



# THE COMPLETE **MULTI-ENGINE** **PILOT SYLLABUS**



**FIFTH EDITION**

Bob Gardner

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**ASA-MPT-S-PD**

# Multi-Engine Rating Syllabus

Appendix A from *The Complete Multi-Engine Pilot* textbook

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## ENROLLMENT PREREQUISITES

The student must be able to read, speak, write, and understand the English language and must possess a valid Private, Commercial, or ATP certificate with instrument, single-engine, land ratings, and a third-class medical certificate (or higher) prior to enrollment.

## TRAINING COURSE OBJECTIVES

The student will obtain the aeronautical skill and knowledge necessary to meet the requirements of a Private, Commercial, or ATP certificate (depending upon the certificate held at time of enrollment), with an airplane category, instrument rating, and multi-engine land class rating.

## COURSE COMPLETION STANDARDS

The student will demonstrate, by way of a flight and written test, the aeronautical skill and knowledge necessary to obtain a Private, Commercial, or ATP certificate (depending upon the certificate held at time of enrollment), with an airplane category, instrument rating, and a multi-engine land class rating. Each task in each area of operation in the *Airman Certification Standards* (ACS) will have been accomplished by the student. The instructor will not proceed to the next lesson until the student is able to explain and/or demonstrate the elements of the procedure or maneuver as required by the ACS.

## Recommended Materials for the Multi-Engine Rating

- *The Complete Multi-Engine Pilot*, by Bob Gardner (ASA-MPT)
- FAA *Airman Certification Standard* ([www.faa.gov](http://www.faa.gov))
- *FAR/AIM* (ASA-FR-AM-BK, published annually)
- *Multi-Engine Oral Exam Guide*, by Michael Hayes (ASA-OEG-ME)

## TRAINING SYLLABUS

The FAA does not require a specified amount of experience to obtain a multi-engine rating. Hours shown for each lesson for flight training, preflight briefing, and post-flight critique are offered as a guide to the instructor. Time used for an individual lesson may be adjusted to the student's needs. The instructor is responsible for ensuring all requirements are met. Points at which normal student progress should meet the requirements of the *Airman Certification Standards* for a task in an area of operation will include a note indicating this, listed under the Skills.

## MULTI-ENGINE RATING COURSE HOURS

The FAA does not specify how much time should be spent training for a multi-engine rating. Instructors may choose to have the student practice solo (or with a safety pilot), in addition to the following Dual Flight lessons. Ground instruction includes preflight briefings, post-flight critiques, and classroom or personal study.

Instructors and students are encouraged to integrate Aviation Training Devices (ATDs) technology with existing methods of aviation instruction and training. Instructors are encouraged to challenge students by altering the virtual environment within which

the lessons take place. This can be done by changing the weather (adding turbulence, altering the winds, or assigning the ceiling and visibility to the approach minimum conditions), and/or simulating a system or engine failure. These changes can be set to occur randomly or within a specified time frame, allowing the students to learn flight and decision-making skills simultaneously. In conjunction with training to the Airman Certification Standards at all times, this method will encourage a willing suspension of disbelief and maximize the value of ATDs in a curriculum. The practice of flying the lesson in a ATD before heading out to the airplane will result in a more efficient training program.

<i>Lesson</i>	<i>Dual Flight</i>	<i>Dual X/C</i>	<i>Dual Night</i>	<i>Instrument Instruction</i>	<i>Ground Instruction</i>
1	1.0				2.0
2	1.0			0.3	2.0
3	1.5			0.5	2.0
4	1.5			0.5	2.0
5	1.0		1.0	0.3	2.0
6	2.0	2.0		1.0	2.0
7	1.0			0.3	2.0
8	1.0			0.3	2.0
<b>TOTALS</b>	10.0 hours	2.0 hours	1.0 hours	3.2 hours	16.0 hours

## LESSON 1 *Dual*

1.0 hour flight

2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to be introduced to the Multi-Engine Rating program, and learn the flight school requirements, procedures, regulations, and grading criteria. Student will also be introduced to multi-engine aerodynamics, regulations associated with multi-engine training, and the training airplane Pilot's Operating Handbook (POH).

