their endeavours possessed many of the characteristics of what we generally regard as being entrepreneurs. Often these characteristics spurred them on to start-up new enterprises but also, ultimately, it meant they became bored when their enterprises grew to a substantial size, and they were forced into the role of being large-scale industrial managers.

Inter-linked to the endeavours of these early aviators/entrepreneurs is the technological context in which they worked. To understand the characteristics that early aviators/entrepreneurs had it is important to appreciate the waves of technological advancement that occurred in the aviation industry starting in 1903. In heavier-than-air aviation, the product had to meet exacting standards of technical quality, as the inherent dangers associated with the emerging technology were ever present. This put considerable development pressures on these people.

It is also important to understand the nature of consumer demand for aviation (coming as it does from a limited number of customers). These customers
Introduction

Consisted of demands from governments for military aircraft, commercial aviation companies, a limited private market and in some cases, exports. Aircraft manufacture in its earliest years tended to be concentrated in a limited number of countries, a factor that remains today. The nature and development of the market is, therefore, a consistent theme in aviation and aircraft aerospace development. The study of the initiation of this industry promises to provide a number of fascinating insights into the nature of the entrepreneurial individual, both then and now.

The general purpose of this study is to examine the nature of a group of individuals who worked in aviation in the years 1903 to 1945, the period during which the aircraft manufacturing industry emerged. It will concentrate on explaining the work of these individuals in terms of their entrepreneurial abilities, rather than their activities as pioneer aviators or aeronautical designers and engineers (although descriptions of these aspects of their lives will be provided, especially to the degree it reflects on their entrepreneurial activities). In addition, this study will look at the nature of the industry in which they worked to see what role the dynamic nature of the industry had in both attracting men of this calibre and providing them with the opportunities to develop their entrepreneurial skills and their organisations.

The first aim of the study, therefore, is to give an explanation of the structure of the aviation industry in the period 1903 to 1945, the nature of technological change and the general entrepreneurial context in which these men worked. The industry is widely believed to have begun in 1903 when the Wright brothers at Kitty Hawk in the United States made their first flight. This event heralded in a period of considerable expansion. The first French aircraft flight took place in 1906 and the first British flight in 1908, and the first orders for military aircraft took place soon after that. Military demand during World War I (1914–1918) helped to transform the industry from a small-scale, workshop-based industry into a vast and complex industry, although immediately after the end of the war, the industry went through a painful contraction.

Although the average number of post-World War I orders for aircraft were initially very limited, production and sales increased from 1923 onwards (Fearon, 1978 p. 237). A brief contraction took place in the early 1930s and then the industry began to grow again, pushed on first by the development of commercial passenger aircraft and later, after 1935, by rearmament. This increased demand helped to recreate a massive industry in the United Kingdom and France, and later still in the United States, employing hundreds of thousands of workers. During these years, a second wave of technological innovation in the industry occurred, with the introduction of metal construction, which created stronger aircraft and greater speeds, which in turn required greater technical effort. As the design and production of aircraft became more complex, more teamwork, a broader distribution of skills and a more sophisticated organisational structure became required. The design and manufacture of aircraft then moved on from a reliance on intuitive design skills to more systematic and scientific approaches being used. These technological changes demanded greater economies of scale in the industry, while
simultaneously increasing considerably the costs of entry into the industry. These factors eventually put pressure on firms to combine in order to reduce average production costs. Technological growth within the industry provided considerable scope for young men to develop their skills, both engineering and entrepreneurial. The novelist Nevil Shute Norway, who worked as a young man in the industry in the 1920s and 1930s, commented in his autobiography on this aspect:

It was exciting to be in aviation in those days, because development went at such a pace. . . . In aviation at that time there were opportunities on every side for those who had the wit to take them.

(1954, pp. 28–29)

This general climate of change provides a reader with an interesting context in which to study industrial development. In the case of aviation, however, although there are history books on the pioneers, there is limited discussion of those who were entrepreneurs, their work and how it led to the establishment of organisations and technologies that established the DNA of the current aviation industry.

The second aim of the study is to link the findings from the study of this early history to modern-day entrepreneurship. For example, the book will explore the interconnection between twentieth-century history, types of entrepreneurship, behaviours and psychological makeup using the early aviation industry as a case study. Early entrepreneurs in aviation will be compared to modern-day entrepreneurs in high-tech, emerging industries, to compare and contrast drivers and the patterns of entrepreneurship in different eras. In doing so, it will be possible to see how a dynamic, emerging market operates where established frameworks of knowledge do not yet exist. The study will explore the important role of communities of practice as alternative learning arenas in emergent high-tech development until government funding kicks in. This community of practice aspect would have appeal in contemporary emerging fields such as drone technology.

