The Air Pilot's **Manual**

Volume 4

The Aeroplane - General Knowledge

- Principles of Flight
- Aircraft General
- Flight Planning & Performance

'Recommended reading'
Civil Aviation Authority CAP 804

POOLEY'S
Air Pilot Publishing

Nothing in this manual supersedes any legislation, rules, regulations or procedures contained in any operational document issued by The Stationery Office, the Civil Aviation Authority, the manufacturers of aircraft, engines and systems, or by the operators of aircraft throughout the world. Note that as maps and charts are changed regularly, those extracts reproduced in this book must not be used for flight planning or flight operations.

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Dorothy holds an ATPL (A) and a CPL (H), and is both an instructor and examiner on aeroplanes and an instructor on helicopters. She is Head of Training for a school dedicated to running Flight Instructor courses at Shoreham. She is also a CAA Flight Instructor Examiner. In addition, having qualified as a solicitor in 1982, Dorothy acted for many years as a consultant specialising in aviation and insurance liability issues, and has lectured widely on air law and aviation insurance. This highly unusual combination of qualifications led to her appointment as Honorary Solicitor to the Guild of Air Pilots and Navigators (GAPAN).

Dorothy is a Fellow of the Royal Aeronautical Society, Past Chairman of the GAPAN Instructor Committee of which she was a founding member and the prime instigator of the Guild's Joint Forum with Central Flying School at RAF Cranwell for Senior Flying Instructors. She is a Past Chairman of the Education & Training Committee. After serving as a Warden on the Court of GAPAN for three years, she was appointed Master for the year 2014-2015 of the newly renamed Honourable Company of Air Pilots. She is also Chairman of the Professional Flying Instructors Association.

In 2003 Dorothy was awarded the Jean Lennox Bird Trophy for her contribution to aviation and support of Women in Aviation and the BWPA (British Women Pilots Association). In 2013, Dorothy received the prestigious award of a Master Air Pilots Certificate from GAPAN. In 2015 she was awarded the Brabazon Cup by the BWPA for her outstanding achievement in aviation. A regular contributor to seminars and conferences, Dorothy is the author and editor of a large number of flying training books and has published articles in legal and insurance journals and many in aviation magazines.

Philip Baxter BA (Hons) LLB (Hons)

Philip holds an ATPL (A), is an Instructor and has been a PPL Examiner. He began his working life in the Civil Service, having joined from school, and stayed for more years than he now cares to remember! He worked in a wide variety of (mostly) very interesting jobs, within several Departments, which included one period as Private Secretary to a government Minister, another (reflecting his long-standing interest in aviation matters) dealing with aircraft noise and ICAO 'Annex 16' issues as well as pollution from aircraft engines; and another as a technical author. Much of the remainder of his Civil Service career was related to telecommunications, ranging from international Treaties to technical standardisation. This included representing his departmental interests on Standards Committees in particular, both internationally and domestically. Both his Degrees, the first in Science and Technology, the second in Law (providing an unusual combination) were awarded following part-time study with the Open University. Since 'retiring' early from a senior middle-management grade, Philip worked for six years as a full-time Flight Instructor and Flight Examiner, accruing some three and a half thousand instructional hours. Phil teaches ground school subjects for the Flying Instructor course and has also been Vice Chairman of the Professional Flight Instructors' Association (PFIA).

Acknowledgements

The Civil Aviation Authority; Cessna, Gulfstream American, Lycoming, Piper and Slingsby for technical material; Captain Steve Oddy, Edward Pape, Dan Robertson, Captain R.W.K. Snell, Daljeet Gill, Dane Elliott, Artem and the many other instructors and students whose comments have helped to improve this manual.

A Condensed History of the Air Pilot Manuals

For over 25 years the Air Pilot Manuals have led the academic training of pilots in the United Kingdom and in many countries around the world.

I first met Trevor Thom, a professional pilot and natural teacher, in Melbourne during a visit to Australia in January 1985. He already had his series of PPL Manuals for the Australian market and I asked him to produce a series for the New Zealand market where we had a small aviation business. Having completed this task, Trevor immediately began writing the first of the Air Pilot Manuals for the United Kingdom market and this project began in earnest on 5th December 1985.

Both Trevor Thom and Robert Johnson commenced the task in my office at Feldon. By the end of the following year, all four volumes were complete and were published in February 1987. At that time, we estimated that 95% of all the UK Flying Schools were using our manuals. Volumes 5, 6 and 7 followed, so completing the full series.

Unfortunately, Trevor Thom had a serious accident at home which prevented him from continuing with the editing of the manuals. His rights were eventually sold to David Robson, another experienced pilot and natural teacher, who progressively improved the drawings and brought colour into the manuals for the first time.

Over the years there have been many assistant editors, in particular Peter Godwin, whose help I first asked for in the very early days with Trevor Thom and which continued until quite recently. The rights in the Air Pilot Manuals are now vested with the Pooley family and they continue to be edited and published from our offices and the school at Shoreham Airport.

The Air Pilot Manuals have an outstanding reputation for accuracy and are continuously updated. They are recommended CAA reading material and are referred to extensively in the CAA examination answer booklet.

