

Introduction

Just a few words (we promise) about who this book is for and how it is organized.

Reader Profile

The project of which this book is the culmination changed enormously over its two-year life so far. It began as a draft AIAA paper, aimed at an readership of engineers, about our redesign of the propulsion system of an amateur built airplane powered by a buried ducted fan. We soon realized that we were preaching to the converted—retelling fundamental truths to engineers who would already know them well. The people who needed our book were the many intelligent, but often misguided laymen who were working on projects like the one we were re-designing. That readership was going to need more, however, than a mere restatement of fundamental facts and an outline of a design method. They would need something like this book.

The end result of months of cogitation was a reader profile which we hope matches the people most likely to need this book, namely:

- above average intelligence
- a working knowledge of mathematics through high school algebra
- an acquaintance (possibly needing refreshing) with high school level physics
- general aeronautical and aerodynamic knowledge sufficient to pass the US Federal Aeronautics Administration (FAA) written examination for the Private pilot's license.

Organization

Once we had this picture firmly in mind, the outline of the book followed quickly. We had to avoid calculus and vector mathematics in our discussion, hence potential theory as well. That in turn meant that while we could prove our basic physical claims, the more complicated results would have to be presented without derivation.

It also limited and focussed our design method by restricting us to ducted fans and excluding shrouded propellers (those with short-chord shrouds). We had originally thought to include the latter, but the interaction of propeller and short shroud could not be simplified enough to remain within the bounds we had set ourselves. Fortunately, the method we had developed would have worked for nearly every project turned up in our survey; we are therefore confident that we are serving the current mainstream of ducted fan design.

This book is conveniently thought of as being divided into four parts. The first, mainly theoretical, presents basic propulsion physics, ducted fan design theory and design procedures for long ducts and the fans housed within them. Part Two is a survey of existing powerplants which the authors feel have potential for ducted fan applications, along with brief theoretical considerations which should help readers evaluate manufacturers' claims. Also included are surveys of existing ducted fan aircraft and of isolated fan units currently in development. Part 3 is our expanded bibliography and a table of symbols used and their meanings. Part 4 consists of examples of worked duct and fan designs.