The third aim of the study will be to provide portraits of some of the most important aviation entrepreneurs in the industry during the period 1903 to 1945. The founders of the early aviation firms were often well-trained engineers, many of whom could be described as entrepreneurs (such as the Wright brothers, Louis Blériot, Glenn H. Curtiss, the Short brothers, Robert Blackburn, A.V. Roe, Geoffrey de Havilland and Thomas Sopwith; see Tables 1.1, 1.2 and 1.3). Although these men have been written about in the past, this work has mainly concentrated on their lives as aviators, designers and engineers rather than as entrepreneurs (see for instance Barnes, 1976; Bramson, 1990; Nockolds, 1950). This is unfortunate as they are a fascinating group of businessmen in their own right and in some cases are amongst the United States, France and the United Kingdom’s most important industrial leaders in the twentieth century.

The fourth aim will be to look at the personal characteristics these men had, and how they used their skills to create companies that enabled them to pursue their personal goals and vision. In each case, these men had to balance the need to create companies that enabled them to develop innovative aircraft designs
embodying new technologies with soundly run company structures that would attract outside investors. This balancing act was a perpetual problem for the early aviation entrepreneurs and their companies, and was tackled in a variety of interesting ways. Explanations of how they achieved this balance will be a central focus of the book.

The final aim is to look at the way in which aviation entrepreneurs interacted with the industry in other countries (e.g. the interactions of United States, the United Kingdom and France, with countries like Germany, Japan and Italy) to pick up and adapt innovations to meet the needs of their target markets.

In undertaking this work the authors have decided to limit their study to three main countries: the United States, France and the United Kingdom. Although it is true that a number of other countries (e.g. Russia, Germany, Italy and Japan) had similar aviation pioneers, it was decided to limit the study to provide a deeper analysis and make it manageable. Looking at Tables 1.1, 1.2 and 1.3 reveals that not all important aviator entrepreneurs in the three focused countries were included in this study. Again, this is not because those omitted were unimportant, but because including all would lead to a shallower, less clear analysis. It is hoped that in the future, researchers will take a renewed interest in these entrepreneurs of the past, many of whom have largely disappeared from public consciousness, even though as individuals they offer much for us to learn.

References


capability exited the industry, resulting in a legitimate and credible design and manufacturing base which dominated further development. Despite all of these changes, however, a number of key people in the early days of the industry took advantage of their flying achievements to found companies and then lead them for a number of subsequent years. They did so without uniform success, but their efforts contributed to the creation of an industry and a range of companies that is still with us today.

References

The Military Factory – Aircraft by Decade. Available at: www.militaryfactory.com/aircraft/aircraft-by-decade.asp
52 Themes and method

Note

1 The Wright brothers are generally given credit for being the first to fly powered, heavier-than-air planes. Even so, a number of claimants exist in a range of countries; for instance, it was asserted that Richard Pierce flew an aircraft in New Zealand in early 1903.

References


entrepreneurial aviators

... military, while Glenn L. Martin dominated the bomber market and Wright mainly manufactured aero engines.

Most of the aviation manufacturers, therefore, struggled through the 1920s, making a small number of recreation aircraft and aircraft for the military. This meant that the industry up until the late 1920s in many ways lagged behind that of France and the United Kingdom, where military purchases of aircraft gave the industry more of a boost. For that reason, before going on to look at the new breed of innovators and entrepreneurs who entered the American industry in the 1920s and 1930s, it is important to see how developments were taking place in Western Europe at this time. In both France and the United Kingdom, aviation pioneers who started up aviation manufacturing firms prior to World War I continued on in the industry in the 1920s and 1930s.

References


created aircraft on a massive scale, enabling the French military to run the world’s largest air force. A number of these companies arose as a result of partnerships with each other. A succession of shocks to the industry in the 1920s, 1930s and 1940s led to the disappearance of many of the pioneers from the industry.

The post-World War I collapse, the Great Depression, nationalisation in 1936 and the German occupation all put pressure on the French industry and led to the failure of a number of the original French companies. A number of French engineers, however, were to enter the industry at this time and were later to resurrect the industry in the post-World War II era.

