Flight Advisor Corner by Hobie Tomlinson

October 2012 **Flying Multi-Engine Aircraft (Part V)**

Progressing with our series on flying FAR Part 23 (CFR 14, Chapter 1, Subchapter C, and Part 23) certified, small multi-engine airplanes, we will continue looking at the issues involved in a multi-engine transition course. We will also continue going through a typical General Aviation Manufactures Association (GAMA) standard format Airplane Flight Manual (AFM) issued for FAR Part 23 certificated airplanes.

United Consultants UC-1 Twin Bee @ KLCI

Aircraft that I flew during my ATP AMES Practical Test *Hobie Tomlinson Image*

The GAMA Pilot's Operating Handbook (POH – Specification #1) and FAA Approved Airplane Flight Manual (AFM) will be in the following format:

- Title Page. . . . . Identifies "Official" AFM for each individual airplane
- Revisions Page . . . . . .Record of Revisions and List of Effective Pages

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- Section I . . . . . .General
- Section II . . . . . Limitations
- Section III . . . . . Emergency Procedures
- Section IV . . . . . Normal Procedures
- Section V . . . . . Performance
- Section VI . . . . . Weight and Balance/Equipment List
- Section VII . . . . . .Systems Description
- Section VIII . . . . . Handling, Servicing, and Maintenance
- Section IX . . . . . Supplements
- Section X . . . . . Safety Information

Last month we stopped at the completion of Section II of the typical AFM, so we will pick up where we left off by continuing with Section III.

Section III (Emergency Procedures) is the first of two sections in the AFM (The second being Section IV – Normal Procedures) which involve checklists, procedures and some intentional memorization. One thing that is immediately noticeable is that there is no section for "Abnormal" procedures (as would be typically found in an AFM for an aircraft certified under FAR Part 25). For smaller and/or older aircraft certified under FAR Part 23, the Abnormal Procedures are typically lumped together with the Emergency Procedures, leaving it up to the operator to sort out the difference.

Before Starting to work through Sections III and IV, it would benefit us to do a review of the following items and concepts:

- **Checklists**
  - Types and Definitions
  - Usage Methods and Memorization
- **Flight Profiles**
  - Two Engine vs. One Engine
  - Pitch/Power/Configuration Diagrams
- **Controllability vs. Performance**
  - Light Weights vs. Heavy Weights

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Checklists Types and Definitions are as follows:

- **Normal Checklists** cover procedures which may be thought of as routine in day-to-day flying.
    - The Normal Checklist is the one that is used for every flight. The Normal Checklist should be a separate "stand-alone" document containing only normal procedures that was created from the Normal Checklist contained in the AFM.
    - For Brevity and Usability, only include the checklist items and their related text, omitting additional system-descriptive information which the manufacturer may have imbedded in the AFM version of the checklist.
    - The Normal Checklist Pages should display the same date as the AFM from which they were extracted, making it apparent when a subsequent AFM revision requires the checklist to be updated.
    - Green Panel-Lights are usually associated with the Normal Checklist and are system "status lights" (i.e. Green landing gear "Down" lights.)
    - Normal Checklist Pages are sometimes given a green border and/or tab for easy identification. They can be either a single or multiple pages, depending upon their complexity.
    - The Normal Checklist Pages should be laminated so that they will stand up to repeated use.
    - When Creating the Normal Checklist it is permissible to add additional "personal preference" items; however, it is not permissible to delete any items that the OEM (Original Equipment Manufacturer) included in their checklist.

- **Abnormal Checklists** cover the use of special systems and/or the alternate use of regular systems. Following the Abnormal Checklist will maintain an acceptable level of airworthiness or reduce the operational risk resulting from a failure condition.
    - The Abnormal Checklist items are typically imbedded in the Emergency Procedures Section of the AFM for smaller and/or older light multiengine aircraft.
    - Abnormal Checklist items can be identified by the fact that they typically involve system and/or component failures which do not need to be

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immediately addressed in order to maintain safe flight (i.e. a single alternator failure).

- The Abnormal Checklist Pages should display the same date as the AFM from which they were extracted, making it apparent when a subsequent AFM revision requires the checklist to be updated.

- Amber Panel-Lights are typically associated with the Abnormal Checklist and are system "caution lights" (i.e. Amber alternator failure light).

- White Panel-Lights are sometimes also used as an "Abnormal Status" light indicator (i.e. fuel crossfeed "ON").

- Abnormal Checklist Pages are sometimes given an amber border for easy identification and will typically involve multiple pages.

- The Abnormal Checklist is usually added behind the Emergency Checklist to create a Mini-QRH (Quick Reference Handbook). When this is done, the Abnormal Checklist pages should have an amber border and/or tab for quick identification.

- When Creating the Abnormal Checklist, it is not permissible to add or subtract items from the checklist contained in the AFM. This checklist needs to be an exact copy of the one in the AFM; however, it is not necessary to include additional system-descriptive information which is sometimes appended to the AFM checklist.