#### Content

- \_\_\_ Review of course and objectives
- \_\_\_ School requirements, procedures, regulations
- \_\_\_ Grading criteria, student's expectations
- \_\_\_ Federal Aviation Regulations, Parts 61, 91, 23
- \_\_\_ Multi-engine aerodynamics
- \_\_\_ Service ceiling
- \_\_\_ Absolute service ceiling
- \_\_\_ Single-engine service ceiling
- \_\_\_ Single-engine absolute service ceiling
- \_\_\_ Centerline thrust
- \_\_\_ Critical engines
- \_\_\_ P-factor
- \_\_\_ Counter-rotating propellers
- \_\_\_ Review POH associated with training airplane

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Introduction and Chapter 1; Pilot's Operating Handbook

### FLIGHT TRAINING

#### Objective:

For the student to be introduced and become familiar with the multi-engine preflight inspection, checklist operations, starting and taxi procedures, and the airplane controls and systems.

#### Content

- \_\_\_ Preflight inspection and aircraft documents (certificates and documents, aircraft logbooks, airplane servicing)
- \_\_\_ Discuss cockpit management
- \_\_\_ Starting Procedures
- \_\_\_ Taxi
- \_\_\_ Run-up procedures
- \_\_\_ Checklist introduction and use
- \_\_\_ Normal takeoff
- \_\_\_ Four Basics: straight and level, climbs, descents, turns
- \_\_\_ Steep turns
- \_\_\_ Demo slow flight
- \_\_\_ Demo power-on stall
- \_\_\_ Demo power-off stall
- \_\_\_ Collision avoidance procedures
- \_\_\_ Normal approach and landing
- \_\_\_ Postflight procedures

#### Completion Standards

Student must conduct the preflight with minimum assistance, properly use all checklists, start and taxi the airplane, and operate the airplane system and controls.

## LESSON 2 *Dual*

- 1.0 hour flight
- 0.3 hour instrument work
- 2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to have an understanding of the systems and engines associated with a multi-engine airplane.

#### Content

- \_\_\_ Multi-engine cockpit instrumentation
- \_\_\_ Propeller systems
- \_\_\_ Engine failures and effect on other systems
- \_\_\_ Air starts
- \_\_\_ Fuel system
- \_\_\_ Electrical system
- \_\_\_ Hydraulic system
- \_\_\_ Turbocharging
- \_\_\_ Pressurization
- \_\_\_ Landing gear system
- \_\_\_ Trim
- \_\_\_ Flaps
- \_\_\_ Environmental system
- \_\_\_ Vacuum system
- \_\_\_ Ice protection system
- \_\_\_ Emergency exit system
- \_\_\_ Avionics, autopilot, FMS
- \_\_\_ Oxygen systems
- \_\_\_ Glass-cockpit systems

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Chapter 2

### FLIGHT TRAINING

#### Objective:

For the student to become proficient with the four basics of flight, demonstrate sound collision avoidance procedures, and gain experience with steep turns, slow flight, and stalls.

#### Content

- \_\_\_ Preflight
- \_\_\_ Aircraft systems
- \_\_\_ Discuss emergency procedures
- \_\_\_ Discuss principles of flight with engine inoperative
- \_\_\_ Normal takeoff and climbout
- \_\_\_ Climbs
- \_\_\_ Straight and level

#### *Turns*

- \_\_\_ 90 degrees
- \_\_\_ 180 degrees
- \_\_\_ 360 degrees
- \_\_\_ Turns to headings
- \_\_\_ Cruise configuration
- \_\_\_ Steep turns
- \_\_\_ Slow flight
- \_\_\_ Power-on stall
- \_\_\_ Power-off stall

#### *Descents*

- \_\_\_ With flaps
- \_\_\_ Without flaps
- \_\_\_ Scanning procedures
- \_\_\_ Normal approach and landing
- \_\_\_ Postflight procedures

#### Completion Standards

Student must maintain altitude within 200 feet, air-speed within 20 knots, and heading within 20 degrees, while performing the maneuvers listed in the content of this lesson.

## LESSON 3 *Dual*

1.5 hours flight  
0.5 hour instrument work  
2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to have a working understanding of the factors affecting multi-engine airplane performance.

