

# STUDY UNIT ONE

## THE MULTI-ENGINE ADD-ON RATING

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### 1.1 INTRODUCTION

- A. Obtaining a multi-engine add-on rating is very challenging and exciting. As a multi-engine pilot, a new world will be opened up to you; you will be able to fly farther, faster, and higher than you have ever flown before!
- B. To become a multi-engine pilot, accomplish the following:
1. Learn as much as you can with this easy-to-use course.
  2. Complete the required flight training for your multi-engine add-on rating.
  3. Pass your FAA practical test.
- C. This study unit explains the requirements for a pilot who has an airplane—single-engine land rating to add a multi-engine land rating to his/her private or commercial pilot certificate.
1. Adding a multi-engine rating to your pilot certificate is tremendously rewarding.
    - a. Because you already know how to fly, the training is more like an aircraft checkout in a complex airplane than your initial private or commercial pilot training.
  2. There are two general approaches to obtain the multi-engine rating:
    - a. Your training can be completed in as little as two days at one of the high-volume, academy-style flight schools that specialize in accelerated training.
      - 1) These intensive schools conduct structured courses which emphasize the important aspects of multi-engine operations.
        - a) The training is directed toward your successful completion of the practical test.
        - b) After about 10 to 15 hr. of intense training, you will demonstrate what you have just learned for your examiner.
      - 2) This method will provide the rating, but you must remember that you are a low-time, inexperienced, multi-engine pilot.
        - a) Depending on your previous experience flying complex and high-performance airplanes, you may need several additional hours of dual instruction before you feel comfortable soloing in a multi-engine airplane.
      - 3) Most accelerated training schools do not rent their airplanes, other than for flight training purposes.
        - a) After earning your rating, you may be able to rent a multi-engine airplane from a nearby FBO or flight school.
        - b) The required check-out for a multi-engine rental may include more than several hours of dual work with a local instructor.

- c) Because the rental airplane may be of a different type than you earned your rating in, view this additional training as an opportunity to become familiar with feeling safe and comfortable in a new airplane as you log additional training time.
        - i) Insurance requirements may stipulate that you need to acquire a minimum number of hours as pilot in command of the make and model airplane you intend to rent before you can fly the airplane solo.
    - b. An alternative is to undergo training at a traditional flight school (e.g., your local FBO).
      - 1) This method may take longer and may be more expensive, but you may benefit from training in more familiar surroundings.
      - 2) Additionally, you will most likely complete your training in the same airplane that you may later want to rent.
        - a) Accordingly, you will save the time and expense of a checkout in a different make and model of multi-engine airplane.
    - c. You may also consider purchasing your own multi-engine airplane for training purposes.
      - 1) There are many advantages to owning your own multi-engine airplane, such as immediate familiarity with the exact location and function of each cockpit control, knowledge of your particular airplane's performance and handling characteristics, and having total control over airplane scheduling and maintenance.
        - a) Additionally, at the completion of your training, you will have an airplane to fly for personal or business reasons.
      - 2) Disadvantages of owning your own multi-engine airplane include the initial purchase cost, the expense of regular maintenance, and the difficulty of obtaining insurance without holding a multi-engine rating.
        - a) Still, for those pilots who can justify it, airplane ownership offers many rewards.
        - b) You may be able to offset some of the costs of ownership by making the airplane available for rental through your local FBO or flight school.
      - 3) Whether you obtain a new or used airplane, being comfortable and familiar with your aircraft will greatly help to ease the tension that you will naturally feel during your checkride.
- D. The following are some advantages of obtaining a multi-engine rating:
  - 1. **Multi-engine airplanes are larger and faster than single-engine airplanes.**
    - a. Aircraft manufacturers typically add a second engine to an aircraft design in order to increase range, speed, and payload.
      - 1) As the pilot of a multi-engine airplane, you will be able to fly farther, get to your destination faster, and carry a larger load.
    - b. With some exceptions, when you pass your multi-engine practical test, your pilot certificate will allow you to fly any multi-engine airplane that does not weigh more than 12,500 lb. and is not powered by a turbojet engine.
      - 1) In order to act as pilot in command of an aircraft having these characteristics, you must hold the appropriate type rating.

## 2. Multi-engine airplanes have redundant systems.

- a. One of the most obvious advantages of flying a multi-engine airplane is the availability of more than one engine should an engine failure occur, especially at night, in the clouds, or over rough terrain.
  - 1) It may be possible for a pilot to successfully complete a flight with one engine inoperative as long as (s)he
    - a) Understands what the airplane will and will not do with one engine inoperative under the existing conditions,
    - b) Has received proper training, and
    - c) Has maintained proficiency.
- b. In addition to the availability of more than one engine, most multi-engine airplanes also have redundant safeguards built into their electrical systems, vacuum systems, hydraulic systems, and pressurization systems (if equipped).
  - 1) Again, it is imperative for the pilot of a multi-engine airplane to thoroughly understand the limitations of each redundant system and take care not to exceed those limitations in the event of a partial system failure.
    - a) Exceeding the limitations of the redundant system could lead to total (instead of partial) loss of the affected system.