- The Abnormal Checklist should be laminated, so that it will stay legible after being in the cockpit for an extended period of time. This (hopefully) will be a "low-use" checklist.

- **Emergency Checklists** cover the use of special systems and/or regular systems in order to protect the occupants and the airplane from serious or critical harm. Emergency Checklists require immediate action and may contain "Boxed Items" which must be committed to memory so that they can be initiated "on-the-spot" should the particular Emergency Checklist Event occur (i.e. engine fire).

  - Emergency Checklist items typically will be the first ones listed in the Emergency Procedures Section of the AFM and usually precede the Abnormal Procedures checklists.

  - Emergency Checklist items involve system and/or component failures that need to be immediately addressed in order to maintain safe flight.

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- The Emergency Checklist Pages should display the same date as the AFM from which they were extracted, making it apparent when a subsequent AFM revision requires the checklist to be updated.

- Red Panel-Lights are associated with the Emergency Checklist and are system "warning lights" (i.e. Red landing gear "Unsafe" light).

- The Emergency Checklist should be given a red border and/or tab for easy identification and may involve multiple pages.

- The Emergency Checklist is typically placed in front of the Abnormal Checklist when making a Mini-QRH (Quick Reference Handbook).

- All Emergency Checklist Steps, which require immediate implementation (and thus memorization), should be defined by being enclosed within a bordered (or shaded) area imbedded in the checklist (hence, the term "boxed items").

- When Creating the Emergency Checklist, it is not permissible to add or subtract items from the checklist contained in the AFM. This checklist needs to be an exact copy of the one in the AFM; however, it is not necessary to include additional system-descriptive information which is sometimes appended to the AFM checklist.

- The Emergency Checklist should be laminated so that it will stay legible after being in the cockpit for an extended period of time.

- **Electronic Checklists** are becoming more common with the rapid adoption of "glass panels." These checklists are typically imbedded in the avionics Multi-Function Display (MFD) and are "called-up" by selecting the appropriate Checklist Page on the MFD. Once the appropriate checklist is displayed, an up-down key is used to "tick-off" the completed times, which then display differently, so that it is readily apparent which items have been completed and which have not. They are sort of a "high-tech" form of the old checklist placards which Piper popularized in the late 1960's. (No comment about why I know that!) It is still important to have "hard-copy" checklists available, as electronics are occasionally known to have "issues." (i.e. Nothing can go wrong, go wrong, go wrong ……..)

Checklist Usage Methods and Memorization are as follows:

Normal Checklists are usually completed using the "Do – Then Verify" method. Because Normal Checklists are used on every flight, pilots become very familiar with them and have a tendency to "rush-thru" them or sometimes even not use them. To help preclude this, the checklist items are performed using "muscle

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memory," otherwise known as the "flow procedure" or just plain "flows." In this method, items are systematically performed at the appropriate points during the flight. Once all the items are completed, the checklist is then read to verify the completed status of each item.

- ✓ In Two Pilot crews, each pilot completes the items located at their respective pilot station. Once all the check list items are completed, the checklist is read by the pilot monitoring (PM) and each item is verified and responded to by the pilot flying (PF).

- ✓ With a Single Pilot crew, the pilot completes the items at the appropriate times. Once all the check list items are completed, the checklist is then read and each item is verified as completed. It is considered a "best practice'' to read the checklist aloud, even with a single pilot crew.

Abnormal Checklists are completed using the "Read and Do" method. Because these checklists are infrequently used, each item is sequentially read and performed. When the flight situation requires the use of both a Normal checklist and an Abnormal Checklist, the Normal Checklist takes precedence. The sequence is thus the Normal Checklist and then the Abnormal Checklist.

- ✓ In Two Pilot crews, one pilot flies the airplane (PF) while the other pilot reads each checklist item out-loud before implementing the item. Before any critical steps are performed, the correct system control should be verified by the pilot flying (PF). The pilot who flies during the performance of an abnormal checklist depends on which pilot panel provides access to the affected system.

- ✓ With a Single Pilot crew, the pilot reads the item and then verifies that the correct system control has been selected before performing the action. It is considered a "best practice'' to read the checklist aloud, even with a single pilot crew.

Emergency Checklists are also completed using the "Read and Do" method. Because these checklists are infrequently used, each item is sequentially read and performed. When the flight situation requires the use of both a Normal Checklist and an Emergency Checklist, the Emergency Checklist takes precedence. The sequence is thus the Emergency Checklist, then the Normal Checklist and lastly – if required – the Abnormal Checklist. (Red, Green, Amber is the proper usage sequence) The best Emergency Checklists have all the required Normal Checklist items imbedded within them and are thus "stand-alone" checklists. All required "boxed" memory items are always completed prior to reading the Emergency Checklist. Then when the Emergency Checklist is read, these "boxed" memory items are also read and verified as completed before proceeding with the remainder of the checklist.

