Rod Machado's Private Pilot Handbook

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Published by The Aviation Speakers Bureau

Copyright Information

Third eEdition Published
April 15, 2020

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Published by: The Aviation Speakers Bureau,
P.O. Box 6030, San Clemente, CA 92674-6030

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Front cover artwork by Sam Lyons
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Chapter One

Airplane Components:

Getting to Know Your Airplane

Let me take you on a short tour of a few typical general aviation airplanes. (*General aviation* is the term often used for "private" flying.) I want you to become familiar with the basic parts of these airplanes, and the common terminology you're likely to encounter at the airport and in the cockpit.

Before starting the tour, let me say that while almost everything I'll point out can be found on almost every airplane you're likely to fly, there are always exceptions. Be flexible (the wings are).

Airplanes are like people (sort of). They come in all sizes, shapes, and colors. But looks really can be deceiving. Airplanes are more similar than they are different (Figure 1). We'll examine several varieties in this chapter.

Think of an airplane as a cigar with two Hershey bars on the sides, a propeller beanie cap on the front, and a tail at the back and you'll have the general picture. The rest of this is just details.

In the Beginning

Let's begin at the beginning, with the *propeller*. Most general aviation airplanes have propellers of some shape or form (Figure 2). When spun by the engine, the propeller produces thrust, which propels (as in propeller) the airplane forward. Atop the prop sits the spinner, a generally cone-shaped piece of metal which deflects air slightly, encouraging it to enter the engine cowling where it helps cool the engine. Engines are by nature hotheads, and most airplane

AIRPLANES ARE MORE ALIKE THAN DIFFERENT.

Fig. 1

AIRPLANE PROPELLERS

Fig. 2

Airplanes have propellers of some shape or form, and some, such as the Adam A500 on the right, have a pusher and a puller propeller configuration.

A RETRACTABLE GEAR AIRPLANE

Retractable gear mean less drag (when retracted) and allows the airplane to attain higher speeds for a given amount of power.

Though it may do a good turn for you on the ground, once airborne the airplane's nose gear extends fully and locks in a centered position, something like an army private standing at attention during inspection. Step on the rudder pedal in flight (top or bottom) and you will move the rudder, at the rear of the plane. The nose gear knows it's not needed now. The strut compresses on landing, and the nose gear is once again free to turn, turn, turn.

Some airplanes don't have a rudder-controlled nose gear assembly (see, I told you there were exceptions). Instead, they have a castering (swiveling type) nose gear as shown in Figure 5. Applying either the right or left main gear brake (gently, please) sets the plane to pivoting about one of its main wheels, turning it the way Nureyev would turn a ballerina. Once airborne, aerodynamic pressure centers the castering nose gear.

The other two feet on an airplane are the *main gear*. These are either fixed ("down and welded" in pilotspeak), or retractable. A fixed gear causes drag in flight, which slows an airplane, but it's simple, reliable, inexpensive to maintain, and is always there when you need it. A retractable gear plane (Figure 6) is more efficient because the gear is tucked up, reducing drag and allowing it to fly faster for a given amount of power. The pilot, however, is responsible for remembering to put the gear back down again before landing. Forget to put it down and the gear will *not* be there when you need it. This is very hard on the underside of the airplane, the runway, the passengers, and your pocketbook. Retractable gear also need more maintenance. This can be expensive over the long haul.

Wing a Ding

While you're crawling around down there, look up. The large things casting a big shadow are the *wings*. These are generally considered important because they make the airplane fly. We'll talk a lot more about wings in the next chapter; for now, it's enough to know that there should be two of them (one on each side of the plane, preferably).

Under each wing on most airplanes is a *fuel tank sump drain* (Figure 7). Water and gunk of various sorts can invade the fuel system, and it must be drained before flight. (Water and gunk are put in the fuel by fuel fairies, trolls, and other things mere mortals can't see.) Using a fuel strainer (Figure 8), you drain a little fuel from each sump or drain site and examine what comes out for the presence of anything that shouldn't be there.

THE UNDER-WING FUEL TANK SUMP DRAIN

Under the wing is a fuel tank sump drain. Since airplane engines don't seem to run very well on impurities, the sumps should be drained before every flight and after every fueling.

FUEL CONTAMINATED WITH WATER

Clear plastic fuel strainers are common equipment in a pilot's flight bag. These allow you to sample the fuel and look for contaminants.

