Flight Advisor Corner by Hobie Tomlinson

January 2012 Transition to Experimental or Unfamiliar Airplanes ~ Part IV

For January we will continue our look at Advisory Circular (AC) Number 90-109, *Airman Transition to Experimental or Unfamiliar Airplanes* which was published by the FAA's Flight Standards Division (AFS-800) on 30 March 2011.

We will begin our January discussion with the subject matter of training required during the process of **Transitioning to a New Airplane.** In the following month we will address the specifics related to transitioning into each of the FAA's **Airplane Families** with **Comparable Type Certificated (TC'D) Examples.**

Transitioning to a New Airplane can be challenging, even when the pilot is experienced and knowledgeable about the characteristics of a particular airplane. This can be even truer when transitioning to an experimental airplane in which the system design, the appearance and location of switches and controls, and the types and locations of instruments and indicators may be different, even between airplanes of the same model.

Transition Training should start with a thorough mastery of the prerequisite knowledge base required to successfully operate the new type of aircraft. Although the overriding tendency of students (and sometimes instructors) is to hop in the new aircraft and start flying, it is really an expensive and inefficient way to approach transition training. Without a good grasp of the knowledge base needed to operate the new aircraft, the training cannot be efficiently done and will result in running up a lot of marginally productive (and expensive) flight hours.

The Subjects, which need to be taught (and learned) in any aircraft transition course, are pretty standard for almost all aircraft types. These subjects consist of the following areas:

I. **Airplane Systems**
   - **a.** *Powerplant(s)*
   - **b.** *Fuel and Oil*
   - **c.** *Electrical*
   - **d.** *Hydraulic*
   - **e.** *Flight Controls*
   - **f.** *Landing Gear and Brakes*
   - **g.** *Heating and Ventilation*
   - **h.** *Pneumatics (and Pressurization)*
   - **i.** *Ice and Rain Protection*
   - **j.** *Avionics and Auto-Flight*
   - **k.** *Exterior and Interior Lighting*
   - **l.** *Other Specialized Systems (i.e. Airframe Parachute System)*

II. **Airplane Flight Profiles**
   - **a.** ***Takeoff*** – (Normal, X-wind, Short, Soft, Instrument, and Engine Failure)

- b. ***Climb*** – (Best Angle, Best Rate, Cruise and for M/E Airplanes – Engine Inop.)
- c. ***Cruise*** – (Max. Endurance, Long Range, Normal, High Speed, and for M/E Airplanes – Engine Inop.)
- d. ***Descent*** – (Constant Power, Constant Speed, Emergency, and Eng. Failure)
- e. ***Approach & Landing*** – (Normal, X-wind, Short, Soft, Instrument, No Flap, Eng. Failure, and for Conventional Gear Airplanes – Wheel Landings)

III. <u>Procedures</u>

- ***a.*** *Normal*
- ***b.*** *Abnormal*
- ***c.*** *Emergency*

IV. <u>Performance</u>

- a. ***Takeoff*** – (Required Speeds and Distances)
- b. ***Climb Gradients*** – (Required vs. Available and S/E Capability for M/E Airplanes)
- c. ***Cruise*** – (Power Settings, Fuel Consumption, Available Range and Max. Useable Altitude)
- d. ***Descent*** – (Normal, Radius of Action available for Eng. Failure, and Max. Useable Drift Down Altitude for M/E Airplanes)
- e. ***Approach and Landing*** – (Required Speeds and Distances including any Speed Additives for Anomalies)

V. <u>Limitations</u>

- a. ***Weights*** – (Max. Ramp, Max. Takeoff, Max. Zero Fuel and Max. Landing as well as Max. Compartment Weights)
- b. ***CG*** – (Loading Procedures to remain within allowable CG limits)
- c. ***Speeds*** – (Vne, Vno, Va, Vfe, Vlo, Vsl, Vso, etc.)
- d. ***Powerplant Limits***
- e. ***Systems Limits***
- f. ***Kinds of Operations Authorized*** – (Day, Night, Instrument, Known Icing, Class II Nav, RVSM, etc.)
- g. ***Auto-Flight Limits***
- h. ***Crosswind Limits***
- i. ***Landing Surfaces*** – (Paved Only or both Paved and Unpaved)

<u>Approach Airplane Systems</u> training with an open mind, irrespective of the airplane's size, its complexity, or your experience level. Even in so-called "simple" airplanes, the innovations of different manufacturers (or individual builders) may cause problems for pilots new to the airplane (or its particular avionics package).

