

The book is an accessible guide to a fascinating industry, civil aircraft manufacturing. Entering the industry is challenging which makes its study an excellent way to learn about operating at the technological frontier.

**Entering the Civil Aircraft Industry:
Business Realities at the Technological Frontier**

By Dean C Roberts PhD


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ENTERING THE CIVIL AIRCRAFT INDUSTRY

**BUSINESS REALITIES
AT THE TECHNOLOGICAL FRONTIER**



DEAN C ROBERTS PHD

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1.

Introduction

This book is an accessible guide to one of the world's most fascinating industries, civil aircraft manufacturing. The industry is fascinating because it has so many facets. These facets make its study an excellent way to learn about globalized industries operating at the technological frontier.

The book is designed to be easily read in three or four sessions, so it is short by design. Why short? The intent is for it to be read! Realistically and pragmatically, thick books tend not to be read. That is the track record. Because this subject area is fascinating, I have tried hard to make the book as readable as possible. I am keen to introduce the industry to others, so I hope it will be read from cover to cover.

Civil aircraft are extremely complex machines. One of the challenges for a new entrant to the industry is that they will have to operate at the technological barrier to be competitive with the incumbents. Another challenge is in managing the large level of capital investment, establishing sophisticated production facilities, creating supply chains, and deploying a global service support network. Further challenges are presented by geopolitical aspects of and pervasive role of government intervention in the industry.

Most countries aspire to have a civil aircraft industry. They see having such an industry as the next step up the value chain of products. What they fail to realize is that this transition is not easy to navigate. There are step changes between undertaking low-level manufacturing tasks and putting together an aircraft that will be certifiable for use by fare-paying passengers.

This book is aimed at businesspeople with an interest in aerospace but also generally interested in high technology and business strategy. There are many lessons to be learned from looking at various aspects of the civil aircraft manufacturing industry. To illustrate this, the book will touch on many case studies as we explore the business and its complexity and dynamics.

In addition to businesspeople, the book is aimed squarely toward business and engineering students, as I am an engineer and a businessperson. Often, the communities of business and engineering find it hard to interact and to communicate. Here, I aim to expand each specialist's worldview by looking at civil aircraft from both engineering and business perspectives, blending the two aspects into one view of the industry.

Much can be learned from the civil aircraft industry and applied to other high-technology sectors. The civil aircraft industry operates at the technological leading edge and has high government involvement. If you can understand aspects of civil aircraft manufacturing, you can therefore examine many other industries with the same set of tools and analytical frameworks.

Another potential audience for this book is people engaged in government policy. Admittedly, this book is not meant to be a deep treatise on industrial policy, and there are many works available from various sources on industrial policy, but this book addresses the issue from a practitioner's point of view. The idea is to try to take lessons from the industry's successes and failures and draw conclusions for other real-world situations.

The final audience I have in mind is academics. The idea of this book is to stimulate academia's interest in the civil aircraft sector as a way to teach globalization and the development of company strategy. Throughout the book, I provide many references to useful publications, journal articles, and folios that can be helpful in further research about the subject.

At this stage, it is probably worthwhile to define what I mean by civil aircraft manufacturing. Certainly, we are looking at familiar companies like Boeing and Airbus that produce large airliners sold to the world's airlines. These two companies are incumbents. We will be also looking at Embraer of Brazil and Bombardier of Canada, who make regional aircraft. They are also incumbents. In addition, we will be considering aspirant companies from countries such as Russia, Japan, and China and examine the chances of their success or failure.

In scope, we will be covering very specifically the civil jet aircraft business, including fifty seater regional aircraft and larger. This includes,

for example, Bombardier CRJ regional jets, the Airbus A320 family, and the Boeing 777. It does not include turboprop-powered aircraft, business jets, or very small aircraft that readers may observe at their local airports. These latter sectors have separate and different industrial dynamics, and each is worthy of a book in its own right.

This book is about civil jet aircraft industry entry, but this needs to be defined yet further. Industry entry has to be on a global scale and long term, so delivery of an aircraft solely to the manufacturer's domestic customer base does not meet this definition. Neither does the situation in which a manufacturer produces just one aircraft type and does not develop a follow-on product. The threshold defined here is therefore high, and only four industries have achieved entry: the US, Europe, Canada, and Brazil.

Although we will be considering principally the civil aircraft sector, the other area we will explore, where appropriate, is the civil aircraft engine scene, as there are lessons to be learned from this sector that will illuminate the civil aircraft scene. This is because engine companies operate in a parallel dynamic of government involvement, technological challenge, and large-scale investment.

The contents of the book will start, as one would expect, with some foundational concepts that address economic fundamentals. The reader requires grounding in some basic economics subjects as comparative advantage and the theories of entry barriers into industries. Those will be addressed with a light touch from a practitioner's perspective in Chapter 2.

Similarly, in Chapter 3, we will look at some of the theoretical aspects of innovation, innovation compared to invention, and the various industrial policy approaches deployed by governments.

Chapter 4 will address high-technology products and will introduce the notion of complex product systems. Civil aircraft are part of this latter grouping of products. A complex product is a hugely complex machine. It is different from the products that most people interact with in their day-to-day lives, such as cell phones and computers. Complex products are usually sold in low volumes and are characterized by a high level of

technology embodiment and interrelatedness of the various components of the product. Chapter 4 will explain the important subject of complex products, which unfortunately is little researched in the literature but is actually an important part of most developed nations' manufacturing bases.