## 3. Multi-engine airplanes have advanced systems.

- a. The improved load-carrying ability obtained by adding a second engine allows many multi-engine airplanes to handle the weight of advanced systems, such as weather radar, de-icing equipment, and pressurization.
- b. These systems allow the airplane to be safely operated over a wider range of altitudes and weather conditions than simpler airplanes, **provided** they are operated competently by a knowledgeable pilot who exercises good judgment.

## 4. Your insurance rates may decrease.

- a. Because it is not possible for an insurance representative to fly with each pilot being insured, insurance companies normally assess a pilot's level of risk based on his/her flight experience and his/her certificates and ratings.
- b. Obtaining a new aircraft rating is generally interpreted to mean that your experience level and competence as a pilot have increased
  - 1) This could result in lower insurance premiums for all airplanes that you fly (i.e., your single-engine insurance rates will probably decrease even if you do not immediately begin regularly flying multi-engine airplanes).

## 5. Your job options and opportunities to gain flight experience will increase.

- a. Most professional pilots will find it necessary to hold a commercial multi-engine rating fairly early in their careers.
  - 1) This is because most types of professional flying (outside of flight instruction) are conducted in multi-engine airplanes.
  - 2) In order to move into a higher-paying aviation job, you will therefore need to hold a multi-engine rating on your commercial pilot certificate.
- b. In addition to the need to be legally qualified for a job flying multi-engine airplanes, you will need to have the appropriate flight experience sought by the employer.
  - 1) Charter companies and airlines generally emphasize multi-engine flight time when considering applicants
  - 2) Therefore, it is important for prospective career pilots to obtain as much multi-engine flight experience as possible.

- c. Even if you only have a multi-engine rating on your private pilot certificate, you will be able to begin building valuable pilot in command flight time in multi-engine airplanes.
  - 1) To build time, you may be able to take advantage of a variety of opportunities including
    - a) Acting as a safety pilot,
    - b) Acting as a required second in command, or
    - c) Alternating pilot in command duties with another pilot on a long trip.

## 1.2 FAA REQUIREMENTS FOR THE MULTI-ENGINE RATING

- A. 14 CFR Sec. 61.63, *Additional Aircraft Ratings*, regulates the addition of aircraft category, class, and type ratings to an existing pilot certificate.
  - 1. An aircraft **category** is a broad classification of aircraft (airplane, rotorcraft, glider, and lighter-than-air).
  - 2. An aircraft **class** is a group of aircraft within a category having similar operating characteristics (e.g., single-engine, multi-engine, land, sea).
  - 3. An aircraft **type** is a specific make and basic model of aircraft (e.g., B727, C172, PA44).
  - 4. EXAMPLE: When you successfully complete your multi-engine practical test, your pilot certificate will bear the category and class rating, "Airplane–Multi-Engine Land."
- B. If you already hold an airplane category rating (e.g., airplane–single-engine land) on your pilot certificate, obtaining a multi-engine rating is relatively simple.
  - 1. You must train with a flight instructor until you are proficient in all of the required maneuvers and procedures specified in the FAA *Practical Test Standards*.
    - a. This training need only continue until you are proficient; there is no minimum training time requirement other than the 3 hr. of flight training within the 60 days preceding any practical test.
  - 2. You must receive the following instructor endorsements stating that you are ready for the practical test:
    - a. **Completion of Prerequisites for a Practical Test: § 61.39(a)(6)**

I have given Mr./Ms. \_\_\_\_\_ (First Name, MI, Last Name) flight instruction in preparation for a (private/commercial) pilot multi-engine rating practical test within the preceding 60 days and find him/her competent to pass the test.

Signed \_\_\_\_\_ Date \_\_\_\_\_ CFI # \_\_\_\_\_ Exp. Date \_\_\_\_\_
    - b. **Additional aircraft class rating: § 61.63 (c)**

I certify that Mr./Ms. \_\_\_\_\_ (First Name, MI, Last Name, pilot certificate, certificate number), has received the required training for an additional airplane class rating. I have determined that he/she is prepared for the (private/commercial) pilot practical test for the addition of an airplane-multi-engine land rating.

Signed \_\_\_\_\_ Date \_\_\_\_\_ CFI # \_\_\_\_\_ Exp. Date \_\_\_\_\_
  - 3. You must pass a practical test administered by an FAA inspector or an FAA-designated examiner (collectively referred to throughout this course as "examiner").
    - a. There is no knowledge (written) test required when adding a multi-engine rating to your existing private or commercial pilot certificate.