The Two Ways of studying systems are as follows:

- **"Point of Use" Method**
- **"System Flow" Method**

The "Point of Use" method is the way I personally prefer to teach systems and is typically used by training providers while teaching more complex airplane systems. The "Point of Use" system is a cockpit orientated methodology where the controls and functions of each system are learned from the pilot's perspective. For every knob, switch, control, indicator, etc. for each system, you need to know the following items:

- ✓ ***Where is it Located***
- ✓ ***What does it Do***
- ✓ ***When do I use it***
- ✓ ***What do I do if it doesn't Work***

The Best Place to learn aircraft systems is in a Cockpit Procedures Trainer (CPT) and what better cockpit procedures trainer is there than the actual aircraft cockpit. Put the aircraft in a nice, quiet, well-lit place in the hangar and plug in an external ground power source. You can now learn (or teach) the aircraft systems by actually seeing, touching and moving all the switches and controls that are safe to operate in that environment. The advantage of learning systems in this way is that the requisite knowledge is permanently associated with the "Point of Use" by the brain; hence when you later use the system, the brain automatically brings up the required information.

Most Modern Pilot Operating Handbooks (POH) or Airplane Flight Manuals (AFM) now contain pictures or drawings of aircraft switches, instruments, controls, etc. that are 'tagged" with relevant system information. Rote (and possibly Understanding) level of system knowledge will occur from studying these publications, but Application and Correlation levels of knowledge will occur during use of a Cockpit Procedures Trainer. This is especially true when acquiring the knowledge and skills necessary for the use of advanced, computer based, avionics systems found in modern Technically Advanced Aircraft (TAA). Because so much of this operational knowledge is based on learning "muscle memory" skills, there is no substitute for training with the actual equipment.

The "Systems Flow" method of teaching systems starts with each system's "origination point" in the aircraft and follows that system through the aircraft until the system's input is finally "used" by the aircraft. At each step of the way, as the system progresses through the aircraft, the requisite, required knowledge about the system is taught. This methodology seems (to me) a little better suited for teaching systems to Aviation Maintenance Technicians (AMTs) than pilots. This is because while the system knowledge will probably be more thorough, it is not necessarily an operationally based knowledge. The ideal training system would expose the transitioning pilot to both methodologies. To steal a phase from the military, "Train like you fly and Fly like you train."

Using the Fuel System as an example, some of the teaching points would be as follows:

System Servicing

- What kind of fuel is required and what color is it?
- How many tanks are there and where are they located?
- Is the fuel serviced via “Single Point” or “Over Wing?”
- Is there a specific tank sequence for refueling?
- Where is the aircraft “bonding” point and is there a fuel additive required?

Fuel Tanks

- How many fuel sump drains?
- Where are the sump drains located and how are they checked?
- Is there a fuel quantity gauge for each tank or a switchable, multifunction gauge?
- How is fuel quantity measured (Gallons, Pounds, Kilos, or Percent of Tank Capacity – i.e. Full, ¾. ½, ¼, Empty)?
- If the fuel quantity indicator is an exposed wire with attached float (Piper J3) or liquid filled tube (Piper PA12), how is it read?

Fuel Controls

- Where is the fuel “shut-off” valve(s) located and how is it placarded?
- Where is the fuel tank selector valve located and what how is it placarded?
- How is the fuel selector moved? Can you read the Placards and feel the detents?
- Does the fuel selector have a “Both” or “Off” position?
- How is fuel “X-feed” selected on M/E airplanes?
- What is the procedure for changing which fuel tank is feeding the engine(s)?
- How do you balance fuel in-flight? What is the maximum allowable fuel imbalance?
- Which fuel tanks are used during takeoff and landing?
- Does changing the fuel tank selector affect the fuel quantity indicator? (On some older Bonanzas, with a single switchable fuel gauge, it was possible to miss-select the fuel quantity indicator to a tank which was not being used).

Fuel Flow

- Is there an electric fuel pump?
- Where is the switch located and when is it supposed to be “ON”?
- Where is the fuel pressure gauge located and what should it read?
- When should you check the fuel pressure?

Fuel Use – (Piston Engines)

- How is the fuel mixture controlled?
- When is “Full Rich” mixture required?
- When and how can the fuel mixture be leaned?
- Can “Lean-of-Peak” (LOP) mixture settings be used and when?
- What is the leaning procedure and proper indications (Best Power and Best Economy)?
- Is the engine fuel injected or carbureted?

- Where is the carburetor heat or alternate air control, located? When is this control required to be used and how is it checked?

Similarly, other systems can be described by the flow method, starting at their power source (alternator, hydraulic pump, flight control input, etc.) and continuing through the system to the end use of its energy. Thus any system on the airplane is capable of being taught or learned by the flow methodology. The flow methodology does have the potential benefit of giving great insight into the “why” of normal, abnormal, and emergency procedures. However, my feeling is that it can also be prone to giving Rote knowledge of aircraft systems, rather than an operationally functional one.