Readers who feel that they do not need the theoretical aspects may skip foundational chapters 2 and 3, and perhaps even 4, jumping straight into the book at Chapter 5 if their only interest is the specifics of the civil aircraft industry and if they feel they do not need the theoretical aspects.

Chapter 5 will provide an introduction to the basics of the civil aircraft industry. We will review the business model, the various participants of the aircraft industry, and, again, the complexity of civil aircraft. In this chapter, we will start getting closer to discussing the civil aircraft industry itself, rather than the prior chapters, which are more foundational.

Chapter 6 provides a more detailed explanation and exploration of the barriers to entry in the civil aircraft industry. Although the subject is introduced in the foundational chapters of the book, Chapter 6 is much more specific about the civil aircraft industry.

An important exploration of the role of government in civil aircraft manufacturing is included in Chapter 7. The gamut of funding mechanisms and their rationales will be discussed, including capital market failure, industry targeting, and strategic trade theory. Their consideration will set up the analytical framework for thinking about this industry later in the book. Also in Chapter 7 are reviews of several countries and regions, covering why and how they support their civil aircraft industries. The US support mechanism is very different from the European experience, as the Brazilian approach is very different from, say, the Japanese scene.

Chapter 8 considers some additional thoughts on entry barriers. Whereas much of the framework in the earlier chapters is based on largely theoretical ideas about what constitute entry barriers, Chapter 8 introduces some practical real-world entry barriers that are very pertinent for civil aircraft manufacturing. This includes, for example, the consideration of how a country defends itself. For instance, if a US-provided defense umbrella is

over an allied nation, this has implications for the domestic defense industry of that nation. This has a knock-on effect on the domestic civil aircraft industry.

The other aspect we will be discussing in Chapter 8 is the relationships between partnering strategies of new entrants with incumbents and exploring the balance of power between those two entities. We will be considering whether becoming a partner with an incumbent is a worthwhile entry route. It is not as straightforward as one might first anticipate. Chapter 8 explores this fascinating conundrum that such an arrangement can produce.

Chapter 9 performs a review of the incumbents' civil aircraft industries and how they entered the sector. We will look at the US, Europe, Brazil and Canada's industries. We look at how each country/region entered the sector, without going into a deep historical analysis. This analysis is then used to draw lessons later in the book.

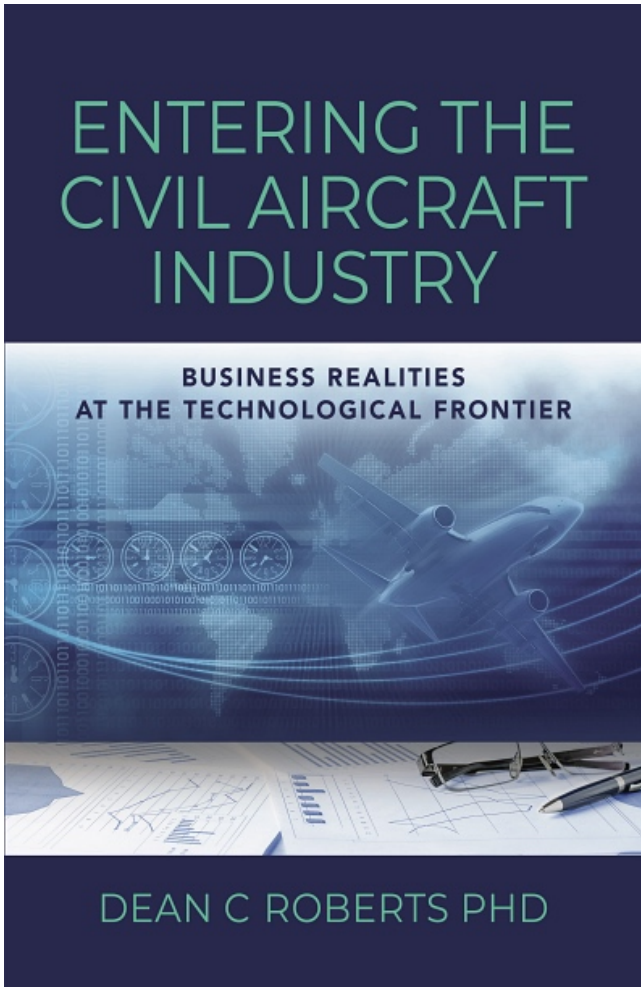
In Chapter 10, I comment on the aspiring nations—Russia, China, and Japan: How are they attempting industry entry? What is the governmental engagement for these nations?

Then, in Chapter 11, I will develop a framework for assessing whether a particular entry strategy is going to be successful. This framework will be based on the foregoing chapters and will look at what has worked and what has failed in the past. Here, I will bring in all the descriptive elements from Chapters 2 through to Chapter 10 and collect the concepts into a coherent framework. This framework can then be deployed to examine other nations with aspirations to enter into the civil aircraft industry and will help us make judgments on whether they will be successful.

Finally, in Chapter 12, we will review the themes of the book and consider the implications. I will consider other aspirant nations coming on the horizon. This is obviously very speculative, because no one knows how the world will evolve, but this is the chapter where the first inklings of their success or failure can be explored.

Chapter Summary

In this first chapter, we have addressed what this book is about, who this book is aimed at, the content of the book, and the approach and the philosophy of the book. The following chapters start with some of the foundational concepts in economics that need to be understood, particularly by students. Here, I will be addressing innovation policy, high-tech and complex product systems, and entry barriers. The book then moves on to the specifics of the civil aircraft industry. Finally, it pulls together a framework that will help us decide whether a particular approach is going to be successful in entering the civil aircraft industry.



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