### 1.3 HOW TO GET STARTED

- A. Call the FBOs and flight schools in your area and find those that offer multi-engine training (not all flight schools do). Try to arrange a meeting with the multi-engine instructors (MEIs) who conduct training at these schools in order to discuss the following points:
1. **Accelerated Training or Conventional Instruction.** Some schools offer an accelerated program of very intense instruction which will get you the rating for a predetermined fee in 1 or 2 days.
    - a. The training is usually structured as an extended practice session in preparation for your practical test.
    - b. Conventional instruction, though typically slower and more costly, will give you more time to understand the theory and procedures behind multi-engine flying, obtain more experience, and gain confidence before your practical test.
  2. **Number of Hours.** The training time required to obtain a multi-engine rating varies from school to school, syllabus to syllabus, instructor to instructor, and pilot to pilot.
    - a. Most training courses range from approximately 6 to 20 hrs. In some cases you could fly more than 20 hrs.
      - 1) You should select a course that offers the best compromise between proficiency and practicality for your budget.
      - 2) Multi-engine training time is expensive. When evaluating your training options, it is essential that you select a program that will prepare you adequately so you can confidently and safely operate the aircraft.
        - a) **EXAMPLE:** If you do not feel comfortable flying a multi-engine airplane by yourself after completing your training course, you may never use your new rating after the practical test.
          - i) As a result, all of the time and money you invested to obtain the rating will have been wasted.
          - ii) It would make more sense to spend a little extra time and money to become comfortable with the airplane before taking the practical test.
    3. **Training Syllabus.** Look at each school's multi-engine training syllabus. Many schools use commercially-developed syllabi.
    4. **Ground School.** This course can be regarded as your complete multi-engine ground school.
      - a. With the exception of learning elements related to your specific make and model of training airplane, which should be accomplished by studying your POH and through discussions with your CFI, completion of this course will provide all of the essential ground school knowledge for you to obtain your multi-engine rating.
    5. **Examiner Availability.** This factor can have a major effect on the total cost of the training program.
      - a. If a flight school has examining authority, or if an examiner can conduct the practical test at the school's home airport, it is usually convenient to complete the course and take your practical test.
        - 1) However, if you must travel to another airport to meet an examiner, be aware that you will incur the extra cost of flying the airplane and your instructor to the examiner.
      - b. Another issue is the schedule availability of the examiner(s).
        - 1) If you have to wait several days to take your practical test, you risk losing proficiency.

- B. The next step is to prepare a written time and expense budget (see example below). This step will help you to map out a schedule of the course and the expected costs.
  - 1. Enter into a firm agreement with the school regarding how you are going to pay for the course **before** you begin.
    - a. It is very disheartening to run out of money before completing your training.
    - b. When you are ready to begin again, you will have to spend additional time and money to regain the level of proficiency you had already developed.
  - 2. Many FBOs and flight schools can help you to obtain financing, if needed.

Time and Expenditure Budget

Hours of Dual at \$ _____ per hour × Number of hours	\$ _____
Flight test (examiner)	\$ _____
Flight test (airplane)	\$ _____
This course	\$ 29.95
Pilot’s Operating Handbook (POH)	\$ _____
Other	\$ _____
TOTAL	\$ _____

- C. If you are unable to find training at your local airport or if you are interested in obtaining accelerated training, you can search for multi-engine training programs in aviation periodicals such as *Aero-Trader*, *AOPA Pilot*, *Flying*, *Plane & Pilot*, *Private Pilot*, and *Trade-A-Plane*.
  - 1. Call the schools you are considering to obtain course descriptions, syllabi, schedules, airplane descriptions, examiner availability, etc.
- D. After you select a flight school, you will need to determine the make and model of airplane in which you will conduct your training. The flight school may have only one multi-engine airplane available for training, or they may offer several options.
  - 1. As soon as you can, obtain a copy of the Pilot’s Operating Handbook (POH) for the airplane that you will be flying so you can begin studying information that is specific to that airplane.
    - a. If you have difficulty obtaining a POH for the airplane that you know you will be using for multi-engine training, contact [Essco Inc.](http://www.essco.com), who specialize in aircraft POHs.
  - 2. Manufacturers who are issued an aircraft type certificate are required to provide a POH with each new airplane.
    - a. The POH that comes with a new airplane is considered to be an FAA-Approved Airplane Flight Manual.
    - b. The POH that you can buy from your FBO or flight school is technically called an Information Manual.
      - 1) The difference is
        - a) An **FAA-Approved Airplane Flight Manual** is specific to one particular airplane and its equipment, and is required to be kept current if any changes are made (e.g., to avionics or to the basic empty weight), but
        - b) An **Information Manual** is generic to all examples of a particular airplane make and model, and is not required to be kept current.
      - 2) Unless otherwise noted, both types of manuals are collectively referred to throughout this course as Pilot’s Operating Handbooks (POHs).