Airplane Flight Profiles are usually published for all modern airplanes. They represent the Original Equipment Manufacturers (OEM) recommended way to operate the airplane and provide for standardization of operations. Because these standardized procedures provide a “Normal” (Abnormal is defined by the absence of Normal), it is important to develop “a Normal” by doing the same thing, the same way, every time. That way the “Abnormal” becomes readily obvious. In older CAR 3 certified airplanes (which do not have any of these published profiles) give serious consideration to developing some of your own and then sticking with them.

Procedures (and checklists) were developed in the aftermath of the Boeing 299 (prototype for the B17) crash which occurred when a highly experienced crew made a takeoff with the control locks engaged. (Control locks were then a brand new invention). The accident board decided that the complexity of developing airplanes would require procedural steps with printed check lists to ensure their accomplishment.

Today, all modern aircraft have checklists for Normal, Abnormal, and Emergency procedures. If you are flying an older CAR 3 certified aircraft, (or an experimental aircraft) which does not currently have any checklists, it would be a large benefit to develop some. Your checklists should be based on generally accepted procedures (i.e. Industry “Best Practices”) plus a study of your particular aircraft’s systems. For a “simple” airplane, the checklist can even be made into an aircraft placard, as is done in some TC’d airplanes.

Normal Procedures checklists are built on a logical cockpit pattern for the following:

- Preflight
- Before Start
- After Start/Taxi
- Run-up (Propeller Airplanes)
- Before Takeoff
- After Takeoff/Climb
- Cruise
- Descent/Approach
- Before Landing
- After Landing
- Shutdown/Securing

Abnormal Procedures address those circumstances when an airplane system or component is not functioning properly, but the situation is not threatening. Generally, abnormal situations are those that do not rise to full emergency status on their own, even in more challenging conditions. An example might be the in-flight failure of an electric trim system. The abnormal procedure would probably secure the system (trim switch to "OFF" and/or Trim CB pulled). After the Abnormal checklist is completed, there should only be a minimal increase in pilot workload.

Emergency Procedures are those which require a timely response to ensure continued safe flight and may require a significant change in the flight profile. Some obvious examples are Engine Failures, In-Flight Fires, etc. Some failures may call for either Abnormal or Emergency Procedures depending on the flight conditions existing at the time the failure occurs. For example, an alternator failure may be an Abnormality during Day, VMC flight, but would be an Emergency during Night, IMC flight.

Probably the Most Important Factor in the successful outcome of a system failure is correctly identifying the problem. This is where a proper understanding of the aircraft's systems including their Normal functioning and indications are critical. For example, high engine oil pressure immediately after engine start (due to cold oil being more viscous) would be expected. Low oil pressure after start (or high oil pressure in cruise) would be indicative of a serious problem. ***Again, Abnormal is the absence of Normal.*** Unless you know what Normal looks like, you will be unable to identify when a system is malfunctioning (i.e. Abnormal).

Once you have determined the correct checklist to use, a solid knowledge of the controls and indicators related to the system is invaluable. It may be that the system performance is compromised due to malfunctioning components relied upon by the checklist. Understanding the expected outcome of the individual checklist steps taken will help you identify failed components and develop a course of action that best rectifies the situation.

Performance and Limitations are important because pilots must be able to identify an acceptable, safe flight envelope and operate within it. For Experimental airplanes, base this envelope on designer's data, experience gained in the flight test program, and post-test phase operations. For TC'd aircraft, operating limitations need to be memorized (flash card time) while relevant performance data needs to be looked up in the operating manuals.

Good Operating Practice is not to "push the operating envelope" after transitioning into a new type airplane, before you have amassed considerable experience in that type airplane. In the airline world, pilots who transition into a new type airplane are restricted to higher minimums until they acquire 100 hours PIC in the new type. Not a bad idea to adapt! This would include things like staying out of short fields, allowing more time to accomplish tasks, not attempting instrument approaches to "low" minimums, not planning maximum range or maximum weight flights, staying out of high wind conditions, etc.

That wraps us up for this month. Next month we will look at the specific training related to transitioning into each of the FAA's **Airplane Families** with some **Comparable Type Certificated (TC'D) airplane examples.**

The thought for this month is **"*Has fortune dealt you some bad cards, then let wisdom make you a good gamester"* – Francis Quarles, British Poet.**

So, until next month, be sure to **"Think Right to FliRite!"**

Happy New Year!

Hobie

Hugh Schoelzel's Piper J5 in "Winter Garb" - CT

Hugh Schoelzel Image