

The Air Pilot's **Manual**

## **Volume 3**

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# **Air Navigation**

*'Recommended reading'*

*Civil Aviation Authority*



**POOLEY'S**  
Air Pilot Publishing

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## **Volume 3**

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Section Four covers the en-route navigation requirements of the Part-FCL syllabus. Refer to the notes on page 278. Section Four will not apply to the UK National PPL training syllabus nor to the LAPL syllabus.

## **Section Four – En-Route Navigation with Radio**

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Steve won an ATC Flying Scholarship and made his first solo flight at Ipswich Airport, moving on to join the Stapleford Flying Club as a PPL. He was a member of the Bristol University Air Squadron and trained on Bulldogs at Filton and RAF St Mawgan whilst at the University of Bath. Steve acted for many years both as a university lecturer and industrial scientist, publishing patents and articles in scientific journals. He is a regular contributor to scientific conferences, seminars and executive education workshops and is a visiting professor at the University of Bath and the University of Greenwich. After retiring from an industrial career, he started flying with TG Aviation at Manston and obtained a CPL(A) from the London Metropolitan University and the Sussex Flight Centre at Shoreham.

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### ***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. By the end of that year, 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 Flying Instructor 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.

# Introduction

Volume 3 of *The Air Pilot's Manual – Air Navigation* – presents this important area of training for the Private Pilot's Licence in a logical sequence of theory, preparation and performance.

## **The Cockpit is a Difficult Environment in which to Learn**

As with the other volumes of *The Air Pilot's Manual*, in *Air Navigation* we have avoided the presentation of 'facts only'. A thorough understanding of the principles will enable you to gain maximum benefit from your actual navigation exercise flights.

This approach will enable you to become a competent pilot/navigator and will also help to minimise your flight training hours. (It does, however, mean that our book is a little longer than it could be if the aim was only to cram in facts without a reasonable understanding.)

*Understanding makes  
for remembering.*

In determining the order in which the information is presented, care has been taken to keep things as logical and practical as possible.

## **Operational Decisions**

Navigation of an aeroplane consists mainly of making common sense operational decisions. These decisions are based on knowledge and experience. Very few are difficult to make – most being logical and simple – but occasionally there are difficult decisions (both on the ground and in flight) to be made. These are the ones for which we must prepare for.

We have adopted a professional approach right from the start, whether your ultimate aim is to be a private pilot or to go on and make aviation your career.

Operational decisions will often have to be taken well away from your home base, and to a large extent you will be on your own. They fall into two categories:

- those made on the ground during pre-flight planning; and
- in-flight operational decisions.

Many decisions are so simple and 'second nature' that you don't realise you are making them. Others require a calm, cool but quick assessment, followed by a decision and action. Proceeding into an area of poor visibility could fall into this category.

The aeroplane will not stand still while you decide what to do in difficult in-flight situations. You cannot just pull over to the side of the road and study your maps. Good pre-flight planning, with many operational decisions taken on the ground – and alternative

courses of action considered in the event of in-flight problems occurring – takes a lot of pressure off the pilot/navigator.

### **The Navigation Computer**

As a pilot/navigator you will become adept at estimating angles, distances, time intervals, fuel consumption, and so on. The art of estimating is an important skill to develop. It is also important that you can calculate these various quantities easily and accurately. To achieve this you will use a navigation computer. It is a simple device (looks complicated but isn't) that allows us to carry out almost every navigation calculation with speed and accuracy.

Electronic navigation computers are available, but we suggest you steer away from them, at least initially, because they do not encourage the pilot/navigator to visualise each situation – an important ability to develop. Once you are adept at the various computing problems involved in air navigation, you might decide to 'go electronic'. Beware of becoming over-reliant on electronic computers because you are not permitted to use them in the examination.

