



The Pilot's Manual

PM 3

# Instrument Flying

All the aeronautical knowledge required to pass the FAA exams,  
IFR checkride, and operate as an Instrument-Rated pilot

*Sixth Edition*



Foreword by **Barry Schiff**

## **The Pilot's Manual 3: Instrument Flying**

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# Introduction to Instrument Flight

# 1

Air travel becomes much more reliable when airplane operations are not restricted by poor weather or by darkness. Greater reliability can be achieved with a suitably equipped airplane and a pilot skilled in instrument flying.

The instrument-qualified pilot and the instrument-equipped airplane must be able to cope with flying in restricted visibility, such as in cloud, mist, smog, rain, snow, or at night, all of which may make the natural horizon and ground features difficult, or even impossible, to see.

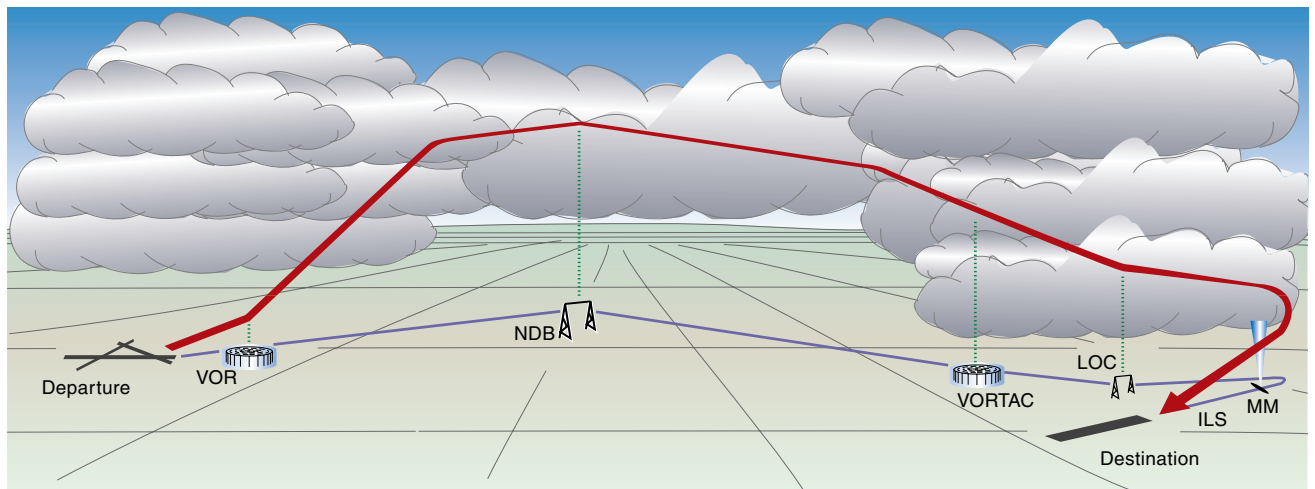
As an instrument pilot, you must learn to trust what you see on the instruments. We generally use vision to orient ourselves with our surroundings, supported by other gravity-perceiving bodily senses, such as feel and balance. Even with the eyes closed, however, we can usually manage to sit, stand and walk on steady ground without losing control. This becomes much more difficult standing on the tray of an accelerating or turning truck, or even in an accelerating elevator.

In an airplane, which can accelerate in three dimensions, the task becomes almost impossible unless you have the use of your eyes.

The eyes must gather information from the external ground features, including the horizon; or, in poor visibility, they gather substitute information from the instruments.



**Figure 1-1**  
Control and performance.



**Figure 1-2** A typical flight on instruments.



**Figure 1-3**  
The eyes and  
the instruments.

A pilot's eyes are very important, and the starting point in your instrument training will be learning to use your eyes to derive information from the instruments in the most efficient way. You will learn various scan patterns that gather the most relevant data for your particular flight maneuver. You will learn the three skills fundamental to instrument flight. These include how to scan the instruments (or, the instrument cross-check), understand their message (instrument interpretation), and be able to direct the airplane along the desired flight path in *instrument meteorological conditions* (IMC) (i.e., airplane control).

## The Cockpit and Radio

### Make Yourself Comfortable in the Cockpit

Instrument flying is much easier if you are comfortable in the cockpit and know your airplane well. Adjust the seat position prior to flight to ensure that you can reach all of the controls easily, and so that you have the correct eye position. The view from the cockpit window must be familiar when you break out of the clouds at a low altitude, following a successful instrument approach, and see the rapidly approaching runway. A correct eye position will make the ensuing landing, possibly in poor visibility, so much easier.

### A Good Communications System Is Essential

Ensure that the radio communications equipment in the airplane is both adequate and fully serviceable. This is of great importance. One of your main responsibilities as an instrument pilot is to remain in communication with ATC. Under IMC, you will not be able to see other aircraft, nor will they be able to see you, hence the visual safety rule of “see and be seen” will not apply.

