Citation Aircraft Flight Manual

In 1978, GAMA, the General Aviation Manufacturers Association, advocated to its members to transition from the POH, or Pilot Operating Handbook concept to the AFM, or Aircraft Flight Manual concept of documenting aircraft performance. Citation Flight manuals are typically organized into 7 sections. The first several pages contain the Log of Effective Pages. The AFM is a living document and is typically updated many times in the life of an airplane. As these updates occur, it can become difficult to make certain that the AFM is current and that all updates have been collated into their proper locations. The Log of Effective Pages, or LOEP can be helpful in determining that the AFM has been updated and contains current information. Remember, the properly updated AFM is required to be onboard the aircraft in order to maintain airworthiness.

Section I contains the Introduction. In this chapter, you will typically find the table of contents, followed by discussions on applicable Serial and/or Unit numbers, how updates are indicated, definitions and Service Bulletins. Confusion sometimes arises regarding the difference between Unit Number and Serial Number on those Citations which have both numbers appearing on the data plate. The unit number is a function of the date which the airplane was manufactured and will never change. The Serial Number on the other hand, is subject to change. A good example is a Citation I or II that was originally certificated as a Transport Category airplane. Let's say a subsequent owner of one of these airplanes decided he wanted to fly the airplane single pilot. That can be accomplished in what amusingly is referred to as a sex change, which can be accomplished by the manufacturer. This would require certain inspections to be accomplished, followed by the assignment of a new Serial Number, which will have nothing to do with the date of manufacture. The Unit Number however, would remain unchanged. What was previously a Transport Category airplane is now a Normal Category airplane. A new Certificate of Airworthiness will be issued with the word NORMAL typed into the upper right hand corner of the C of A where the word TRANSPORT was previously typed.

The opposite is also possible, particularly with a Citation TWO Single Pilot aircraft, referred to as a CE-551, or a IISP. Due to the certification rules of normal category airplanes that existed when the airplane was manufactured, the Single Pilot Citation Two has a maximum takeoff weight of 12,500 pounds. These airplanes typically weigh around 8000 pounds and can carry 5000 pounds of fuel. A IISP with full fuel would weigh around 13,000 pounds, 500 pounds above its maximum certificated takeoff weight, and there is no one in the airplane yet. The utility of a II SP can be increased significantly by converting it to a Transport Category Citation TWO, or CE-550. This can increase takeoff weight to 13,300 pounds with little or no airframe work and up to 14,700 pounds utilizing an after marked STC, typically by upgrading wheels and brakes. This makes a Citation II a much more useful airplane.

Section II is titled Operating Limitations. It contains limitations in such areas as weight, speed, powerplant, fluid types, systems & many other operational limitations. This entire section is fair game for oral questioning on the Citation Type Rating practical test.

Section III is titled Operating Procedures. This section contains three checklists, titled Emergency, Abnormal and Normal Procedures Checklists. The “BOXED” items are considered immediate action items, those that the pilot should be able to execute without consulting the checklist. In addition to their appearance in the AFM, the procedures in these checklists are typically printed on one or more durable, easily handled documents for use in the cockpit. The Normal, Abnormal and Emergency Checklists in the cockpit should be in agreement with those in the AFM. Like Limitations, the BOXED items of the Emergency Checklist are fair game on oral questions during the Citation Type Rating practical test.

By the way, checklists are best used to “check” that we have accomplished the necessary tasks, hence the name “checklist”. They are not intended to be do-lists and can be somewhat cumbersome when used as do-list. Most professional crews will “flow” the cockpit by memory and then “check” to make certain all items were accomplished, when workload permits. It is difficult to fly the airplane while simultaneously reading the book of instructions, especially during single pilot operations. During Initial training, it may be necessary to resort to a “read and do” operation, but the eventual goal should be to first “do” what needs to be done and then “check” to be sure nothing was missed when doing so will not distract from flying the airplane. If not used properly, checklist can actually become a distraction to flying the airplane, especially during single pilot operations.