The French pioneers tended to have strong engineering education and experience in their backgrounds, although they also tended to become frustrated with working for established companies and very early on branched out on their own. Flying instruction and prize money were used to finance the initial manufacturing concerns a number of them stayed in the industry for a considerable length of time, even into the post-World War II period. A number of them were keen on speed-related sports besides flying, such as cycling and the racing of motorcars. Funding of the initial companies tended to come from private sources, although the use of prize money and profits from flying schools and exhibition flying were common, as it had been in the United States.

Although the French industry is generally regarded as being unsuccessful in the 1920s and 1930s compared with developments taking place at the time in the United States and the United Kingdom, the industry did survive and in the post-World War II period became one of France’s preeminent manufacturing sectors. Many of the pioneers of the French industry by this time had left the industry but it is notable that some, like Dassault and Saulnier, were amongst the most important managers of the post-war industry. It was not in France, however, that the most enduring legacy of the aviation pioneers was to occur. Instead, it was in the United Kingdom where a number of the industry’s early flyers were able to stay in the industry for very long periods, and it is to this industry that we now turn in the next chapter.

References

Entrepreneurial aviators


the company’s prestige enabling him to maintain the independence of the company until his death.

Handley Page, in addition, was a pioneer of technical education and was to remain involved in it throughout his adult life, both at the technical college and university levels. He used his teaching early in his career to support himself while he worked on his various aircraft projects, but he also remained directly involved in the development of technical education even after he became the managing director of his company. In addition, he also favoured research in technological developments and often later in life wrote and spoke about this aspect of the industry. Very notable about his career was his steadfast refusal to merge his company with others in the late 1950s, an illustration of his very strong determination to run things his own way, and a common characteristic of many of the aviation pioneers/entrepreneurs (Fearon, 1978).

6.6 Conclusion

Like their American and French counterparts, the British pioneers often sought to enter the manufacturing of aircraft, although in the wake of the collapse in demand post-World War I also struggled to survive. Despite various bankruptcies and takeovers, A.V. Roe, the Short brothers, Frederick Handley Page and Robert Blackburn all managed to remain in the industry, a product of their ability to take advantage of the limited military sales of the RAF in the 1920s and early 1930s. Handley Page was the only one to develop a significant presence in the developing commercial markets of the 1920s and 1930s, and even this was to a degree a by-product of the company’s wartime development of heavy bombers. The others tended to survive by producing non-aviation products in the early 1920s and then by specialising in the production of types of military aircraft; Blackburn in naval aircraft and A.V. Roe and the Short brothers in floatplanes and flying boats.

Despite the differences with their American and French counterparts, the British pioneers were similar in that they tended to be young, adventurous, naturally inventive types, often with technical college educations (Robert Blackburn being a rare exception with an engineering degree), who had trouble settling into conventional engineering trades careers. Each also exhibited a dogged attachment to the industry riding out as best they could severe downturns in the early 1920s and early 1930s. Roe, Blackburn and Handley Page all managed to survive in the industry into the 1950s, an indication of their strong commitment to aviation and the determination to which they pursued their interests.

References


form of Geoffrey de Havilland to build up the United Kingdom’s largest aircraft manufacturing concern in World War I.

Even established businessmen like Thomas Holt, however, struggled to maintain their businesses in the early 1920s slump in demand for aircraft. The transition from wartime military aircraft to peacetime commercial flying proved to be a difficult one, and a range of technological changes had to take place. Thomas Holt, however, did have the necessary enthusiasm before the war to establish a viable supplier of aircraft. In doing so he was able to combine the employment of gifted, innovative designers like Geoffrey de Havilland with a lifetime of experience in managing enterprises. Thomas Holt, unlike a lot of the United Kingdom’s early founders of aviation companies, sold out of the industry at this time, while still retaining his support of the industry.

Thomas Sopwith was similar in that he was able to gradually acquire enough managerial experience to run a considerable industrial empire, while at the same time employed creative design teams. The creation of the Hawker Hart by the Hawker design team effectively changed the course of Sopwith’s company by creating enough income from military sales to float the company and then use the funds raised to take over other companies. Sopwith then stayed associated with the industry long after the other pioneer aviators had retired. Sopwith stayed on the board of directors of Hawker Siddeley until he finally retired at the age of 90 in 1980. Still a public figure in the United Kingdom in the 1970s, he embodied for many the very epitome of the aviation pioneers/entrepreneurs.

References

government funding. Both were able to adapt to these circumstances, with Geoffrey de Havilland, in particular, being able to design aircraft well suited to the market.

