Flight Advisor Corner by Hobie Tomlinson

February 2012 **Transition to Experimental or Unfamiliar Airplanes ~ Part V**

For February 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 with a review of each of the FAA's **Airplane Families** with **Comparable Type Certificated (TC'D) Examples.** We will then address the specifics related to transitioning into each family type.

By way of review, the FAA AC 90-109 lists airplane families as follows:

I. Light Control Forces and/or Rapid Airplane Response

a. Experimental Airplane examples: RV-8, Pitts S-2SE & Christen Eagle.
b. Comparable Type Certificated (TC'd) examples: Grumman AA-1, Globe Swift & Extra 300.

II. Low-Inertia and/or High-Drag

a. Experimental Airplane examples: Rans S-12 & Fly Baby.
b. Comparable Type Certificated (TC'd) examples: Piper J-3 (Cub) & Aeronca 7AC (Champ).

III. High-Inertia and/or Low-Drag

a. Experimental Airplane examples: Glasair & Lancair.
b. Comparable Type Certificated (TC'd) examples: Cirrus SR-22, Cessna Columbia, Piper Comanche & Mooney M20.

IV. Nontraditional Configuration and/or Controls

a. Experimental Airplane examples: Long EZ, Air Cam & Breezy.
b. Comparable Type Certificated (TC'd) example: Lake Amphibian.

V. Nontraditional and/or Unfamiliar Airplane Systems Operations

a. Experimental Airplane examples: Wankel or Rotax Powered Aircraft (i.e. Kitfox).
b. Comparable Type Certificated (TC'd) examples: Flight Design CTSW (Rotax Powered) & Soloy CE206 (Turboprop Conversion).

VI. Nontraditional and/or Unfamiliar System Component Maintenance Requirements

a. Experimental Airplane examples: Folding or Removable Wing Airplanes (i.e. Airplanes or Gliders which can be trailered).
b. Comparable Type Certificated (TC'd) example: AeroCar (i.e. Roadable Airplanes – Six built).

VII. Specialty Airplane – (i.e. "One-of" Airplanes)

a. Experimental Airplane examples: Gee Bee R1 Replica, Hugh's H1 Replica (crashed), BD-1 Jet, Aerostar 601P Turbine Conversion.
b. Comparable Type Certificated (TC'd) examples: No TC'd Aircraft exist in this category; however some aircraft may be available which have similar characteristics or systems.

Transition Training for Family I Airplanes (Light Control Forces and/or Rapid Airplane Response)

1) **Defined** as airplanes with light control forces – coupled with strong control authority – for rapid maneuvering about one or more axis. This group also includes airplanes that have substantial disharmony between two or more axes.

2) **Typical Accidents** involve pilots not maintaining adequate aircraft control during initial climb after takeoff and ending with an inadvertent stall/spin scenario.

3) **Discussion** of transition hazards are as follows:

   a. Many Experimental Airplanes look like TC'd airplanes but actually have light control forces and/or a very quick maneuvering response. Lightweight and lightly wing-loaded airplanes can have the same quick, light maneuvering response as aerobatic airplanes. The hazard with this family is that without some level of training, the pilot may over-control the airplane, which may manifest itself in any phase of flight. This can result in damage during takeoff and landing, loss of control in-flight and/or overstressing the airframe to the point of structural failure.

   b. Unfortunately, aircraft with poor stall-handling qualities frequently have these control characteristics. This can prove to be a deadly combination when aggressively maneuvering close to the ground. Before purchasing an experimental airplane, consider the effort expended by the manufacturers of TC'd airplanes to ensure good handling characteristics. Experimental airplanes are not ensured to have the same good handling characteristics. Transferring conventional GA handling techniques to aircraft with light control forces and/or rapid maneuver response can result in inadvertent stalls, loss of control, or structural failure.

4) **Recommended Training** needs to be designed to teach the required control inputs in order to prevent over-controlling airplanes with light controls and quick responses. This training cannot be simulated and needs to occur in an airplane with similar characteristics.
   a. Best Training is accomplished in the specific airplane with a well-qualified instructor experienced in the specific make and model.
   b. Second Best Training is in the same model airplane.

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c. Third Best training is in an airplane with similar characteristics.

Transition Training for Family II Airplanes (Low-Inertia and/or High-Drag)

1) **Defined** as airplanes which rapidly lose energy (airspeed and/or altitude) when there is a loss or reduction of power.

2) **Typical Accident** involves pilots misjudging the amount of power required during the landing flare, resulting in a hard landing or nose gear collapse.