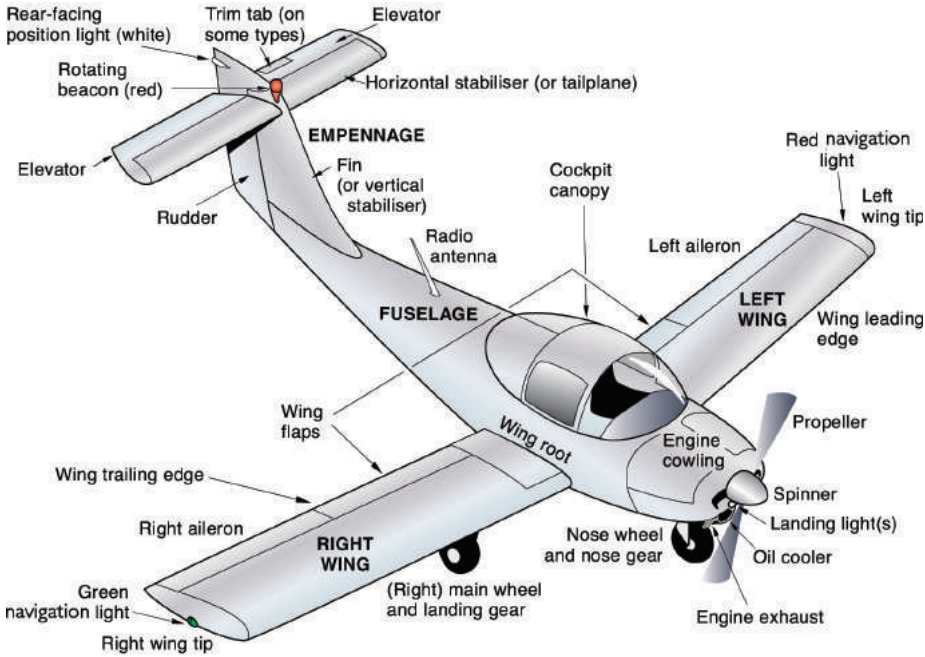
Robert Pooley
CStJ FRIN FRAeS

Introduction

An aeroplane is a man-made device designed to use natural forces to enable motion through the air, or to enable *flight*.

Air is that mixture of gases which surrounds the earth. If even the slightest pressure is applied to air, it will flow and change its shape as long as it remains 'free' or unconstrained. Hence it may be classified as a fluid.

The study of the motion of any 'thing' (often called 'a body' by scientists, engineers and applied mathematicians in particular) or the flow of air past it is described as 'aerodynamics'. Thus, aerodynamics describes the motion of an aeroplane through the air; and this subject forms a significant part of the principles of flight.



A modern training aeroplane

To control an aeroplane safely and to make correct decisions during the course of a flight, a pilot must understand the principles of flight. When in flight no pilot has time to analyse in detail the effect of everything that he or she does, or is about to do, or fails to do, but all pilots should be aware of what their

aircraft are doing, and why, as well as what is happening as a consequence of their action or inaction.

The purpose of *The Air Pilot's Manual* is to give you the understanding and knowledge both to be a safe and competent pilot, and to pass the exams. These books will remain a useful reference throughout your flying career.

To be a good pilot you must have a sound understanding of the principles of flight, the operation of aircraft, and the performance capabilities of the particular aircraft types that you fly.

Aircraft General Knowledge, Principles of Flight, Flight Performance and Planning Exams

This volume is designed to prepare you for the EASA Part-FCL Private Pilot's Licence (Aeroplanes) EASA Light Aircraft Pilots Licence (Aeroplanes) and the National Private Pilot Licence (NPPL) Examinations in Aircraft General Knowledge, Principles of Flight, and Flight Performance and Planning. You take these exams at your flight training organisation. This text on Aircraft General Knowledge comprises four sections:

1. **Principles of Flight.**
2. **Airframe, Engines and Systems.**
3. **Flight Instruments.**
4. **Airworthiness and Flight Performance and Planning.**

Section One covers Principles of Flight for which there is one examination. Sections Two and Three cover the topics contained in the examination entitled Aircraft General Knowledge. Section Four covers most of the topics contained in the examination entitled Flight Performance and Planning, but the examination also includes some topics covered in Vol. 3, *Navigation,* particularly *Section Two - Flight Planning.*

EMERGENCIES. It is required that you be familiar with the general procedures for handling basic aircraft emergencies on the ground and in the air. These are covered in the relevant chapters in this volume (15, 16 & 17) as well as in the first chapter of Vol. 1, *Flying Training*. Fire extinguishers and their use are covered in the *Safety, First Aid and Survival* section of Vol. 6.

GENERAL AVIATION SAFETY SENSE. A series of CAA *General Aviation Safety Sense* leaflets is available covering various important subjects, such as use of Mogas, aeroplane performance, weight and balance, and piston engine icing.

These leaflets are also available to download from the CAA website:

www.caa.co.uk, then type in 'safety sense leaflets' in the search option.

Information contained in these leaflets is sometimes used for PPL exam questions.

AIRCRAFT TYPE. An appendix at the end of this volume contains information designed to prepare you for the ground examination: Aircraft Type. This exam is normally conducted orally by the flight examiner who conducts the PPL Skill Test and is confined to the type of aeroplane in which your flying skills will have been tested, usually immediately after that test has been completed.

Exercises

Exercises and answers for all the chapters in this book are at the end of each chapter.

Section One

Principles of Flight