- c. A typical POH will have the following nine sections (in numerical order):
  - 1) **General.** This section contains a basic description of the airplane.
  - 2) **Limitations.** This section describes the airplane's operating limitations.
  - 3) **Emergency Procedures.** This section describes what to do in a variety of emergency situations.
  - 4) **Normal Procedures.** This section contains checklists and descriptions of normal operations.
  - 5) **Performance.** This section contains graphs and tables that describe the airplane's capabilities under a variety of conditions.
  - 6) **Weight and Balance.** This section contains tables or graphs that can be used to determine that the airplane is properly loaded for flight.
    - a) In an FAA-Approved Airplane Flight Manual, this section will also contain the airplane's basic empty weight, and an equipment list showing the weight and location of each piece of equipment that is installed in the airplane.
  - 7) **Airplane and Systems Description.** This section describes the function and operation of each aircraft system.
  - 8) **Servicing and Maintenance.** This section describes aircraft servicing and preventative maintenance that can be accomplished by (or with the supervision of) the pilot.
  - 9) **Supplements.** This section describes optional equipment that was available at the time of the airplane's manufacture, regardless of whether it has been installed.
    - a) In an FAA-Approved Airplane Flight Manual, this section describes the optional equipment that is actually installed in the airplane.
3. Note that this course deals with multi-engine concepts and procedures in general; it is NOT make and model specific.
  - a. We periodically refer to the Piper Seminole, Beechcraft Duchess, and Cessna 310 as examples of common multi-engine airplanes, but information about your training airplane must be obtained from the specific model's POH. Obtain a copy as soon as possible. The sooner you have a copy of the POH, the sooner you can begin learning about the airplane that you will use for training and the practical test.
    - 1) You and your instructor are responsible for covering the systems and procedures that are specific to your airplane.

#### 1.4 EXPERIENCE IN COMPLEX AND HIGH-PERFORMANCE AIRPLANES

- A. We recommend that you already have experience in complex, high-performance single-engine airplanes before beginning your multi-engine training.
  1. Virtually all multi-engine airplanes are complex; i.e., they have constant-speed propellers, flaps, and retractable landing gear.
    - a. The operation of these systems is fundamentally the same regardless of the number of engines an airplane has.
    - b. Knowing how to use these systems before beginning your multi-engine training will simplify your learning task by allowing you to focus your efforts on the concepts and procedures that are specific to multi-engine airplanes.

2. With both engines operating, most multi-engine airplanes have climb and cruise performance that equals or exceeds that of high-performance single-engine airplanes, i.e., airplanes having an engine of more than 200 horsepower.
  - a. This is true even if the multi-engine airplane does not technically qualify as “high-performance,” i.e., neither engine produces more than 200 horsepower.
  - b. The following popular multi-engine training airplanes are examples of airplanes that do not meet the technical definition of a high-performance airplane, but still offer “high” performance with both engines operating:
    - 1) Piper Seminole
    - 2) Piper Apache
    - 3) Early Piper Senecas
    - 4) Beechcraft Duchess
    - 5) Beechcraft Travel-Air
- B. If you begin your multi-engine training without already having some experience in complex and high-performance airplanes, you should expect to spend up to 10 extra hours learning and mastering procedures for such airplanes.

## 1.5 PRIVATE VS. COMMERCIAL PILOT PRIVILEGES

- A. Most pilots treat the multi-engine rating strictly as an “add-on” rating to their existing pilot certificate.
  1. This means that the appropriate grade of multi-engine rating (i.e., private or commercial) is added after obtaining a private or commercial pilot certificate with a single-engine rating.
- B. You are not required to pursue your multi-engine training exclusively as an add-on rating for your existing certificate, however.
  1. If you hold a commercial pilot certificate, you have two options:
    - a. **Private pilot add-on.** You can be tested according to the *Private Pilot Practical Test Standard* for an add-on rating if you are only interested in flying multi-engine airplanes for personal reasons.
      - 1) This practical test is slightly less rigorous than the commercial pilot test, so less time (and thus, money) may be required to prepare for it.
      - 2) However, your multi-engine rating will be limited to “private pilot privileges only.”
        - a) If you later wish to obtain full commercial pilot privileges for multi-engine airplanes, you will need to pass an additional practical test.
    - b. **Commercial pilot add-on.** You can be tested according to the *Commercial Pilot Practical Test Standard* for an add-on rating in order to obtain full commercial pilot privileges for multi-engine airplanes.
      - 1) This test is somewhat more stringent than the private pilot test.
        - a) Thus, a multi-engine rating with commercial pilot privileges is a better rating from an insurance company’s point of view and will be required by a potential employer.
        - b) If you hold a commercial pilot certificate, we **strongly** recommend that you take the commercial practical test.

