Flight Advisor Corner by Hobie Tomlinson

February 2013 **Flying Multi-Engine Aircraft (Pt. IX)**

As we continuing our series on flying FAR Part 23 (CFR 14, Chapter 1, Subchapter C, and Part 23) certified, small multi-engine airplanes, we are looking at the background training issues involved in completing a multi-engine transition course. This month we will complete our discussion of a typical General Aviation Manufactures Association (GAMA) standard format Airplane Flight Manual (AFM) issued for FAR Part 23 certificated airplanes.

The 4-Cylinder Twins – 1959 Beechcraft Model 95 – "Travel Air"

AirVenture 2008 - Oshkosh, WI - 702 built (1958 – 1968) **(180 HP/Side)** ***Wikipedia Image***

Last Month we paused after completing **Section VII** on **Systems Description.** This month we will pick up our discussion with **Section VIII** on **Handling, Servicing and Maintenance.**

Section VIII (Handling, Servicing and Maintenance) is a chapter that often gets overlooked by pilots**.** This is unfortunate because it contains much vital information that is of importance in assuring the continued safe operation of the airplane. Pilots typically brush this information off with the thought that it is solely a maintenance function. The fact remains, however, that it is the Owner/Operator who is ultimately responsible for

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assuring that the airplane is properly maintained, irrespective of who actually performs the work. (***FAR, Part 91.403(a) states*** *"The owner or operator of an aircraft is primarily responsible for maintaining that aircraft in an airworthy condition, including compliance with part 39 of this chapter."*) Thus, even though the owner/operator assigns the maintenance work to someone else, he/she still retains *Primary Responsibility* for its completion

FAR Part 91.403 also includes the following pertinent regulations:

(b) No person may perform maintenance, preventative maintenance, or alterations on an aircraft other than as prescribed in this subpart (Pt. 91) and other applicable regulations, including part 43 of this chapter.

(c) No person may operate an aircraft for which a manufacturer's maintenance manual or instructions for continued airworthiness has been issued that contains an airworthiness limitations section unless the mandatory replacement times inspection intervals, and related procedures set forth in that section or alternate inspection intervals and related procedure set forth in an operations specification approved by the Administrator under part 121 or 135 of this chapter or in accordance with an inspection program under 91.409 (e) have been complied with.

Note: The above regulation requires commercial operators to abide by the manufacturer's recommended overhaul times and inspection intervals. It does not specifically apply to part 91 operations. I can't even begin to count the times I have heard "We don't need to do that because we're part 91." I have the following thoughts on that course of action:

1) There are very valid reasons why part 121 (airline) and part 135 (charter) operations are inherently safer than part 91 (personal and pleasure flying) operations and this is one of them. Part 91 (corporate) operations usually abide by the even more stringent "industry best practices" and do not suffer the same degradation of safety.

2) It is usually a false economy anyway, because it not only results in a current degradation of safety, but causes higher costs "down the road" when the maintenance issues can no longer be ignored.

3) Flying airplanes with any of their systems beyond the mandatory replacement times or required inspection intervals is a guaranteed recipe for trouble.

4) Multiengine airplanes, especially "old" multiengine airplanes, are not for the "financially challenged." Don't be fooled by the purchase price, it is that low for a reason! The costs of

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operating any aircraft are directly related to what that aircraft would cost if it could be purchased "brand-new" today, and have no relation to what the aircraft was actually bought for. (The price for a new Beechcraft Baron is over $1.2M USD) Thus you can expect to spend a significant amount of money owning and operating a piston, multiengine aircraft, especially an older one.

5) And lastly, will you be "any less dead" because you were flying under part 91? (There are very significant reasons why the industry calls these items "best practices"!)

(d) A person must not alter an aircraft based on a supplemental type certificate unless the owner or operator of the aircraft is the holder of the supplemental type certificate, or has written permission from the holder. (STCs are "owned" by the person who obtained them like a patent. By "purchasing" the STC you obtain the legal right to install it on your airplane.)

Note: While on the subject of supplemental type certificates (STCs), we should diverge a moment and discuss an accident that occurred in a Cessna T337G (Turbo Skymaster) aircraft at Monmouth Executive Airport (KBLM) on February 15, 2010. During an abrupt high-speed pull-up from an "airshow" pass, the right-wing, forward-upper spar cap failed in compressive buckling, resulting in the in-flight separation of the right wing and 5 fatalities. An entire article could be written on the ADM (Aviation Decision Making) deficiencies leading to this tragic accident, but the point to be made here is the installation of multiple STCs on this particular airplane. A quote from the NTSB report is as follows, ***"….The combination of STCs (22 different mods) on the accident airplane created wing loads that were not initially evaluated."*** As a result of this accident, the FAA issued Airworthiness Directives (ADs) 2010-21-18, 2011-15-11, and revised the operating limitations for this type airplane. It was also discovered that the FAA does not provide any guidance to an STC installer to help determine the interrelationship between multiple STC modifications.