Section IV is titled Performance, and it describes what the airplane is capable of from a performance point of view. This section is one of the most frequently used sections in the Flight Manual. This chapter begins with a compliance statement confirming that the aircraft performance data is based on FAR Part 25, commonly referred to as Transport Category. Notice that this is true of all Citations, regardless of whether they are certificated under Part 25, or as is the case with the Normal Category Citation 501 and 551, they are certificated under Part 23, or Normal Category. Unlike light Part 23 airplanes, all Citations must be flown only when conditions allow the airplane to meet transport category performance minimums. More on that later.

Later in Section IV, you will find discussions on the configurations and procedures followed when takeoff and landing data were being created, some definitions and discussion on noise characteristics. Familiarity with all of these definitions is suggested, but at least one of them deserve additional comment. Surprisingly, there is no Takeoff Field Length data provided for normal "all engines operating" departures. We do not have access to data telling us how much runway is consumed during a normal 2 engine takeoff. Published Takeoff Field Length is the longest of: The distance required to accelerate the airplane to V1 and stop: The distance required to accelerate the airplane to V1, frequently (and somewhat inaccurately) referred to as decision speed, suffer an engine failure and continue the takeoff and climb to 35 feet at V2 with one engine inoperative: or 115% of the distance required to depart normally and climb to 35 feet with both engines operating. The longest of these three distances will be published as Takeoff Field Length. We don't know which of these distances is published and we actually don't care. We just need to know that we have adequate runway for all of those possible outcomes.

Next in Section IV, a number of Standard Charts are presented. These very useful charts cover things like temperature, pressure, distance and fuel quantity conversion factors, International Standard Atmosphere, stall speeds as well as several others.

Then comes one of the more frequently used parts of the Performance Section, Takeoff Performance. This section begins with a discussion of Simplified Criteria, a set of conditions that cover the vast majority of the departure conditions that exist. Typical conditions that must prevail in order to use simplified criteria include: no obstacles, anti-ice selected "OFF", flaps set to Takeoff & Approach, at least 5000 (or 5200) feet of runway available, no tailwind and no runway gradient. Departure Airport Altitude is limited to either 5000 or 6000 feet pressure altitude, depending on model. Temperature limits will also apply. This criteria will provide you with default V speeds, which will typically be slightly above the actual V speeds you would find if you accessed specific performance tables applicable to prevailing conditions.

Next in the Performance Section, you will find a chapter outlining Procedures for use of Takeoff Tables. This may include procedures to follow in order to assure that brake cooling time is adequate in early 500 and 550 series airplanes equipped with the light Goodyear brakes. This chapter will include tables which show Maximum Takeoff Weight Permitted in order to assure that minimum climb gradient can be maintained if an engine were to fail after V1. It will present tables which present corrections to Decision Speed and Takeoff Distance if uphill or downhill runway gradients apply. In general, you would prefer to takeoff with flaps set to Takeoff & Approach on most Citations, unless the Maximum Weight Permitted by Climb Requirement table dictates a lesser flap takeoff. A zero flap (or Flaps 7) takeoff will require more runway but climb performance will be better in the clean configuration. Zero flap takeoffs are not documented for the Citation SII and V. Takeoff configuration options for those aircraft are Flaps 7 and Flaps 15, with the Flaps 7 option being most commonly used, since the runway savings is minor and the airplane climbs out much better during a flaps 7 takeoff.

Next comes the tables that provide Takeoff Field Length performance from Sea Level to 14,000 feet, with both takeoff flap options and with engine anti-ice selected to ON or OFF. These tables are presented at a wide range of temperatures and provide V speeds and resulting Takeoff Distances you can expect as a result. We typically will use these tables when one or more conditions in the Simplified Criteria table are not met.