2. If you hold a private pilot certificate, you have several options:
  - a. **Private pilot add-on.** You can be tested according to the *Private Pilot Practical Test Standards* if
    - 1) You are only interested in flying multi-engine airplanes for personal reasons, or
    - 2) You are a low-time private pilot with career aspirations, and you want to begin building multi-engine pilot in command time.
  - b. **Initially obtain your commercial pilot certificate in a multi-engine airplane.** You can be tested according to the *Commercial Pilot Practical Test Standards* if you wish to obtain a commercial pilot certificate.
    - 1) This approach will require considerably more time and money than simply adding a multi-engine rating with private privileges, but you will obtain a commercial pilot certificate in the process.
      - a) You will be limited to private pilot privileges in single-engine airplanes until you pass a practical test to add single-engine privileges to your commercial pilot certificate.
    - 2) You will also be required to pass the FAA commercial pilot knowledge test before taking your practical test.
      - a) You can use Gleim's *Commercial Pilot FAA Knowledge Test* book, *FAA Test Prep* CD-Rom, or *Online Ground School* to prepare for your commercial pilot knowledge test.
  - c. **Initially obtain your commercial pilot certificate in a single-engine airplane; then add the multi-engine rating.** If you wish to obtain a commercial pilot certificate, you can
    - 1) First, be tested for single-engine privileges according to the *Commercial Pilot Practical Test Standards*.
      - a) You will be required to pass the FAA commercial pilot knowledge test before taking the practical test.
      - b) You can use Gleim's *Commercial Pilot FAA Knowledge Test* and *Commercial Pilot Flight Maneuvers and Practical Test Prep* books to prepare for your commercial pilot knowledge test and your single-engine commercial pilot practical test.
        - i) Gleim's *FAA Test Prep* CD-Rom or *Online Ground School* can also be used to prepare for the commercial pilot knowledge test.
    - 2) Then, be tested for multi-engine privileges as an add-on rating, also according to *Commercial Pilot Practical Test Standards*.
    - 3) This approach is something of a cost compromise between obtaining a multi-engine rating that is limited to private pilot privileges and initially obtaining your commercial pilot certificate in a multi-engine airplane. It is the preferred sequence for pilots who plan to obtain commercial pilot certificates with single- and multi-engine ratings.
      - a) This is because your multi-engine training and practical test will take less time (and thus, money) if you already have a single-engine commercial pilot certificate.
        - i) Fewer prerequisites must be met for an add-on rating than for an initial pilot certificate.
        - ii) Thus, meeting the initial requirements for obtaining a commercial pilot certificate in a single-engine airplane will save you money by allowing you to spend minimum training time in the costlier multi-engine airplane.

- C. Note that, if you intend to get an instrument rating, you will save money by obtaining your instrument rating before obtaining a commercial pilot certificate or a multi-engine rating, for reasons explained in the next subunit.
- D. The practical test tasks used for the commercial and private pilot multi-engine add-on ratings are identical.
  - 1. The practical test for each add-on rating consists of 27 tasks that must be successfully completed.
    - a. Two of these 27 tasks are optional pertaining only to pilots who wish to extend their instrument flying privileges to multi-engine airplanes.
    - b. Commercial pilot applicants will be held to tighter tolerances on altitudes, airspeeds, and headings.

- 2. The 27 required tasks are listed below.

AREAS OF OPERATION:

I. PREFLIGHT PREPARATION

- F. Performance and Limitations
- G. Operation of Systems
- H. Principles of Flight—Engine Inoperative

II. PREFLIGHT PROCEDURES

- A. Preflight Inspection
- B. Cockpit Management
- C. Engine Starting
- D. Taxiing
- F. Before Takeoff Check

IV. TAKEOFFS, LANDINGS, AND GO-AROUNDS

- A. Normal and Crosswind Takeoff and Climb
- B. Normal and Crosswind Approach and Landing
- C. Short-Field Takeoff and Maximum Performance Climb
- D. Short-Field Approach and Landing

V. PERFORMANCE MANEUVER

- A. Steep Turns

VII. SLOW FLIGHT AND STALLS

- A. Maneuvering During Slow Flight
- B. Power-off Stalls
- C. Power-on Stalls
- D. Spin Awareness

VIII. EMERGENCY OPERATIONS

- A. Emergency Descent
- B. Engine Failure During Takeoff Before  $V_{MC}$
- C. Engine Failure After Liftoff
- D. Approach and Landing with an Engine Inoperative
- E. Systems and Equipment Malfunctions
- F. Emergency Equipment and Survival Gear

X. MULTI-ENGINE OPERATIONS

- A. Maneuvering with One Engine Inoperative
- B.  $V_{MC}$  Demonstration
- C. Engine Failure During Flight (by reference to instruments)
- D. Instrument Approach—One Engine Inoperative (by reference to instruments)

## PRIVATE VS. COMMERCIAL PILOT MULTI-ENGINE ADD-ON RATING TASKS

NOTE: Of the 27 tasks required for the private and commercial pilot multi-engine add-on rating FAA practical tests, the following 12 tasks have slight differences, as explained below.