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- ✓ In Two Pilot crews, the pilot flying (PF) performs the required "boxed" memory items prior to the pilot monitoring (PM) reading the Emergency Checklist. The PM then reads each checklist item out-loud before implementing the action. Before any critical steps are performed, the correct system control must be verified by the PF. The pilot who flies during the performance of an Emergency Checklist is typically the Pilot in Command (PIC), but this may vary depending upon the nature of the emergency.

- ✓ With a Single Pilot crew, the pilot performs all "boxed' memory items before initiating the Emergency Checklist. The pilot then reads the Emergency Checklist and verifies that all "boxed" items have been correctly performed before proceeding with the remainder of the checklist. Remaining checklist items are then read and implemented. It is very important that the correct system control is always verified before performing any required action. (i.e. Think then act – Don't react!) It is considered a "best practice'' to read the checklist aloud, even with a single pilot crew.

Flight Profiles for both Normal and Engine Inoperative (EI) should be either obtained from your training provider or developed in conjunction with your instructor. These are important so that we can measure our performance against a "benchmark" standard and perform each maneuver the same way every time. These profiles are part of the Standard Operating Procedures (SOPs) which are an industry "Best Practice" for aircraft operations. Safety heavily depends on "structured flight profiles" rather than freelancing "of-the-cuff" maneuvers. It is important to take the time to become very familiar with these profiles as it will save considerable training time (and its associated expense) when checking out in a new airplane.

Pitch/Power/Configuration Diagrams provide the **Pitch** attitude, **Power** setting, and airplane **Configuration** values for either the Normal condition or an Engine Inoperative (EI) condition during each phase of the flight. Leaning these values will also save considerable training time (and its associated expense) when checking out in a new airplane. (Figure 1 provides an example of one of these charts.)

Controllability vs. Performance issues should be understood when discussing Engine Inoperative (EI) operations. The basic thoughts regarding these two issues are as follows:

- ➢ Operations at lighter weights usually provide adequate (or more than adequate) EI performance, but the lower airspeeds involved can provide controllability issues to the unwary. Things happen much faster at the lighter weights. Greater control deflections are required to maintain directional control due to the lower airspeeds involved. In my earlier years, I would also train the instructor pilots on engine failures occurring at light weights, which was an eye-opener for some.

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- Operations at heavier weights generally provide easier controllability but now performance issues dominate. While heavier weights make directional control issues easier, they require considerably more finesse with pitch control in order to achieve the required optimum performance. Heavy weight EI operations always have very little performance margin to sacrifice with less-than-precise pitch control.

- Part 23 Piston Twins have marginal performance at best, and the universal tendency is to try to force aerodynamic performance which simply is just not there. The result is to bleed off essential airspeed, leading to loss of control. It is important to remember that optimal performance airspeeds are always higher than the minimum controllability airspeeds. Thus, it is very important to maintain the flight discipline to stay with the optimum performance airspeeds, whether they result in a climb, level flight, or even a shallow descent. Maintaining the correct airspeed will result in the best performance possible under the existing circumstances. ***Allowing the airspeed to bleed off below the desired performance airspeed will not only decrease the available performance, but will eventually result in the loss of control, which always has a very high fatality rate!***

This looks like a good place to break for this month. Next month we will finish up some final items on Normal and Emergency Procedures Sections and then move into Section V - Performance.

The thought for this month is ***"It takes less time to do a thing right than to explain why you did it wrong. ~* Henry Wadsworth Longfellow – American Poet**

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

Sample Pitch/Power/Config. Diagram - Typical Lt. Piston Twin (Fig. 1)

Flt Phase	Two Engine	Engine Inoperative (EI)
	Pitch / Power / Configuration	Pitch / Power / Configuration
Takeoff	7 deg / Max Pwr/ Flaps=Up & Gear=Down	Abort! Abort! Abort!
2nd Seg Climb	12 deg / Max Pwr/ Flaps=Up & Gear=UP	7 deg / Max Pwr/ Flaps=Up & Gear=UP
Enr Climb	5 deg / 25"& 2500RPM / Fl=Up & GR=UP	7 deg / Max Pwr/ Flaps=Up & Gear=UP
Cruise	2 deg / 23"& 2300RPM / Fl=Up & GR=UP	4 deg / 25"& 2500RPM / Fl=Up & GR=UP
Enr Descent	0 deg / 21"& 2100RPM / Fl=Up & GR=UP	2 deg / 23"& 2300RPM / Fl=Up & GR=UP
Approach	2 deg / 15" & 2300RPM/ Fl= App & GR=Dn	3 deg / 21"& 2500RPM/ Fl= Up & GR= Down
Landing	5 deg / Idle / Flaps =Down & Gear=Down	5 deg / Idle / Flaps = App/Dn & Gear= Down

Note: These are approximate **v**alues for a typical light Piston Twin at training weights. These chart values should be verified and then adjusted for your individual airplane during your flight training.

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