Update to

The Complete Advanced Pilot

Fourth Edition
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This update makes *The Complete Advanced Pilot*, Fourth Edition, current for all regulatory and procedural changes effective February 2010. Each entry below signals a change or addition to the text, as listed as follows:

Page Number, Location on Page, Instructions:
Description of change or new text as appropriate.

Page 1-3, right column, change the first sentence of the "Note" to read:

Glass cockpit airspeed indicators (and altimeters, Page 1-5) take their inputs from air data computers, and their displays are vertical tapes and digital readouts, not needles.

Page 1-9, left column, add new paragraph to the end of the "Gyroscopic Instruments" section:

Solid-state devices, which use the Attitude Heading Reference System (AHRS), are subject to the same errors as mechanical devices, but the forces involved are so small, and errors are so easily detected and corrected, that for practical purposes pilots can ignore precession — except when taking FAA knowledge exams.

Page 1-18, right column, change the first sentence in the top paragraph to read:

The illustration shows how the command bars tell you to enter a descending left turn (top) or a climbing right turn (bottom). By flying the delta into the vee of the command bars you establish the correct pitch and bank to accomplish the desired maneuver.

Page 2-5, right column, change the second paragraph under "Glass Cockpit Scan" to read:

The scanning techniques I describe are valid for panels such as Figure 2-6, the venerable six-pack. Digital displays are much easier to scan. If you look at the panel on Appendix Page B-1, which is typical, you will note that the bank instruments — the banking scale, the heading indicator, and the attitude indicator — can be scanned top-to-bottom, while the pitch instruments — airspeed indicator, vertical speed indicator, altimeter, and again, the attitude indicator — can be read from left to right.

Page 2-21, left column, insert new paragraph after the top paragraph (before the paragraph that begins "The designer gains…"):

This is a good place to point out that when you took your private pilot checkride, the PTS required that you demonstrate recovery "after the stall occurs," but the commercial checkride standard asks for recovery "as the stall occurs." A fine distinction but an important one. "As the stall occurs" is usually interpreted to mean at the first aerodynamic indication of a stall, such as the onset of stall buffet. As you progress through the certificates to the ATP, required stall recognition gets earlier and earlier — because as you move up into more sophisticated

and aerodynamically cleaner airplanes you don't want to even get close to a stall. This thinking is emphasized when you get into jets, where the control yoke will be pulled right out of your hands if you don't relax back pressure.

Page 4-1, left column, insert new paragraph to follow the second paragraph:

To become fully prepared for electronic navigation, read the *Advanced Avionics Handbook* (FAA-H-8083-6), available for download at **www.faa.gov** and at any pilot supply store. I recommend the book because the file size is quite large.

Page 4-1, bottom left column, replace the "Note" paragraph with the following:

Note: A Global Positioning System (GPS) with Wide Area Augmentation (WAAS) is approved as a primary means of navigation; no backup is required. You will read more about GPS and WAAS later in this chapter. Knowledge tests for the instrument rating still include questions on VOR and ADF navigation (and many planes do not have GPS of any kind), so I will discuss these systems to prepare you for the FAA tests, if not for actual instrument flight training.

Page 4-14, right column, insert a new section at the bottom of the page:

Time/Distance To Station

It's hard to believe that in this day of distance measuring equipment and the global positioning system the FAA is concerned about how you would determine the time or distance to a navigation facility in the absence of these modern wonders…but it's true that there are some questions on the knowledge test for which I have not prepared you.

Fundamental to the understanding of these solutions is the fact that if you determine how many seconds it takes for a VOR indicator or ADF needle to travel a given number of degrees (ten is convenient), divided by the number of degrees, it equals time to the station in minutes. If you know your ground speed toward the station you can convert this time to distance. It works like this:

Turn perpendicular to a VOR radial (FROM is a given) with the needle centered…start timing. Turn the OBS ten degrees ahead (clockwise if the station is to your right, counterclockwise if it is to your left) and stop timing when the needle re-centers. The number of seconds it took to re-center, divided by ten, is the number of minutes to the station. Knowing your ground speed, you can easily convert this to miles and/or fuel burn.