All that is to say this, older aircraft typically have multiple STC modifications, so *it is incumbent upon the owner/operator (or potential owner/operator) to do their homework using due diligence and common sense*. This includes insuring that all STCs currently installed on an airplane have been properly installed, properly documented in both the aircraft records and the AFM, and are legal for that particular type airplane.

The Introduction to **Section VIII (Handling, Servicing and Maintenance)** is a single page which sets forth the purpose of this section as outlining the requirements for

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maintaining the airplane in a condition equal to that of its original manufacture. It further states that it is the responsibility of the owner/operator to ensure that all maintenance is performed by qualified mechanics in conformity with all airworthiness requirements established for the airplane and that *all limits, procedures, safety practices, time limits, servicing, and maintenance requirements – contained in this section of the AFM – are considered mandatory*. Lastly, it reminds owner/operators that it is the aircraft's serial number which controls items that are pertinent to each individual airplane.

The Publications page sets forth those documents which are essential for ensuring that the correct maintenance procedures for the airplane are followed. This page is followed by information on the required **Airplane Inspection Periods,** on **Preventative Maintenance That May Be Accomplished by a Certificated Pilot,** and information on **Alterations or Repairs to Airplane.**

> **Note: FAR Part 1.1 (General Definitions)** states "*Preventative Maintenance* means simple or minor preservation operations and the replacement of small standard parts not involving complex assembly operations." **FAR Part 43.3 (g)** states "Except for the holders of a sport pilot certificate, *the holder of a pilot certificate issued under part 61 may perform preventative maintenance on any aircraft owned or operated by that pilot which is not used under part 121, 129, or 135 of this chapter*. The holder of a sport pilot certificate may perform preventative maintenance on an aircraft owned or operated by that pilot and issued a special airworthiness certificate in the light-sport category."

The Ground Handling section contains required information and procedures for aircraft **towing, parking, tie-down,** and **main wheel jacking.**

Flyable Storage (defined as between 7 and 30 days) is discussed next. To prevent (i.e. minimize) internal piston engine corrosion, it is a recommended "best practice" to fly the aircraft at normal cruise power for at least 30 minutes every 7 consecutive days. (This is done to warm-up the engine oil to normal operating temperature, to "boil-off" the condensation water suspended in the oil, and to prevent the suspended water from combining with residual combustion deposits to form corrosive compounds within the engine.) Aircraft which are not going to be flown weekly should be placed into "Flyable Storage." When the aircraft is not flown during a given week, the engine(s) should be rotated through six revolutions (after insuring the Mags are **"OFF",** throttles **"CLOSED,"** and Mixture(s) in **"ICO" –** Idle Cut-Off) in order to recoat the cylinder walls with oil. Beyond the 30-day period, this process will just "scuff" the cylinder walls as the oil film has totally drained from the cylinders. Aircraft which are planned to be "out-of-service" for longer than 30-day periods need to be prepared for long-term storage by maintenance personnel in accordance with the aircraft manufacturer's approved procedures.

External Power procedures are discussed next. Because of the high electrical starting loads of many modern aircraft, external power usage has increased considerably in recent years. Modern avionics can be easily damaged by voltage transients. Most light aircraft

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do not have any external power protection circuits, so the proper procedures for the use of external power have taken on greater significance in recent years. As a general statement, the battery switch should be **"ON"** before connecting external power to the aircraft in order for the battery to act as a "shock absorber" in protecting electrical components from voltage transients (power fluctuations). No power should be supplied to the aircraft connection cable by the GPU (Ground Power Unit) during the aircraft power cable connection/disconnection process. The GPU power output should be verified within acceptable limits before closing the GPU power-connection relay to supply power to the aircraft. If using a "battery pack" in conjunction with an aircraft power-cable, ensure that the polarity is correct. (Most light aircraft use a negative ground system.)