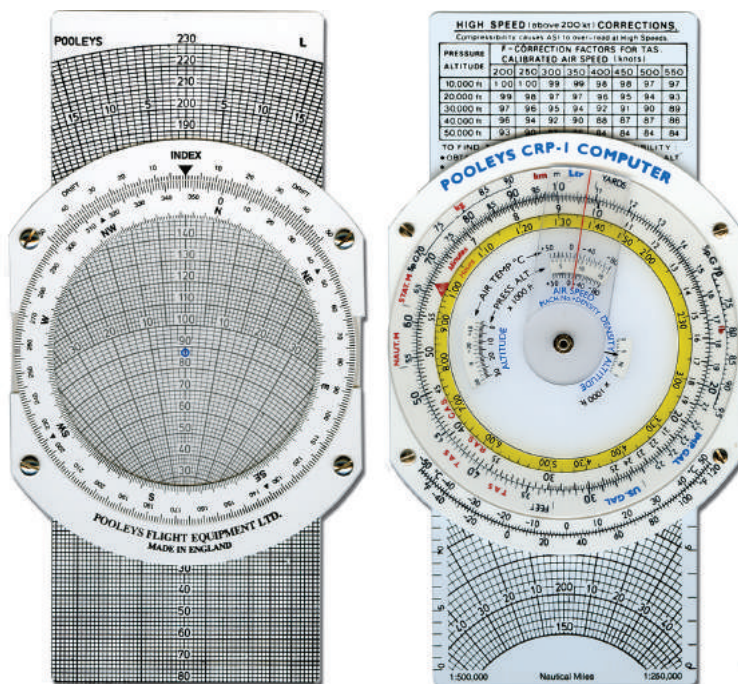
The basic concept of the slide navigation computer dates back to early navigation days. The modern version is an essential piece of equipment for a pilot/navigator.

The slide navigation computer has two sides:

- a **wind side**, which enables solution of *triangle of velocities* problems for flight-planning and en route navigation; and
- a **calculator side** (the main component of which is a circular slide-rule on the outer scales), used to perform the simple arithmetical calculations involved in flight operations, e.g. distance, speed and time; conversion of units; fuel quantities and consumption; true airspeed.

Two chapters in the first section describe using the navigation computer – one chapter for each side. Although it may appear a little complicated at first, working through the examples and illustrations we have set out will make using the computer logical and simple.





### ■ The wind and calculator sides of a navigation computer

#### **The Theory Examination**

Navigation is part of one of the theory examinations for the UK Private Pilot's Licence (PPL), which you will sit at your flying school. Prior to this you should be achieving considerable success in completing questions at the end of most of the chapters. In this volume some chapters have exercises interspersed through the text to give you practice on a particular aspect of the chapter before moving on.

The Exercises form an important part of the course and we recommend that you work through them carefully.

This manual is more than just a text to allow you to pass the examination, though this is one of its aims. It is designed to remain as a reference text on your shelf for as long as you fly.

#### **The En route Navigation Section (PPL Skill Test)**

This is the province of your flying instructor. The test is carried out at the completion of your flying training and is part of the PPL Skill Test (although with the agreement of your examiner it may be flown as a separate section.) It is designed to assess your ability as a pilot/navigator. This manual, and your navigation cross-country training, will prepare you fully for the Navigation element of the PPL Skill Test.

### **Private Pilot Licences**

This edition covers the material contained in the NPPL training syllabus as well as that required by the European Part-FCL and Light Aircraft Pilot Licence (LAPL) syllabus. Students should follow one syllabus only. Section Four of this manual is only required for the Part-FCL Licence, not for the NPPL or LAPL, although the theoretical knowledge examination may include some of this material for any of the licences.

### **Operational Information**

For safe flight operations it is essential that all pilots refer to current operational information. This basically involves using latest issues of aeronautical charts, and amended flight information publications, circulars and NOTAM (Notices to Airmen).

In the UK, the primary source of operational information is the UK Aeronautical Information Publication (AIP), a large, frequently amended manual produced to an international standard by the Civil Aviation Authority. Your flying school and Air Traffic Services (ATS) units should have amended copies of the UK AIP available for reference, although these days they are often available on a CD rom, or directly on the internet from the AIS website: [www.ais.org.uk](http://www.ais.org.uk). As the AIP is a formidable and bulky set of documents for a PPL holder (because the majority covers airline-type instrument flight procedures), there is also available a conveniently sized publication known as *Pooley's Flight Guide*, which is revised regularly. You will find references to both *Pooley's Flight Guide* and the UK AIP throughout *The Air Pilot's Manual*. Note that these references are no substitute for referring to current, amended documents. If you are ever in any doubt about operational information, in *Pooley's Flight Guide* or the UK AIP, refer to an amended copy of the AIP and current air legislation documents; and **always** check the latest AIRACs (which detail AIP updates), AIP Supplements and Aeronautical Information Circulars (AICs) and NOTAM prior to flight.

**NOTE** There are many examples of extracts of tables from the AIP and other sources and excerpts from aeronautical charts and their legends in this manual. It is not always practical to replace these illustrations every time the source document becomes out of date, so please be aware that information contained in these table and charts is not necessarily current. The tables or charts illustrate a particular point in the text for which their insertion into this manual is relevant.

Section **One**

# **Basic Navigation Theory**

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