With an ADF, turn to put the ADF needle directly off one wing…90 degrees relative bearing. Start timing. When the needle has moved ten degrees, stop timing. Use the same calculation to find time to the station. Of course, you could use any number of degrees—just divide the time in seconds by the number of degrees the bearing has changed and you have your answer.

We used a similar method called "doubling the angle on the bow" when I was going to sea in the Coast Guard: If the relative bearing to the station changes from 20 degrees to 40 degrees (for example) in ten minutes while the ship maintains a constant heading, the time to the station is ten minutes. Using this method avoids the time lost in turning perpendicular to the station.

Page 4-15, right column, replace the bottom two paragraphs in the GPS section with the following:

Older GPS units, certificated under Technical Standard Order C129, required that a backup navigation system—this means VOR in real life—was necessary in order to use the unit under instrument flight rules. Many of these units are still in the general aviation fleet. New technology GPS navigators, incorporating the Wide Area Augmentation System (WAAS), are certificated under TSO C146a and require no backup. You must look at the supplement in your Approved Flight Manual (the one with the airplane's tail number on it, not the one for sale at the pilot supply shop) to learn the certification status of the equipment in the airplane you are about to fly. It is also important to realize that all installations are not equal, even if the equipment is the same; each airplane owner decides what options to purchase for the GPS installation, and they do not all agree. Bottom line: Read the manual.

Page 5-12, bottom left column, insert new paragraph to follow item #5 in list:

The NWS issues a Graphic Airmet (G-Airmet) which affords the user a three-hour loop illustrating the hazardous conditions listed above four times daily, at 0855, 1455, 2055, and 0255. Each G-Airmet is valid for twelve hours with a time resolution of no more than three hours.

Page 5-28, top left column, add a new paragraph at the end of "Data Link" section:

Note that this is not real-time weather; there can be a delay of as much as 11 minutes between collection of data and its display in the cockpit. Use this information strategically, to avoid whole areas of bad weather, not tactically to pick your way between suspicious looking echoes.

Page 5-29, left column, add new short paragraph to the end of the "Approach, Are You Painting…" section:

By going to **www.wunderground.com/radar/map.asp** you can access real-time Terminal Doppler Weather Radar returns at 45 airports to get a more detailed controller's-eye view of precipitation returns in the airport vicinity.

Page 5-32, bottom left column, replace the paragraph that starts with "Unless…" with:

The AIM says that "known ice" is "known or observed or detected ice accretion"; actual adhesion, rather than the existence of potential icing conditions, is the determinant. The FAA does not consider the mere presence of clouds or of other forms of visible moisture at temperatures at or below freezing to constitute known icing conditions. Pilots are expected to evaluate all available meteorological information relevant to a proposed flight, including surface temperatures, temperatures aloft, forecasts, and pilot reports. If the composite information indicates to a reasonable and prudent pilot that he or she will be operating in conditions that will cause ice to adhere to the aircraft, then known icing conditions likely exist; if the pilot operates the aircraft contrary to the restrictions in the AFM, the FAA may take enforcement action. It all boils down to what a reasonable and prudent pilot would do in similar circumstances.

Page 7-3, top right column, in the eighth line of the full paragraph, change sentence to read:

WAAS-enabled navigators certificated **under TSO C146a** need no backup equipment.

Page 7-4, left column, under Block 8, insert after the first sentence:

If you will be navigating using GPS, select an initial approach fix at the destination based on the forecast weather. Down the road, if given a choice between the IAF and Vectors, choose the IAF. With some GPS navigators, if you select Vectors most navigators will delete all waypoints between the IAF and the missed approach point…and you might need some or all of them.

Page 7-5, left column, insert new section before "Special Planning Considerations":

GPS Departures

Use your GPS navigator's flight plan function. With a flight plan activated, it will automatically sequence your flight from waypoint to waypoint. Fight the urge to use the "Direct to" function…that is for airplane drivers, not pilots. The GPS database contains published waypoints that you can enter by using a cursor to spell their names; after the first few letters an auto-complete function will do the rest for you.