Servicing of the aircraft is next on the list and includes the following items:

- ✓ **Fuel System** that includes the correct fuel type and grade, proper servicing order/procedure for the fuel tanks (cells), fuel drains, and fuel strainers (typically serviced by maintenance personnel).
  - I notice more and more pilots solely relying on their electronic fuel management systems (typically a part of modern avionics systems), including continuing to operate with defective aircraft fuel quantity indicators.
    - First and foremost, for any light aircraft that does not have a MMEL (Master Minimum Equipment List), this is a direct violation of **FAR 91.205(b) (9)** which requires an *operating* "fuel gauge indicating the quantity of fuel in each tank" to legally fly the aircraft. Aircraft which have an MMEL need to be operated in conformance to the requirements of that MMEL. (Flying an aircraft in violation of the FARs usually voids your insurance, among other bad things.)
    - Secondly, light aircraft fuel management systems are typically not sophisticated enough to read the actual fuel in the tanks, they only know what the pilot tells them. (GIGO – Garbage in, Garbage out).
    - Thirdly, even though a physical "ground check" of fuel in the tanks is made (which needs to be part of every preflight), other events can occur to change the amount of available fuel onboard (i.e. a defective fuel cap, siphoning fuel, or a remote cockpit-sump-drain continuing to leak fuel.)
  - Many fuel systems have to be filled in the correct order to actually obtain the specified "full tank capacity" amount of fuel onboard. (Opening the wrong fuel cap during a "ground fuel-check" with these type systems can also result in significant fuel spillage.)

- ✓ **Oil Systems** on modern horizontally-opposed aircraft engines are usually wet-sump, pressure type systems. However, there are still "dry-sump" systems out

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there. (Radial engines and inverted in-line engines use dry-sump, pressure type systems.)

- Individual engines have their own "personalities" and each engine will have "sweet-spot" where it is happiest with the oil quantity. This is usually about 80% of maximum capacity (i.e. One to two quarts below maximum). More oil quantity than that amount is just "blown-out" of the crankcase breather. Significantly less oil quantity than that amount is not able to remove enough heat from inside the engine and results in excessive oil temperature.
- Regular oil changes (usually each 100 hours with modern oil filters) are very inexpensive maintenance, as they remove oil which has become contaminated by accumulated, acidic combustion deposits.
- Induction air filters should be inspected at each oil change interval.

✓ **Battery** care and service is very important, as some critical systems use battery power. Never fly (or store) an aircraft with a low/dead battery.

- A dead battery may not recharge, even if the aircraft is started with a GPU, leaving you without a source of emergency electrical power.
- A dead battery will freeze in cold weather, thus ruining what might otherwise be a serviceable battery.
- On November 28, 2001 a Beech C45H was lost in a non-fatal training accident in Hudson, NY due to a bad battery. When an actual engine failure occurred, the trainee feathered the wrong engine. Because the propeller feathering (and unfeathering) oil pumps on the Beech 18 are electric and both engine generators were now off-line (due to the two failed engines), the crew was unable to reverse their mistake. Because of the bad battery, they were only left with the possibility of successfully making a power-off, forced landing into an undesirable location.

✓ **Landing Gear** systems definitely require periodic service and maintenance to include at least the following:

- Proper tire pressure maintenance is critical on aircraft tires, especially in cold weather.
  - Aircraft tires, especially high-pressure tires, tend to gradually lose pressure over time. Underinflated tires build up excessive heat, which will quickly destroy the integrity of the tire sidewall and ruin the tire. Also, an underinflated tire will slip (rotate) on the wheel under landing loads, causing a flat tire.
  - Never attempt to taxi with a flat tire, as the tire (and quite probably wheel) will be quickly destroyed.
  - In an iconic, fatal accident, a LR60 was lost in Columbia, SC on September 19, 2008 due to underinflated tires failing during the takeoff-roll.
- Shock Struts need to be monitored for proper inflation.
  - Never taxi an aircraft with a flat shock-strut, as structurally damaging loads can be transmitted to the airframe.

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        - Under/over inflated shock struts can cause gear retraction issues.
        - Shock-strut servicing is a maintenance function.
    - Shimmy Dampers need to be kept serviced and in proper repair.
    - Hydraulic fluids need to be monitored and serviced to proper levels.
    - Brakes need to be monitored for wear limits during preflight.

- ✓ **Anti-Icing fluids** (Alcohol or TKS systems) need to be quantity checked, serviced, and verified for proper operation prior to departure into cold weather.

Minor Maintenance items have requirements and precautions as follows:

- ✓ **Lubricate** door and window seals with a non-stick compound (i.e. Oakite 6).
- ✓ **Gas Heater** fuel sumping, fuel filter cleaning, and air valve lubrication.
- ✓ **Battery** charge/change precautions to prevent reverse polarity damage to the alternators and other electrical components.
- ✓ **Aircraft Lubrication** points, time intervals, and proper type lubricants.
- ✓ **Aircraft Cleaning** methods, precautions and proper type cleaning compounds. Note: Aircraft Cleaning has become its own specialty and is more important than most pilots think. Very expensive damage can be quickly incurred due to improper cleaning materials or methods. (Price out replacing a cleaning-damaged windshield or deice boot sometime!)