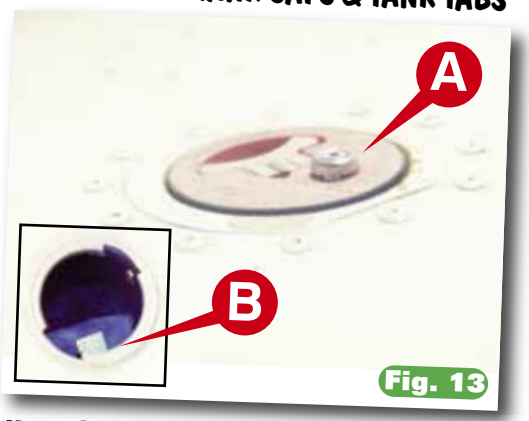
A SUCTION-TYPE STALL WARNING DEVICE

A suction-type stall warning device located on the wing's leading edge provides an audible warning to the pilot when a stall is near.

AN ELECTRIC STALL WARNING DEVICE

An electric stall warning device provides the pilot with a similar stall warning by connecting two small metal tabs and activating a cockpit buzzer.

VENTED FUEL TANK CAPS & TANK TABS



Vented fuel caps (position A) allow air to enter the tank and replace the fuel consumed by the engine. A marking tab (position B) inside the tank used to visually indicate the fuel level.

FUEL TANK VENT LINE

Some airplanes have tank vent lines which also allows airflow into the fuel tanks. A tank filled to the brim may need to purge some of its fuel through this line as the air in the tank expands.

will sometimes see a marking tab, used to visually calibrate the tank's fuel quantity. Some caps are vented—they have an opening for air to enter and exit. If the tank were tightly sealed, as fuel was used in flight a vacuum would form in the tank, and eventually fuel flow would be restricted or might even stop. Not good. Instead of vented caps, some airplanes allow air into or out of the tank via tank vent lines (Figure 14).

"Instead of our drab slogging forth and back to the fishing boats, there's a reason to life! We can lift ourselves out of ignorance, we can find ourselves as creatures of excellence and intelligence and skill. We can be free! We can learn to fly!"

Richard Bach, Jonathan Livingston Seagull

ENGINE ACCESS

We often check the engine's oil quantity just like we do in a car—with a dipstick.

On some airplanes, you pull on the quick drain lever for a fuel sample (watch your shoes!).

Some airplanes have a different version of the fuel strainer located on the side of the cowling.

Antenna Farm Deluxe

Airplanes, like police cruisers, are virtual antenna farms. Atop the tail you will probably see two *VOR antennas* (Figure 22). VOR stands for very high frequency omnidirectional range, a navigation system that depends on receiving signals from ground stations. A variety of other antennas, usually mounted on top of the fuselage, permit communication with controllers on the ground and with other aircraft. More on antennas later.