You can also enter user-defined waypoints. Learn how to enter a new or a user defined waypoint into a flight plan while enroute in case you are diverted or get a revised clearance. When you select a Standard Instrument Departure all of the associated waypoints will be entered for you (this will also be true when you select an approach procedure).

Use the flight plan function to check your preflight calculations; this helps catch errors. If your preflight calculations said that it is 307 degrees, 47 NM between PODNK and RATSO intersections but the GPS flight plan says 040 degrees, 123 miles, you have an error somewhere… maybe a mis-typed waypoint name.

Page 7-6, left column, insert new paragraph after the first full paragraph:

The oral exam before your instrument checkride will include questions about Controlled Flight into Terrain (CFIT), situations in which a fully functioning pilot with a fully functioning airplane inexplicably flies it into the ground…or mountain. Observing published minimum cruising altitudes, including off-airway routes in accordance with §91.177, ensures that you will not hit anything; however, departures are something else. Controllers have been known to issue vectors and assign altitudes and then forget the pilot…it has happened to me. You must stay constantly aware of your height above the ground, because if you are maintaining an assigned altitude while the terrain rises beneath you (not uncommon in mountainous terrain) you are at risk. Never hesitate to ask a controller if a newly assigned altitude seems unusually low based on your knowledge of the terrain.

Page 7-10, right column, insert new paragraph after the first partial paragraph:

All departure procedures, either conventional or graphic, may be designed using either conventional or RNAV criteria. RNAV procedures will have RNAV printed in the title: "PODUNK TWO DEPARTURE (RNAV)." When planning to use an RNAV procedure, if a reversed W appears in the Notes portion of the approach plate you must check for RAIM availability.

Page 7-17, left column, insert a new paragraph after the top paragraph:

The FAA has begun designating "T" routes for use by RNAV-equipped aircraft between 1,200 feet AGL and 18,000 feet MSL (above 18,000 feet they are called "Q" routes). When assigned such a route you continue to maintain altitude using your barometric altimeter while the GPS keeps you out of the trees. ATC must have continuous radar contact while you are flying a Q or T route.

Page 8-1, left column, add new second paragraph:

I should note here that for GPS navigators, "enroute" means more than 30 nautical miles from either the departure or destination airports; when in the enroute phase of flight using GPS navigation, full-scale deflection occurs five nautical miles either side of the centerline of the route segment, unlike a VOR radial that gets wider with distance from the station. As you cross the 30-mile mark on arrival, your GPS receiver sensitivity increases; learn more in Chapter 9.

Page 8-15, left column, replace second paragraph under "WAAS" with:

Almost all new GPS units incorporate WAAS; refer to your airplane's Approved Flight Manual to determine the types of operation for which the GPS installation is approved.

Page 8-15 left column, insert new paragraphs just above "Databases":

Garmin incorporates a RAIM prediction (actually, Fault Detection and Exclusion) function in its GPS software; no matter whose equipment you are using, you should ask for a RAIM outage prediction when getting your preflight briefing. Some online flight planning programs include this service. Use **www.raimprediction.net** to access a 24-hour overview of RAIM availability.

One of the many wonders of satellite navigation is that the equipment mounted in your panel is constantly evaluating the quality/accuracy of its position information and will either warn you or deny you the use of certain approaches if designed accuracy standards cannot be met.

Page 9-1, left column, insert new second paragraph:

GPS approaches are a little different. As you get within 30 NM of the destination, the sensitivity of your GPS increases from 5-mile full deflection to 1-mile full deflection. This is "terminal mode" and occurs automatically; it is at this point that you should select an approach and arm the approach mode (some receivers do this automatically). When you are two miles from the final approach waypoint the sensitivity increases to 0.3 NM full deflection; this is approach mode.