Task	Private Pilot	Commercial Pilot
Operation of Systems	Explain 3 Systems (minimum)	Explain 5 Systems (minimum)
Normal and Crosswind Takeoff and Climb	$V_Y +10/-5$ kt.	$V_Y +/-5$ kt.
Normal and Crosswind Approach and Landing	$1.3 V_{SO} +10/-5$ kt. Touchdown within 400 ft. of a specified point.	$1.3 V_{SO} +/-5$ kt. Touchdown within 200 ft. of a specified point.
Short-Field Takeoff and Max-Performance Climb	$V_X$ and $V_Y +10/-5$ kt.	$V_X +5/-0$ kt. $V_Y +/-5$ kt.
Short-Field Approach and Landing	$1.3 V_{SO} +10/-5$ kt. Touchdown within 200 ft. of a specified point.	$1.3 V_{SO} +/-5$ kt. Touchdown within 100 ft. of a specified point.
Steep Turns	Heading $+/-10^\circ$ . Altitude $+/-100$ ft. Airspeed $+/-10$ kt. Bank $45^\circ +/-5^\circ$ . Turns to both the left and right.	Heading $+/-10^\circ$ . Altitude $+/-100$ ft. Minimum bank $50^\circ +/-5^\circ$ . Roll from one turn directly into another in the opposite direction.
Maneuvering During Slow Flight	Altitude $+/-100$ ft. Airspeed $+10/-0$ kt. Heading $+/-10^\circ$ Bank $+/-10^\circ$	Altitude $+/-50$ ft. Airspeed $+5/-0$ kt. Heading $+/-10^\circ$ Bank $+/-5^\circ$
Power-Off Stalls	Bank not to exceed $20^\circ +/-10^\circ$ Recover after stall occurs. Maintain heading $+/-10^\circ$	Bank not to exceed $20^\circ +/-5^\circ$ Recover as stall occurs. Maintain heading $+/-10^\circ$
Power-On Stalls	Bank not to exceed $20^\circ +/-10^\circ$ Recover after stall occurs. Maintain heading $+/-10^\circ$	Bank not to exceed $20^\circ +/-10^\circ$ Recover as stall occurs. Maintain heading $+/-5^\circ$
Approach and Landing with One Engine Inop.	Approach speed $+10/-5$ kt.	Approach speed $+/-5$ kt.
Systems and Equipment Malfunction	Know and take appropriate action on a minimum of 3 systems.	Know and take action on a minimum of 5 systems.
$V_{MC}$ Demonstration	Accelerate to $V_{XSE}$ or $V_{YSE} +10/-5$ kt. during recovery.	Accelerate to $V_{XSE}$ or $V_{YSE} +/-5$ kt. during recovery.

## 1.6 IFR VS. VFR-ONLY PRIVILEGES

- A. The tasks you will be required to perform on your multi-engine rating practical exam will depend in part on what privileges and limitations your current pilot certificate gives you.
1. If you hold a private or commercial pilot certificate without an instrument rating, you may add a multi-engine rating to your pilot certificate.
    - a. Without an instrument rating, your private pilot certificate will carry the limitation, "VFR Only."
      - 1) If you were to add a single-engine instrument rating to your private pilot certificate, you would need to demonstrate two tasks in a multi-engine airplane to remove the "Airplane Multi-Engine VFR Only" limitation from your certificate.
        - a) These tasks both involve flight by reference to instruments. They are:
          - i) One Engine Inoperative During Straight-and-Level Flight and Turns
          - ii) One Engine Inoperative – Instrument Approach

- b. Without an instrument rating, your commercial pilot certificate will carry the limitation, “The carriage of passengers for hire in airplanes on cross-country flights in excess of 50 nautical miles or at night is prohibited.”
          - 1) If you were to add a single-engine instrument rating to your existing commercial pilot certificate, you would need to demonstrate the same two tasks listed above to remove the “Airplane Multi-Engine VFR Only” limitation from your certificate.
  - 2. With either a private or commercial pilot certificate, you may add a multi-engine airplane instrument rating without first adding an instrument rating to your single-engine pilot certificate.
    - a. In this case, you would be compelled to complete all the tasks indicated for the rating addition in the Instrument Rating Practical Test Standard.
- B. If you hold a private or commercial single-engine pilot certificate with an instrument rating at the time you seek a multi-engine add-on rating, you will be required during your practical test to demonstrate both of the multi-engine instrument tasks mentioned above.
- 1. The completion of these two tasks will extend your instrument pilot privileges to your multi-engine pilot certificate.
  - 2. Gleim recommends that pilots earn a single-engine instrument rating prior to adding on a multi-engine instrument rating in order to
    - a. Reduce training costs
    - b. Reduce training time
    - c. Reduce the complexity and potential frustration of training flights

## 1.7 FEDERAL REGULATIONS RELEVANT TO MULTI-ENGINE OPERATIONS

- A. All of 14 CFR Parts 1, 61, and 91 are relevant to you as a pilot, and you are required to know and comply with the relevant sections.
- 1. The sections most relevant to multi-engine flying are 14 CFR Sections 1.1, 1.2, 61.39, 61.55, 61.57, 91.117, 91.205, and 91.213.
  - 2. These sections are summarized below and on the next four pages. In addition to this summary, you should have a current Gleim *FAR/AIM* to refer to as necessary. You can order one now by clicking [here](#).
- B. **14 CFR Section 1.1—Definitions**
- 1. **Class.** Aircraft within a category (e.g., airplanes) having similar operational characteristics, such as single-engine, multi-engine, land, sea, etc.
    - a. The definition is relevant to pilot certification, ratings, and limitations.
  - 2. **Critical Engine.** The engine whose failure would most adversely affect the controllability and performance of an aircraft.
    - a. On most light twins, the left engine is the critical engine.
    - b. If the engines rotate in opposite directions (counter-rotating), as on the Piper Seminole, there is no critical engine.
  - 3. **Pilot in Command.** The pilot responsible for the operation and safety of an aircraft.
    - a. Unlike single-engine aircraft, many large multi-engine airplanes require a PIC (pilot in command) and an SIC (second in command) to operate the aircraft (e.g., due to FARs, insurance requirements, or company policies).
  - 4. **Rated Takeoff Power.** The approved horsepower that is developed under standard sea-level conditions, within the engine operating limitations, and limited in use to periods of not over 5 minutes for takeoff operation.