3) **Discussion** of transition hazards are as follows:

a. Airplanes with less drag require less thrust for the same performance, which increases their efficiency. Although high-drag airplanes have all but disappeared in the modern, production-airplane world, they still exist in surprising numbers in the ranks of short takeoff and landing (STOL), vintage and experimental airplanes.

b. Most Pilots don't take their initial training in these types of airplanes. New pilots thus become accustomed to the drag characteristics of the modern TC'd airplanes in which they learned to fly. Many "Low and Slow" airplanes glide at a lot steeper angle than these pilots are accustomed to, which can cause big problems when transitioning to Family II airplanes.

c. Pilots reducing power for landing expect a glide path like the TC'd airplanes they are used to flying. Instead they get a much steeper approach than expected and find themselves nearing the ground with a low energy state and high descent rate. When the landing flare is attempted from this condition, the airplane will quickly decelerate even further while continuing to maintain its excessive descent rate.

d. Power is the normal method of compensation for the descent characteristics of low-inertia and high-drag airplanes, thus engine reliability becomes critical. Because these airplanes often use non-TC'd engines (which provide more power with a smaller size and lighter weight) engine reliability may suffer. The consequences of an engine failure in these airplanes can be significant.

e. These characteristics surprise a significant number of pilots. Half of the accidents with these type airplanes occur during landing, versus a 30 percent overall landing accident rate for homebuilt aircraft in general. (Half of the pilots in these accidents had less than 12 hours in this type airplane versus 60 hours in airplane type for homebuilt aircraft accidents in general)

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f. Other Hazards (besides power management issues) exist with these airplanes. While all airplanes experience an increase in stall speed with an increase in load factor (i.e. in turns), these airplanes also experience a significant airspeed decrease with an increase in load factor. This trait, coupled with a low cruise speed to stall speed margin, makes these airplanes particularly susceptible to unintentional stalls.

4) **Recommended Training** for this family includes both Ground Training and Flight Training.

a. Ground Training for airplanes with Non-TC'd engines must include any available training on how to operate that specific engine. For example, to minimize the chances of power interruption, operators of two-stroke engines should receive training on avoiding cold seizures and how to manage the engine to maximize reliability. Pilots operating airplanes with propeller-speed reduction units must understand the power modes and RPM ranges to avoid.

b. Flight Training recommendations are as follows:

i. Best Training is accomplished in the specific airplane with a well-qualified instructor experienced in the specific make and model.
ii. Second Best Training is in the same model airplane.
iii. Third Best training is in an airplane with similar characteristics.
iv. Simulating the drag characteristics of these airplanes is possible using TC'd airplanes such as the Cessna CE-150 and maneuvering with 40 degrees of flaps (within placarded limitations – of course). Deceleration upon power loss will be similar and the steeper descent rates will help prepare the pilots for operating their own airplane. By flying a TC'd airplane in the high-drag configuration, the pilots will experience how fast speed can decay and how much lower the nose needs to be maintained during approach in order to keep an adequate approach speed.
v. Power Landings are recommended while using a power-on, controlled approach profile with the power maintained throughout the round-out transaction to touchdown. This use of power during landings will approximate the glide angle that the typical pilot is used to flying. Delay training in power-off approaches and landings until the pilot has sufficient experience with the airplane.

5) **Transitioning to Lower Performance Airplanes,** from high-performance airplanes, still presents many challenges. Prudent pilots respect the challenges of flying any new type of airplane, regardless whether or not it is a transition from a low performance airplane to a high performance airplane or vice versa.

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6) **Transitioning from a multi-crew airplane to a single-pilot airplane** also creates its own challenges. Some examples of the challenges associated with transitioning to low performance airplanes are as follows:
   a. The effects of weather are more pronounced in low-performance airplanes.
   b. Low-performance airplanes are affected more (as a percentage) by headwinds than typical TC'd airplanes.
   c. Turbulence will be more pronounced than in typical TC'd airplanes.
   d. The ability to handle crosswind landings will be reduced from that which is available in typical TC'd airplanes.
   e. Avionics will probably be less capable than pilots are used to in typical TC'd airplanes.
   f. Handling characteristics will be different from typical TC'd airplanes.

Transition Training for Family III Airplanes (High-Inertia and/or Low-Drag)

1) **Defined** as airplanes which decelerate slowly when power is removed

2) **Typical Accident** involves pilots misjudging their approach energy, which in turn causes high, fast approaches with their associated long landings. This results in overruns or, worse yet, attempted go-arounds which occur too late in the landing sequence.

3) **Discussion** of transition hazards are as follows:

   a. This Family of airplanes is on the leading edge of the low-drag design technology. They are beautiful, sleek and look fast even while sitting on the ground. These airplanes are fast, efficient, and have significant range; however, unless their low-drag characteristics are adequately managed, they will build excessive speed during the critical flight phase of approach and landing.

   b. Unmanaged excess speed can result in overshooting the final approach path and descent angle, an inadvertent stall during a much-too-late go-around attempt, wheel barrowing, loss of control, and runway excursions.

   c. Also Included in this family are airplanes designed for high-speed cruise. These airplanes have relatively high stall speeds necessitating high approach and landing speeds. This can be a challenge for pilots transitioning from lower performance airplanes that will result in long touchdowns, runway overruns and much-too-late go-around decisions. These airplanes also become challenging when required to follow a slower airplane in the traffic pattern.