Next, you will typically find a chapter showing “Single Engine Takeoff Flight Path Distances” in all takeoff configurations. It shows either the 3 or 4 climb-out segments used during flight tests data acquisition when the airplane was certified. Regardless of whether 3 or 4 segments were used, the most restrictive climb segment will typically be second segment. That is the segment that begins after gear retraction is complete, typically by 35 feet and continues to either 400 feet above the departure runway or in some cases, 1500 feet above. Minimum permitted engine out climb gradient during this segment is typically 2.4%, or 2.4

feet per hundred. The Maximum Takeoff Weight Permitted by Climb Requirements table described earlier, assure us that gradient can be met. Since Climb Gradient is not provided on any of the aircraft flight instruments, it is understandable that this 2.4% number in itself, doesn't provide the average pilot with much useful information. However, applying a little math can convert that performance index into a number we are more familiar with, "feet per minute" rate of climb. 2.4% is equal to 2.4 feet per hundred or 24 feet per thousand or approximately 150 feet per nautical mile. The target single engine climb-out speed during second segment is V2. Let's say V2 is published as 110 KIAS, which is pretty typical. In order to climb out at a 2.4% gradient at 110 knots in still air near sea level, the airplane must be capable of climbing at approximately 275 feet per minute, a number that is presented on the vertical speed indicator and a number most of us can relate to. Some of these Single Engine Takeoff Path Flight Distances can be somewhat eye opening. As an example, let's see how far we would have to travel, single engine, to get to pattern altitude after departing Flagstaff Arizona in a Citation 550 at 13,300 pounds on a 20 degree Centigrade, or 68 degree Fahrenheit day. At those conditions, we would just make second segment climb gradient with flaps set to 15 degrees, per our Maximum Weight Permitted by Climb Requirement table. Published takeoff distance required would be 6640 feet, V1 would be 105, Vr would be 107 and V2 would be 114. If we lost an engine after V1 however, it would require 105595 feet, over 17 miles to get to 1500 feet AGL!

If that 6640 feet published takeoff distance sounds a little longer than you were expecting, remember that published takeoff distance for a multiengine jet is different than it is in a light twin. The published takeoff distance for the entire Citation family, is the longest of:

Distance required to accelerate to V1 and stop,

Distance required to accelerate to V1, lose an engine and continue to 35 feet at V2 with one engine inoperative, or

115% of all engine takeoff distance to 35 feet, whichever is longest.

We do not have access to "all engine operating" takeoff distance in most multiengine civilian jets.

The next few tables presented are primarily supporting data for those performance parameters we just described. They present actual climb gradient during first and second segment at a variety of weights and temperature.

The final chapter in the Performance Section is titled Approach and Landing. This is where we go to look up published landing distance. It begins with a discussion of procedures to follow to utilize the data and then presents conditions that restrict landing under certain conditions, even if the aircraft is lighter than the published maximum landing weight. In some cases, brake heating may be a factor on early Citation I's & II's. For all models, there will be limitations on how heavy you can land at high altitude airports based on your ability to go around, both with an engine failed and with both engines operating normally. In other words, if the airplane doesn't have the performance to go around at any airport you plan on landing at, at current temperature, weight and altitude, you aren't authorized to go there. That information is presented in the "Maximum Weight Permitted by Climb Requirements" charts. In essence, the airplane has to be able to climb out at roughly a 3.2% climb gradient with both engines operating, flaps set to 15 degrees and gear UP and it must be able to climb out at about a 2.1% gradient with one engine inoperative, flaps set to 15 degrees and gear UP.

Section V is titled Supplements and it includes information on certain options that may or may not be installed on the airport and frequently includes information on operations under certain foreign, non-N registration entities.

Section VI is titled Weight & Balance and it contains aircraft specific weight, moment and arm information. The most recent weighing and calculated effect of additions & deletions should be presented in this section. Instructions on calculating weight and balance, showing station locations of seats and baggage areas, Weight & Balance forms used to compute Weight & Balance, and certain weight limitations ate typically included.

Section VII is the final section and it is titled Advisory Information. Information in this section is not necessarily supported by flight test data, but it may be the best source of information available to deal with certain conditions, such as wet or contaminated runways and standing water. Different "Types" of anti-icing and de-icing fluids are also typically covered in this section.

If you happen to notice that the AFM in your early Citation contains VIII sections, that's because Section V, originally labeled "APPENDIX" was originally included and later deleted on those early models.