5. **Rated Maximum Continuous Power.** The approved horsepower that is developed in standard atmosphere at a specified altitude, within the engine operating limitations, and approved for unrestricted periods of use.
  6. **Rating.** Part of an Airman Certificate which sets forth special conditions, privileges, or limitations, e.g., instrument or multi-engine airplane ratings added to an existing private or commercial pilot certificate.
  7. **Stopway.** An area beyond the takeoff runway that is no narrower than the runway; centered upon the extended centerline of the runway; able to support the airplane during an aborted takeoff, without causing structural damage to the airplane; and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff.
- C. **14 CFR Section 1.2 – Abbreviations and symbols.** The following abbreviations and symbols are specifically related to the operation of a light twin with one engine inoperative.
1. **V<sub>MC</sub>:** Minimum control speed with the critical engine inoperative.
    - a. This airspeed is shown on the airspeed indicator by a red radial line.
  2. **V<sub>LOF</sub>:** Liftoff speed; i.e., the speed at which the airplane transitions from the ground to flight.
  3. **V<sub>YSE</sub>:** Single-engine best rate-of-climb speed.
    - a. This airspeed is shown on the airspeed indicator by a blue radial line.
  4. **V<sub>XSE</sub>:** Single-engine best angle-of-climb speed.
  5. **V<sub>SSE</sub>:** Safe single-engine speed.
    - a. This is the minimum airspeed at which intentional engine failures and single-engine operations should be conducted while training.
  6. Additionally, the following standard airspeeds applicable to single-engine airplanes are also applicable to twins: V<sub>SO</sub>, V<sub>S1</sub>, V<sub>X</sub>, V<sub>Y</sub>, V<sub>A</sub>, V<sub>NO</sub>, V<sub>NE</sub>, V<sub>R</sub>, V<sub>LE</sub>, V<sub>LO</sub>, V<sub>FE</sub>, V<sub>FO</sub>.
- D. **14 CFR Section 61.39 – Prerequisites for Practical Tests**
1. To be eligible for a flight test for additional rating issued under Part 61 (e.g., an additional aircraft category, aircraft class, or instrument rating), the applicant must:
    - a. Have passed the required knowledge test within the preceding 24 calendar months
      - 1) This requirement is not applicable to multi-engine add-on ratings.
    - b. Have received the required flight and ground training, and obtained the necessary aeronautical experience.
    - c. Hold at least a third-class medical certificate.
    - d. Meet the minimum age requirements of the rating.
    - e. Have an endorsement from an authorized instructor who certifies that (s)he has given the applicant flight instruction in preparation for the flight test within the preceding 60 days and finds him/her competent to pass the test.
    - f. Have a completed and signed FAA Form 8710-1, Airman Certificate or Rating Application.
- E. **14 CFR Section 61.57 - Recent Flight Experience: Pilot-in-Command.** No person may act as a pilot in command of an aircraft unless (s)he has met each of the following requirements:
1. Within the preceding 24 calendar months, accomplished a flight review, or passed a pilot proficiency check conducted by an examiner, an approved pilot check airman, or a U.S. Armed Force, for a pilot certificate, rating, or operating privilege.

2. Within the preceding 90 days, made three takeoffs and landings as the sole manipulator of the controls in the same category, class, and, if a type rating is required, type of aircraft (in order to carry passengers).
  - a. Thus, this requirement must be met separately in both single- and multi-engine airplanes.
3. Within the preceding 90 days, made three takeoffs and landings to a full stop at night as the sole manipulator of the controls in the same category, class, and, if a type rating is required, type of aircraft (in order to carry passengers at night).
4. Within the preceding 6 calendar months, performed at least 6 instrument approaches, holding procedures, and intercepting and tracking courses through the use of navigation systems, under actual or simulated instrument conditions (to act as PIC under IFR).

**F. 14 CFR Section 91.117 – Aircraft Speed**

1. No person may operate an aircraft below 10,000 ft. MSL at an indicated airspeed of more than 250 kt., unless authorized by ATC.
2. No person may operate an aircraft within 4 NM of the primary airport of a Class D or C airspace at an indicated airspeed of more than 200 kt.
3. No person may operate an aircraft in the airspace underlying Class B airspace or in a VFR corridor through Class B airspace at an indicated airspeed of more than 200 kt.