Page 9-9, left column, insert new section before "Procedure Turns":

Sequencing Vs. Non-Sequencing

This is a GPS-only discussion. In the normal course of events, a GPS navigator is always heading TO the next waypoint (called leg mode), and as it passes over or by it, the unit automatically heads toward the next following waypoint. Like crossing a river by stepping on rocks, as I have mentioned elsewhere. This is automatic sequencing. I should note here that there are fly-by waypoints and fly-over waypoints; fly-over is self-explanatory, but fly-by means that the unit will anticipate a turn and begin it early, cutting the corner.

There are times, however, that automatic sequencing is not desirable, and three of those times are procedure turns, holding patterns, and vectors-to-final. Before I go any further, it is essential that you read the manual for the installation in the plane you are going to use, because this is an area where manufacturers do different things in different ways. Don't take anything I say here to be applicable to a specific unit or installation. The documentation for the installation you are using is the best place to look.

Note: I don't get into GPS knobology because different manufactures have different ways of doing things. For details, good references are ASA's "GPS Trainer," their G-1000 and Avidyne CD-ROM courses, and Max Trescott's "GPS and WAAS Instrument Flying Handbook."

First, course reversals. In sequencing mode, as you pass over the final approach fix (FAF) the GPS will sequence to the missed approach waypoint. If you want to, or have to, do a full approach, most (but not all) units require that you switch to non-sequencing or "OBS" mode and fly the procedure turn manually. Turning inbound, you switch back to sequencing mode and proceed normally.

Much the same is true of holding patterns; you need to switch from sequencing to non-sequencing and fly the hold manually in most cases. Some units display the holding pattern, some fly it for you, some leave the solution in your hands. The important thing to remember is that you have to be in non-sequencing mode while in the hold.

Most units have a vectors-to-final mode because they are so common. Obviously, if the controller says "Turn right heading 130, vectors to final," you don't want to fly directly to the final approach fix. Follow the manufacturer's instructions.

Page 10-12, right column, add after "See Figure 10-10.":

Note: Middle and inner markers are being decommissioned by the FAA in many locations.

Page 10-33, left column, replace the bottom paragraph with the following:

When using a box approved for WAAS and conforming to TSO-146(a) you will enjoy greater accuracy and more options. However, because the geostationary satellites (GEOs) serve the center of the continent best, there is diminishing accuracy at the northern and southern extremes. Always ask for WAAS FDC Notices to Airmen, but note that on some approach plates, pilots are notified that WAAS outages may occur daily and that WAAS NOTAM service is not provided by a reverse W in the Notes area at the upper left. When you see the reversed W, plan on LNAV minimums because vertical guidance might not be available.

Page 11-7, right column, insert a new paragraph under the second paragraph:

You might also want to look at **www.asf.org/askatc**. This site offers pilots the opportunity to ask controllers any and all questions about communications. You do not have to be a member of the Air Safety Foundation to access this site.

Page 12-3, right column, insert new paragraph under Part 91:

14 CFR 91.109: **Flight Instruction; Simulated Instrument Flight and certain flight tests.** Because its title refers to flight instruction, many pilots skip over this regulation, not realizing that it is the "safety pilot" regulation they must refer to when planning an instrument proficiency flight. You are interested in both 61.55 and 91.109(b). It is my recommendation that all such flights take place under Visual Flight Rules in Visual Meteorological conditions with the pilot at the controls wearing a hood, because if the flight is conducted under Instrument Flight Rules, the safety pilot must hold an instrument rating…even in Visual Meteorological Conditions.

Page 13-16, left column, after the second paragraph under "Aeronautical Decision Making" insert new paragraph:

The *Risk Management Handbook* (FAA-H-8083-2) contains additional information and is available for download from the FAA website.

Page 14-2, left column, insert a new paragraph after the second paragraph:

Note that the phrase "single-pilot resource management" (SRM) appears in just about every Area of Operation in the Practical Test Standard. You are expected to demonstrate your ability to use all available resources in order to complete your instrument flight safely…and comfortably for your passengers. This means that you should use the autopilot and the multifunction device (if installed) until the examiner "fails" them, and that you should consider air traffic controllers, flight service station personnel, and any other ground-based sources that you might need as part of your team. Asking ATC for "delay vectors" when things start falling apart is an example of using all available resources.