From Aerodynamics to Zulu

Making the Most of Your Ground School Experience

BY SUSAN PARSON

When you're all pumped up about learning to fly, the idea of ground school may not seem all that exciting. Far too often, both learners and (sad to say) instructors view this part of the process as a necessary evil — just something you have to endure in order to pass the FAA knowledge test (aka "the written test"). It's true that there is plenty of room for improvement in the much-maligned FAA knowledge test. To that end, the ongoing industry-led Airman Certification Standards (ACS) project (see sidebar) is helping the agency start those improvements by providing a framework the FAA can use to better align knowledge test questions with practical skills.

Your approach to ground school, though, should be focused on far more than a box-checking pass-the-test exercise. Ground school is the key to making the most of not just your flight training experience, but also the flying and training you do after initial certification. Allow me to explain by taking you through a guided tour of the typical ground school curriculum.

Airplane Systems

For many learners, the first look at the inside of a typical GA airplane is bewildering and maybe even a little bit intimidating. Whether it's a newer model equipped with glass cockpit avionics or an older bird with the traditional round dials (known colloquially as "steam gauges"), you might find yourself wondering how you will ever learn it all. A discussion of airplane anatomy and systems is certainly included in your early flight lessons, but you will learn a lot more and spend a lot less by mastering the basics in a good ground school course.

Pilots quickly learn "aviate, navigate, communicate" as the way to remember task priorities. The aviate, navigate, communicate mantra also provides a great framework for learning aircraft systems. This particular ground school session focuses heavily on "aviate" by presenting controls (exterior control surfaces and internal flight controls), powerplant, and instruments used to monitor things like airspeed, attitude, and altitude.

Though navigation and communication are covered in later ground school sessions, this one will likely include an introduction to the instruments used for these important functions.

Aerodynamics

Once you have a basic grasp of how the exterior flight control surfaces move and how the internal flight controls are used to move them, you're ready to learn about how the airplane and its parts interact with their natural environment — the air. In this part of ground school, you will learn how the pilot uses flight controls and knowledge of aerodynamics to manage lift, weight, thrust, and drag, which are known as the Four Forces of Flight. (Warning: You are also likely to hear the corny pilot joke; "May the (four) forces be with you.")

You will also learn important terms and concepts such as angle of attack and relative wind, and how these concepts relate to an aerodynamic stall. Your flight training will include hands-on demonstration and practice of these concepts but, as in the case of airplane systems, mastering these ideas in ground school will allow you to learn a lot more and spend a lot less when you get to the flight training stage.

Flight Environment

This part of ground school introduces you to a number of important topics. You will learn about types and classes of airspace, along with requirements and procedures for operating in each one. There will be a detailed introduction to airports, traffic pattern operations, runway signs and markings, and much more. In this context, you may also get an introduction to some of the "rules of the road" for collision avoidance, such as who has the right of way when two or more aircraft are converging. Another important flight environment topic is a detailed introduction to aeronautical charts, such as VFR sectional and terminal area charts.

Communication Procedures

English is my native language, but every word I heard on the radio during my first flight lesson would have been complete gibberish if I had not already learned something about "PilotSpeak" in ground school. As you might imagine, the language of aviation is highly precise in both its grammar (structure) and its vocabulary, including use of the phonetic alphabet. In fact, there is a dictionary of aviation terms and phrases called the Pilot/Controller Glossary to ensure that pilots and controllers assign the same meaning to the same words and phrases. This session of ground school is thus intended to help you start learning the grammar and structure of PilotSpeak. Investing the time to learn these basics on the ground will help you enormously in the air, both in making your own transmissions and in understanding transmissions made to you.

Meteorology for Pilots

Because we operate in the weather, GA pilots develop a near-obsessive interest in this topic. Ground school introduces you to basic principles of meteorology. These include learning what causes weather (uneven heating of the earth's surface and resulting heat exchanges), how differences in air pressure create fronts, how fronts behave, and why pilots need to care about moisture and temperature. You will learn to identify cloud types and use them as weather "signposts" in the sky. And, of course, no session on meteorology would be complete without a thorough discussion of hazards such as thunderstorms, turbulence, wind shear, and ice.