**G. 14 CFR Section 91.205 – Powered Civil Aircraft with Standard Category U.S. Airworthiness Certificates: Instrument and Equipment Requirements.**

1. No person may operate a powered civil aircraft with a standard category U.S. airworthiness certificate without the specified operable instruments and equipment.
2. The following instruments and equipment are required under the specified conditions:
  - a. **VFR - Day**
    - 1) Airspeed indicator
    - 2) Altimeter
    - 3) Magnetic direction indicator (compass)
    - 4) Tachometer for each engine
    - 5) Oil pressure gauge for each engine using a pressure system
    - 6) Temperature gauge for each liquid-cooled engine
    - 7) Oil temperature gauge for each air-cooled engine
    - 8) Manifold pressure gauge for each altitude engine
    - 9) Fuel gauge indicating the quantity of fuel in each tank
    - 10) Landing gear position indicator, if the aircraft has a retractable landing gear
    - 11) For small airplanes certificated after March 11, 1996, an approved anticollision light system
    - 12) Approved flotation gear for each occupant and one pyrotechnic signaling device if the aircraft is operated for hire over water beyond power-off gliding distance from shore
    - 13) Approved safety belt with approved metal-to-metal latching device for each occupant who is 2 yr. of age or older
    - 14) For small civil airplanes manufactured after July 18, 1978, an approved shoulder harness for each front seat
    - 15) An emergency locator transmitter (ELT), if required by FAR 91.207
    - 16) For normal, utility, and acrobatic category airplanes with a seating configuration, excluding pilot seats, of nine or less, manufactured after December 12, 1986, a shoulder harness for each seat in the airplane

b. **VFR - Night**

- 1) All equipment listed in item 2.a. on the previous page.
- 2) Approved position (navigation) lights
- 3) Approved aviation red or white anticollision light system on all U.S.-registered civil aircraft
- 4) If the aircraft is operated for hire, one electric landing light
- 5) An adequate source of electricity for all electrical and radio equipment
- 6) A set of spare fuses or three spare fuses for each kind required which are accessible to the pilot in flight

c. **IFR - Day and Night**

- 1) All instruments and equipment listed in item 2.a. and, if the flight is to be conducted at night, item 2.b. above.
- 2) Two-way radio communications and navigational equipment appropriate to the available ground facilities.
- 3) Gyroscopic rate-of-turn indicator, except on certain aircraft as defined by FAR 91.205 (d)(3)(i).
- 4) Slip-skid indicator.
- 5) Sensitive altimeter adjustable for barometric pressure.
- 6) Clock displaying hours, minutes, and seconds.
- 7) Electrical generator of adequate capacity.
- 8) Gyroscopic bank and pitch indicator (artificial horizon).
- 9) Gyroscopic direction indicator (directional gyro).
- 10) Flight above 24,000 ft. MSL requires distance measuring equipment (DME).

H. **14 CFR Section 91.213 – Inoperative Instruments and Equipment.** No person may take off in an aircraft with inoperable instruments or equipment installed unless:

1. An approved minimum equipment list (MEL) exists for that specific aircraft. Note that an MEL is a list of equipment that does NOT have to be operable.
  - a. The MEL lists any limitations placed upon the operation of the aircraft for each piece of inoperative equipment; e.g., the airplane cannot be operated at night without a landing light.
2. The aircraft has within it a letter of authorization, issued by the FAA FSDO in the area where the operator is based, authorizing operation of the aircraft under the minimum equipment list.
  - a. The MEL and authorization letter constitute an STC (supplemental type certificate) for the aircraft.
    - 1) The approved MEL must:
      - a) Be prepared in accordance with specified limitations.
      - b) Provide guidance as to how the aircraft is to be operated with the instruments and equipment in an inoperable condition.
    - 2) The aircraft must be operated under all applicable conditions and limitations contained in the MEL.
  - b. The following instruments and equipment may NOT be included in an MEL:
    - 1) Instruments and equipment that are specifically or otherwise required by the airworthiness requirements under which the aircraft is type-certificated and which are essential to the safe operation of the aircraft.
    - 2) Instruments and equipment required by an Airworthiness Directive.
    - 3) Instruments and equipment required for operations by the FARs.
  - c. Persons with MELs per FARs 121, 125, or 135 shall use them.

3. Except when operating an aircraft that has an MEL as described on the previous page, a person may take off with inoperative equipment in an aircraft that has NO MEL if:
  - a. An FAA Master MEL (MMEL) has not been developed by the FAA, and the inoperative equipment is not required by the aircraft manufacturer's equipment list, any other FARs, ADs, etc.
  - b. An FAA MMEL exists, and the inoperative equipment is not required by the MMEL, the aircraft manufacturer's equipment list, any other FARs, ADs, etc.
  - c. The pilot or an appropriate maintenance person determines that the inoperative equipment does not constitute a hazard to the intended operation.
  - d. The inoperative equipment is removed, or deactivated and placarded "inoperative."
    - 1) In this case, the aircraft is deemed to be in a "properly altered condition" by the FAA.