What differed between the two, however, is that de Havilland managed to maintain his position as chief designer at his company and work with the company’s managers and company directors. Shute Norway found that more difficult, first taking on the role of managing director, which involved less direct work in design. This was not unusual in the aviation industry, with men like Sopwith, for instance, moving in a similar direction, but Shute Norway found the work less inspiring and finally ended up leaving the industry after a dispute with his company’s board of directors.

The careers of both men illustrate the tensions that existed in aviation manufacture in its earliest days, in that innovative design teams had to sit with corporate structures, which over time got larger in scale. Dealing with these tensions was an important problem which de Havilland was able to overcome, Shute Norway less so.

References
Rentschler’s early family exposure to successful company operations in cars, steam and diesel engines gave him technical and administrative exposure to the running of successful company operations. It was, however, his World War I exposure inspecting aircraft engines that made him aware of the opportunities to enhance them. Inability to secure funding, despite his connections, did not prevent him from starting his own company with Pratt & Whitney. No doubt personal money, connections and an innovative engine design helped. At this point, he moved away from a stable career in the family business to pursue his vision of better aircraft flight. But four years later, the partnership had run its course, and he moved on to another start-up (United Aircraft) with Boeing and Vought until his death. In this position, he developed several successful jet engines.

9.4 Conclusion

Although the main motivation of men like Rentschler and Royce was not an obsession with flying, they did both exhibit a strong notion of the types of designs they wished to pursue and were prepared to leave conventional careers as engineers to pursue their ideas. It was only by founding their own companies that they were able to achieve the dreams that they had, so in a way, their entrepreneurial spirit was driven by the demand of their engineering plans. Royce even went as far as leaving the job of running the companies he founded to other associates so he could concentrate his efforts on design and development. But even Rentschler turned his back on quite lucrative and stable careers, first with the family business and then with Wright to pursue his own more risky ambitions.

References

As the industry became more complex, and economies of scale in production became more important, the larger market size became an important part of the development of the American industry. After World War II, competition for both military and commercial orders intensified. As the founders of the companies retired, a consolidation of the industry occurred. Even with this consolidation, some of the company founders stayed associated with the companies into the 1960s and 1970s.

References
the United States. Rolls-Royce began producing aero engines during World War I after the Royal Aircraft Factory asked Rolls-Royce to develop a new 200-h.p. air-cooled engine. In a much later era, Rolls-Royce became once again involved in the American industry when in 1995 it acquired the Allison Engine Company, a manufacturer of gas turbines and components for aviation, industrial and marine engines. The two companies had a technical association dating back to World War II and Rolls-Royce had previously tried to buy the company when General Motors sold it in 1993, but General Motors opted for a management buyout instead for US$370 million. In 2001, Rolls-Royce and its LiftSystem was amongst the group that won the JSF contract for the F-35.

The production is just one example of the complex components that go into the production of modern aircraft. Throughout the history of the industry, a substantial international trade has been undertaken in engines and other aircraft components, which has added to the global nature of the industry.

11.6 Conclusion

Although aviation is generally seen as being a global industry because of the importance of international commercial air travel, the global nature of the industry became apparent before commercial air travel became possible. Indeed, the 1908 contests between the likes of Blériot and Curtiss seem as much as anything to mark the beginning of a tremendous international interest in the industry as well as the beginning of an international network of flyers and manufacturers which had continued down to the present day. A key element of the success of the aviation industry has been its ability to share and build on others’ designs and technology quickly.

All of the early pioneers of flight had an interest in international events and this interest continued as they developed their manufacturing concerns. Although military interests and government involvement might have had the effect of dividing the industry along national lines, the global interlinkages continued into the present day. These links exist today in a variety of forms, many which have a long history stretching back to the earliest days during World War I.

References

Figure 12.2 Flybe Bombardier Dash-8–400 (G-JECL) takes off from Manchester Airport, England, 29 March 2009

References


institutions are unable to keep up. During rapid expansion and contraction peri-
ods, it is those embedded in the area who are best positioned to encourage and
fund experimentation and start-ups, suggesting they could provide an important
bridge between institutions (e.g. governments) wishing to invest wisely. As the
technology and industry stabilises, the relevance of governments and educational
institutions increases as they provide links to a broader ecosystem encompassing
research institutions, start-ups, investors and government funding necessary for
embedding and building on the changes and for giving the technology credibility.
Finally, governments and research institutions must seek to structure a market that
rewards productive entrepreneurial ability that correctly identifies and responds to
the needs of the marketplace.

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