Aviation Weather Data

Logically enough, you need to understand what a weather front is and how it behaves before you can understand how it impacts you as a GA pilot. Therefore, once you have mastered a few basic principles and concepts of meteorology, you are ready for a ground school lesson on the printed and electronically-available reports and forecasts, graphic weather products, and information sources used to convey weather information to pilots. You will learn what weather products are available, along with their content and limitations. This ground school session will also cover how to use various weather products for preflight planning and en route weather decision-making.

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Airplane Performance

All airplanes have limitations. When the manufacturer wants to certificate a new aircraft make and model, the company has to perform extensive testing to determine how the aircraft will perform in a variety of operating conditions (e.g., altitude, temperature, pressure). The manufacturer prints the results of these tests in the performance section of the aircraft's Pilot Operating Handbook (POH) or Airplane Flying Manual (AFM). In ground school, you will learn to use performance charts, graphs, and tables to determine things like takeoff and landing distance, climb and cruise performance, expected fuel consumption, and crosswind performance. This part of ground school also covers the very important subject of weight and balance.

Navigation

This part of ground school offers an introduction to the principles of navigation, starting with basic ideas like compass directions, pilotage, and dead reckoning. Traditional ground school navigation sessions have

focused heavily on interpreting and using VOR (very-high-frequency omnidirectional range) and NDB (non-directional beacon) ground stations and the associated panel-mounted receivers for radio navigation, but current courses have naturally begun to focus more on the principles (and limitations) of GPS satellite navigation.

Cross-Country Flight Planning

I typically present this part of a ground school course as the "capstone" session. Information on the flight planning process, human factors, and aeronautical decision-making is presented for the first time, but the development of an assigned practice flight plan allows — indeed, requires — the learner to connect and correlate material from many of the previous ground school sessions. Even if you use one of the many excellent flight planning apps to assist in this process, I would argue that there is still value in learning to use a good old-fashioned plotter (and maybe even an E6-B slide rule flight computer) to master the fundamentals of plotting a course and calculating flight distance, time, and fuel consumption. (In case you were wondering where the "zulu" part of this article's title fits, this area is one answer to that question. A solid grasp of Universal Coordinated Time — zulu — is very helpful in flight planning.)

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Regulations

Pilots, like drivers, are expected to know the rules of the road for both certification and safe operation. To that end, this ground school session provides information on the major Title 14 Code of Federal Regulations (CFR) elements pertaining to these issues. Typically, this session presents 14 CFR part 1 (definitions), 14 CFR part 61 (certification of pilots), and 14 CFR part 91 (general operating rules). There is also a discussion of NTSB part 830, which covers accident and incident reporting requirements.

Which Comes First?

One last point. People often ask whether to complete ground school before flight training, or pursue them simultaneously. My answer? It depends. There is no single best answer for all circumstances, but here are the guidelines I offer. The demands of ground school can be substantial, with extensive reading and even homework assignments. If you are a working adult taking ground school at night or on weekends, my advice is to consider a sequential approach. First direct your limited time and energy to completing ground school and, ideally, taking (and of course passing!) the knowledge test immediately afterward. Grounded (so to speak) in your new aeronautical knowledge, you can then focus all of your spare time and energy toward applying that knowledge to flight training.

If your circumstances do afford sufficient time and energy for a simultaneous approach to ground school and flight training, go for it. However, I still recommend that you consider completing the first few ground school sessions before you start flight training. As noted, you will learn more and spend less if you can bring at least basic knowledge of airplane systems, aerodynamics, communications, and flight environment to your first flying lesson.

Now — go forth and learn, and may the four forces be with you!

Susan Parson (susan.parson@faa.gov, or @avi8rix for Twitter fans) is editor of FAA Safety Briefing. *She is an active general aviation pilot and flight instructor.*