Lastly, Notes, Lists, and Tables as follows:

- ✓ Special/Harsh Operating Conditions note.
- ✓ Recommended Servicing Schedule (items and intervals)
- ✓ Consumable Materials List (items and material specification)
- ✓ Bulb Replacement Guide (bulb and part number)
- ✓ Overhaul and Replacement Schedule (items and time intervals)

The Supplements Section (IX) contains the required information and procedures for optional aircraft equipment which is installed on the aircraft by either the OEM (original Equipment Manufacturer) or by aftermarket vendors. They can include both equipment supplied by the OEM and/or equipment furnished by aftermarket vendors holding an aircraft STC for that aircraft. The lists of STC modifications available for older aircraft are extensive and typically include increased horsepower, additional fuel, higher gross weight, increased speed, modern system upgrades, vertex generators, STOL (short takeoff and landing) modifications etc.

- ✓ **The Log of Supplements Page** opens the section and should be used to validate all the supplements contained in the supplement section.
    - All Supplemental Equipment actually installed on the aircraft should be validated by maintenance personnel and compared with the aircraft maintenance records and the supplements section of the AFM.

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- All missing Supplemental Equipment documentation for equipment actually installed on the aircraft must be obtained and appropriately placed in both the aircraft maintenance records and Supplements Section of the AFM.
- Any Supplemental Equipment documentation for equipment not actually installed on the aircraft should be removed from the AFM.

The Safety Information Section (X) contains Operational Safety Information deemed pertinent to that type airplane by both the OEM and Aftermarket Vendors of installed STC equipment. The gamut is far and wide including FAA Safety Information, Safety Information Desired by Legal Depts., and Safety Information inserted by Engineering or Flight Test Depts.

Typical Topics which would be covered in the Safety Information Section of an AFM are as follows:

- ✓ Passenger Briefing Information and/or Passenger Briefing Cards
- ✓ Turbulent Weather Operational Precautions including recommended airspeed
- ✓ Icing Conditions Operational Precautions including minimum safe airspeed
- ✓ Mountain Flying/High Density Altitude Precautions
- ✓ M/E Aircraft EI (Engine Inoperative) Precautions
- ✓ Aircraft Training Precautions
  - Slow Flight and Stalls
  - Intentional Engine Inoperative Precautions
    - Vsse Speed (Minimum speed for intentional, dynamic engine-cuts)
    - Recommended "Zero-Thrust" power setting (to best simulate the drag-effect of a feathered propeller)
  - Recommended procedures for an unintentional "Departure" from Controlled Flight
    - Recovery from an Incipient-Spin Entry
      - Note: Surviving this in a Multiengine airplane usually requires two immediate steps: 1) closing both throttles to eliminate any asymmetrical thrust, and 2) aggressively unloading the wing (to ½ G or less) with forward control pressure while neutralizing any aileron input
    - Recovery from an Aircraft Upset (Nose High or Nose Low)
- ✓ Procedures to Avoid Shock Cooling and Detuning of Piston Engines
  - Shock Cooling damages engine cylinders
  - Detuning damages engine crankshaft counterweights
- ✓ Contaminated Runway Operational Procedures and Precautions
- ✓ Harsh Operational Conditions
  - Additional Maintenance recommendations

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- Corrosion Prevention recommendations

The GAMA Format AFM contains an incredible amount of valuable, pertinent information. I'm afraid that we, in the light aircraft training business, have long been deficient in providing our customers with the proper background and knowledge they need from this publication in order to competently operate their aircraft.

That concludes our look at a typical **GAMA format AFM** and is our stopping point for this month. Next month we will finally start working our way through the Multiengine Practical Test Standards **(PTS)** which is **FAA-S-8081-12C (with changes 1 – 4) Commercial Pilot Practical Test Standards for Airplane (SEL, MEL, SES, and MES)** and became effective on June 1, 2012.

The thought for this month is: "**Credentials don't matter; Truth matters!" ~ *David Barton*, founder of WallBuilders.**

So, until next month, remember to **Think Right to FliRite!**

The 4-Cylinder Twins – Piper PA-30 Twin Comanche

2,142 built (1963-1972) – Production was ended by 1972 Lock Haven flood
(160HP/Side) ***Wikipedia Image***

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