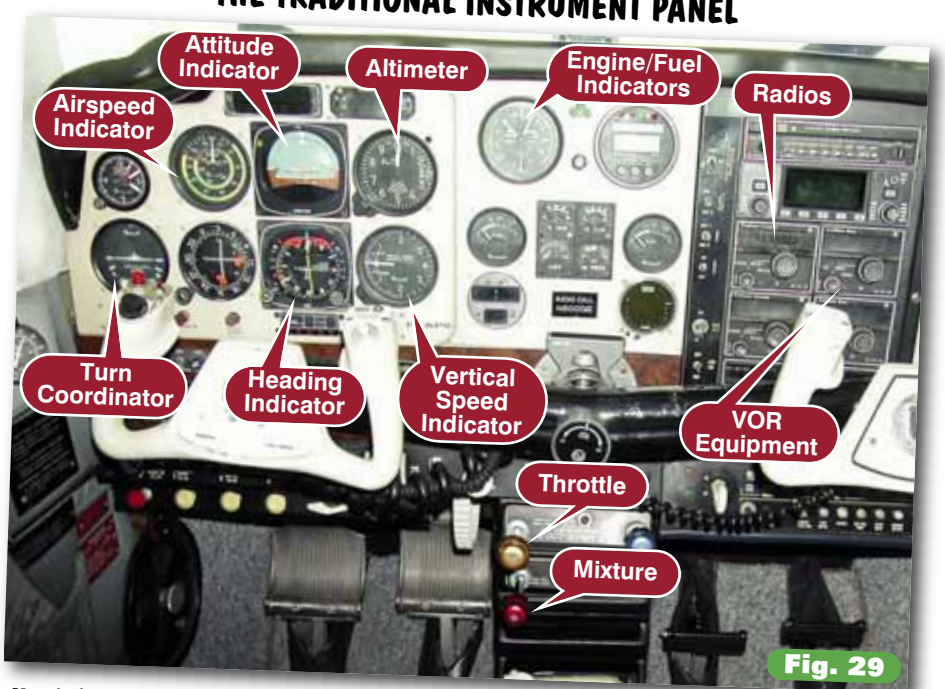
Back Up Front

Let's get back to where we began—the front of the airplane, where you will find (I hope) the *engine cowling* (Figure 23). Some airplanes have engine cowlings that can be easily opened for inspection before every flight (Figure 24). Unfortunately, many modern general aviation airplanes have only a small pop-open door (Figure 25) through which you try to peer to see if everything under the hood is good. The experience is something like looking inside a Coke can through the pop top in the dark. It's through this door that you generally check for adequate engine oil (using a dipstick much like that of a car, as shown in Figure 26), and drain a sample of fuel from the lowest engine point to check for contamination before taking to the air (Figure 27).

Checking the fuel is a simple procedure. You pull on the lever in Figure 27 which activates a *quick drain valve*. Fuel drains onto the asphalt although you should try to capture it in a sampling container. This makes it easier to detect the presence of water. Some airplanes have a different version of a fuel strainer, as shown in Figure 28. These airplanes allow the sampling of the fuel strainer's contents by a valve located on the outside of the cowling. Most small general aviation airplanes have three drain valves (one for each of the two fuel tanks, and one for the fuel strainer) while more complex craft have five or more drains.

Entering the cockpit (a.k.a. "the front office") you will see a wide (actually, bewildering) array of instrumentation as shown in Figure 29. These instruments are often known as *analog* flight instruments

THE TRADITIONAL INSTRUMENT PANEL



No, it isn't the Space Shuttle, even though it seems to have as many dials, switches, knobs and lights. Soon they'll all become very familiar to you.

THE LATEST GLASS COCKPIT PANEL

Fig. 30

The primary flight display uses solid state technology to generate its flight instruments. These instruments are similar to those found in the traditional analog-instrument equipped airplane. Nevertheless, the essential analog instruments (airspeed indicator, attitude indicator, magnetic compass and altimeter) are still found in many glass cockpit airplanes. The multi-function display provides computer generated engine instruments, checklists, weather information as well as GPS-generated information in the form of a moving map, terrain information, essential airspace information and much more.

because they are mechanical in nature. On the other hand, glass cockpit technology is often found in the newest technically advanced general aviation airplane cockpit as shown in Figure 30 and 31. (Read more about primary flight displays in Postflight Briefing #5-2 on page E36.) Each instrument or item has a specific name and serves an important purpose (this includes the plastic cup holders, if your airplane is so equipped). Before long you will become intimately familiar with each item. It may look overwhelming at first, but within a few hours of starting to fly you will be right at home with all these tools of the trade. Then you can bring your friends out and dazzle them with your knowledge. This is part of the thrill of aviation.

Now that we've become somewhat familiar with the airplane and its components, it's time to take a look at what makes an airplane fly. The science of aerodynamics is fundamental to the safe operation of any airplane. Since safe operation is really the only kind that makes a whole lot of sense when you're talking about airplanes, let's find out what's keeping you up in the air.

PRIMARY FLIGHT DISPLAY INSTRUMENTS

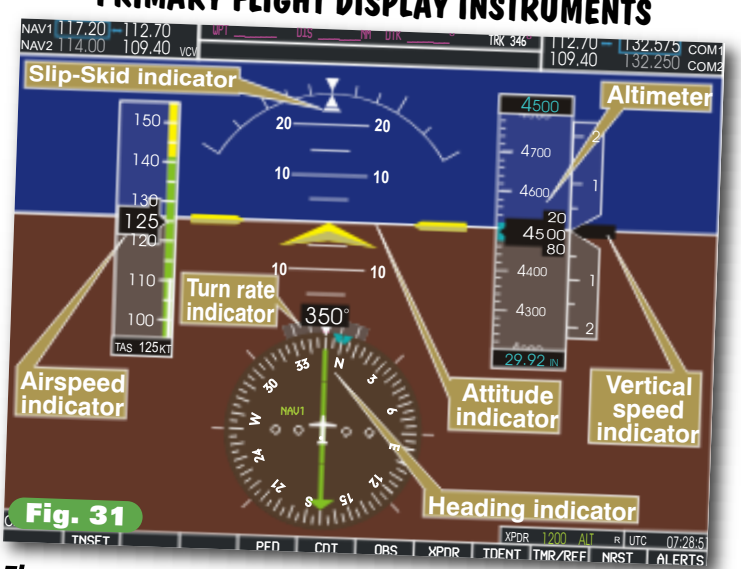


Fig. 31

The newest primary flight displays (PFDs) provide the same instrumentation as analog instruments. The main difference is in how these instruments are interpreted.