*In instrument meteorological conditions (IMC), “see and be seen” does not apply. Communications equipment is essential.*

The separation of aircraft in IMC is achieved by each pilot flying along a known route at a known altitude at known times, with ATC, in cooperation with the pilots, ensuring that there are no conflicting flight paths. Good communications are therefore essential. On the rare occasions when a radio or electrical system fails, special procedures outlined in the regulation (14 CFR 91.185) will minimize risk.

During your instrument training, there will be a fair amount of talking in the cockpit. Your instructor will be explaining things to you, and offering words of encouragement as you perform the various maneuvers.

If this cockpit communication has to be done by shouting over the engine and air noise, as it was in days past, then a lot of totally unnecessary stress will be introduced into the cockpit. A good intercom system will make life a lot easier for you and for your instructor, and will save you time and money. Speak with your instructor about this.

# Attitude Flying and Applied Instrument Flying

The first step in becoming an instrument pilot is to become competent at *attitude flying* on the full panel containing the six basic flight instruments. The term attitude flying means using a combination of engine power and airplane attitude to achieve the required performance in terms of flight path and airspeed.

Attitude flying on instruments is an extension of visual flying, with your attention gradually shifting from external visual cues to the instrument indications in the cockpit, until you are able to fly accurately on instruments alone.

*Partial panel* attitude instrument flying, also known as limited panel, will be introduced fairly early in your training. For this exercise, the main control instrument, the attitude indicator, is assumed to have malfunctioned and is not available for use. The heading indicator, often powered from the same source as the AI, may also be unavailable.

Partial panel training will probably be practiced concurrently with full panel training, so that the exercise does not assume an importance out of proportion to its difficulty. You will perform the same basic flight maneuvers, but on a reduced number of instruments. The partial panel exercise will increase your instrument flying competence, as well as your confidence.

An excessively high or low nose attitude, or an extreme bank angle, is known as an *unusual attitude*. Unusual attitudes should never occur inadvertently but can result from distractions or a visual illusion. Practice in recovering from them, however, will increase both your confidence and your overall proficiency. This exercise will be practiced on both a full panel and a partial panel.

After you have achieved a satisfactory standard in attitude flying, on both a full panel and a partial panel, your instrument flying skills will be applied to en route flights using navigation aids (NAVAIDs) and radar.

*Attitude flying on instruments is an extension of visual flying.*



**Figure 1-4** The full panel (left) and the partial panel (right).

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Pass the FAA exams, IFR checkride, and operate as an Instrument-Rated pilot.

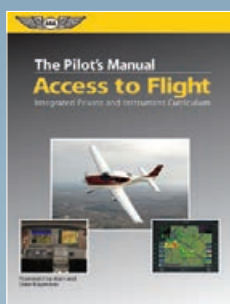
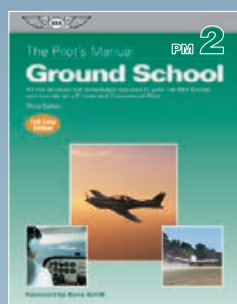
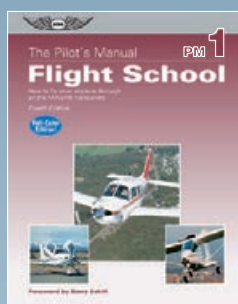
Whether you fly for pleasure, business, or are seeking a career in aviation, the Instrument Rating is your ticket into the full spectrum of the airspace system and the key to maximizing the functionality of your pilot certificate. This book provides everything you need to know to safely fly under Instrument Flight Rules (IFR) and in Instrument Meteorological Conditions (IMC).

*Instrument Flying* covers all the needed aeronautical knowledge and skill, from basic attitude flying to navigation and meteorology, to the actual IFR maneuvers flown in the air. You will master the preflight preparations required for instrument flight before learning IFR departure, en route, terminal and approach procedures. Both conventional "steam gauge" and glass cockpit instruments are covered.

Hundreds of **full-color illustrations** simplify even those procedures perceived to be complicated: holding patterns, intercepting and tracking, flying an approach with crosswinds. Thorough review sections at the end of each chapter hone your knowledge. Helpful notes in the margins provide quick definitions of terms, further emphasis on key points, or explanation of mnemonic devices.

## The Pilot's Manual Series

The success of *The Pilot's Manual* textbook series lies in its remarkable Editorial Team, which includes airline, military and professional pilots, flight instructors, university professors, FAA representatives, meteorologists, members of industry organizations, and designated examiners. The writing is clear, concise, and provides comprehensive information on the practical aspects of flying. Each book has more than 500 pages and at least as many original illustrations and charts.



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