4) **Recommended Training** for this family includes both Ground Training and Flight Training.

   a. Ground Training for airplanes in this family should include reviewing the proper power, airspeed operating limits, altitude, and configuration for the specific airplane's approach and landing maneuver. Training should include the proper configuration and adequate speed control for producing a stabilized descent and landing approach. Performance calculations for landing distance and adequate safety margins for runway length should be taught so that pilots are aware of the runway lengths necessary for safe airport operations. Decision making on when to reject a landing and initiate a go-around should be taught before flight training begins.

   b. Flight Training must include descents from cruise altitude, pattern work, and landing distance awareness. Training must include instruction in descent profiles to teach the proper distance versus altitude from which to begin a normal descent profile. A properly planned descent profile should permit the aircraft to descend without large reductions in power and simultaneously prevent over-speeding the aircraft. If the aircraft is equipped with speed brakes, incorporate their correct use into the training. Landing pattern practice should emphasize proper power, correct descent profile, and configuration for the approach and landing phase of flight. Demonstrate the landing distance required for different types of approaches in the various landing configurations. Then practice them until successful repeatability is assured. There also needs to be an emphasis on adequate control (and a correct understanding) of the airplane's stopping distance.

5) **Transitioning to Higher Performance Airplanes** can be demanding for most pilots without previous high performance airplane experience because of their new flight controls, new systems and more complex systems. The increased performance and complexity of higher performance airplanes require additional planning, judgment, and piloting skills. Transition training in these types of airplanes needs to be accomplished in a systematic manner using a structured course of instruction which is administered by a well-qualified flight instructor. This class of airplanes will involve exposure to some, or most, of the following:

   a. Turbocharged Engines allow the aircraft to maintain sufficient cruise power at high altitudes where there is less drag, providing higher true airspeeds and increased range. Aggressive and/or abrupt throttle movements will increase the possibility of over-boosting (or shock cooling) the engine, both of which will cause severe engine damage.

   b. Retractable Landing Gear systems may operate mechanically, hydraulically, electrically, or may employ a combination of the two systems. Pilot knowledge of the system, including proper procedures for emergency landing gear extension, is vital.

c. Fuel Systems tend to be complicated on complex and high-performance airplanes. This leads to fuel mismanagement, as reflected in the Nall report that states almost one-third of fuel-related accidents involve fuel mismanagement (i.e. fuel starvation – rather than fuel exhaustion).

d. Performance (aerodynamics) which allow the airplanes to obtain higher airspeeds make them less forgiving than slower airplanes. Since proper energy management is a significant part of flying high-performance airplanes, the student must learn to fly "by-the-numbers."

e. High Altitude Training is required to fly as PIC on any airplane certified for altitudes above FL250. Not only are there physiological requirements, but there are also aerodynamic and handling considerations which are critical to safety when operating at the airplane's upper altitude limits. This knowledge is invaluable, even when operating at altitudes below FL250.

f. Turboprop Transition involves learning the different engine operating procedures that are unique to gas turbine engines. The turboprop airplane flies and handles just like any other airplane of comparable size and weight – the aerodynamics are the same. The major difference is in understanding the new type engine's operating procedures and its related systems.

g. Jet Transition absolutely requires that pilots receive training in the specific type jet from a knowledgeable and experienced instructor. This is due to the jets performance capabilities, flight characteristics, and more complicated systems. The very best transition training for jet airplanes will be obtained from a recognized training provider using a Level D, Full Flight Simulator (FFS). TC'd civil jets require a FAA Flight Test to obtain the required type rating upon your airman certificate, as well as a 25 hour, mentored, Initial Operating Experience (IOE) period prior to operating the airplane as Pilot-In-Command (PIC).

I can't resist ending the high-performance section with a "war story." During my tenure as TWA's B747 Fleet Manager, we had a relatively low-time Commercial Pilot (with a CE-500 Type Rating) who showed up and announced he wanted to purchase a B747 type rating. (My pea-brain cannot even comprehend having that kind of money.) Anyway, this pilot made the purchase and we provided him with a double simulator course using an instructor who had a good GA background. After he had successfully passed the FAA Flight Test in the simulator, due to his low flight time and the fact that we were using a Level "C" simulator, an abbreviated aircraft flight test was required. Out came the checkbook and suddenly I found myself on the way to Stewart Int'l Airport - KSWF (from Kennedy Int'l Airport - KJFK) in an empty TWA B747. I was seated in the right seat, our GA student in the left seat, a Flight Engineer Instructor at the Engineer's panel and an FAA Air Carrier Inspector in the Jump Seat. It was one of those *what-am-I-doing-here* moments! To emphasize the effect of using a systematic, structured training program, this gentleman successfully passed his FAA Flight Test for a B747 Type Rating that day. Sometimes events happen which you couldn't even begin to make up!

This looks like a good place to break for this month. Next month we will finish this series up by looking at the transition training requirements for the remaining four families of airplanes

The thought for this month is: **"An optimist is a guy that has never had much experience" – *Don Marquis, American Philosopher*.**

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

Family I Airplane (Light Control Forces & Rapid Response)

LoPresti Swift-Fury (converted Globe Swift) *Hobie Tomlinson Image*

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