#### Content

- \_\_\_ Weight and balance
- \_\_\_ Empty weight
- \_\_\_ B.O.W.
- \_\_\_ Zero fuel weight
- \_\_\_ Effects of CG on performance
- \_\_\_ Performance planning
- \_\_\_ Minimum controllable airspeed
- \_\_\_ Multi-engine V-speeds:  $V_S$ ,  $V_{S0}$ ,  $V_{SSE}$ ,  $V_X$ ,  $V_Y$ ,  $V_{XSE}$ ,  $V_{YSE}$ ,  $V_A$ ,  $V_{FE}$ ,  $V_{LE}$ ,  $V_{MC}$ ,  $V_{NO}$ ,  $V_R$ , climb-out speed, approach speed
- \_\_\_ Conditions that affect  $V_{MC}$
- \_\_\_ Takeoff and landing distance
- \_\_\_ Accelerate-stop distance
- \_\_\_ Accelerate-go distance
- \_\_\_ One-engine performance
- \_\_\_ Time, fuel, and distance to climb
- \_\_\_ Range and endurance profiles
- \_\_\_ Cruise power tables
- \_\_\_ Descent planning
- \_\_\_ Energy management concepts

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Chapter 3 and Chapter 8

### FLIGHT TRAINING

#### Objective:

For the student to demonstrate a working knowledge of the airplane weight and balance and performance characteristics, and gain proficiency in slow flight and stalls.

#### Content

- \_\_\_ Preflight
- \_\_\_ Aircraft V-speeds
- \_\_\_ Performance data
- \_\_\_ Weight and Balance
- \_\_\_ Normal takeoff
- \_\_\_  $V_X$  and  $V_Y$  climbs
- \_\_\_ Cruise configuration
- \_\_\_ Steep turns
- \_\_\_ Slow flight
- \_\_\_ Power-on stall
- \_\_\_ Power-off stall
- \_\_\_ Spin awareness
- \_\_\_ Demo one-engine shutdown
- \_\_\_ Demo emergency gear extension
- \_\_\_ Normal approach and landing
- \_\_\_ Go-around procedures
- \_\_\_ Postflight procedures

#### Completion Standards

Student must maintain altitude within 200 feet, air-speed within 20 knots, and heading within 20 degrees, while performing the maneuvers listed in the content of this lesson.

## LESSON 4 *Dual*

1.5 hours flight

0.5 hour instrument work

2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to have a working knowledge of the preflight preparation necessary for a multi-engine flight.

#### Content

- \_\_\_ Taxiing a twin
- \_\_\_ Differential taxiing
- \_\_\_ Preflight inspection
- \_\_\_ Passenger briefings
- \_\_\_ Abnormal situations
- \_\_\_ Run-up and takeoff checks
- \_\_\_ Minimum equipment lists
- \_\_\_ Multi-engine cockpit instrumentation

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Chapter 4

### FLIGHT TRAINING

#### Objective:

For the student to demonstrate proficiency in slow flight, stalls, and emergency procedures.

#### Content

- \_\_\_ Preflight
- \_\_\_ Discuss minimum equipment lists
- \_\_\_ Differential taxiing
- \_\_\_ Short-field takeoff and climbout
- \_\_\_ Cruise configuration
- \_\_\_ Steep turns
- \_\_\_ Slow flight
- \_\_\_ Stalls
- \_\_\_ One engine shutdown
- \_\_\_ Emergency gear extension
- \_\_\_  $V_{MC}$  demonstration
- \_\_\_ Drag demonstration
- \_\_\_ Identify, verify, feather dead engine
- \_\_\_ 4 basic maneuvers with feathered engine
- \_\_\_ Re-start engine
- \_\_\_ Short-field approach and landing
- \_\_\_ No-flap landing
- \_\_\_ Postflight procedures

#### Completion Standards

Student must maintain altitude within 150 feet, air-speed within 15 knots, and heading within 15 degrees, while performing the maneuvers listed in the content of this lesson.

## LESSON 5 *Dual*

- 1.0 hour flight
- 1.0 hour night
- 0.3 hour instrument work
- 2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to have a working understanding of the factors that affect multi-engine takeoff and departure.

#### Content

- \_\_\_ Climb rates
- \_\_\_ The takeoff roll
- \_\_\_ Engine failure
- \_\_\_ Multi-engine takeoff procedures
- \_\_\_ Departure procedures

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Chapter 5

### FLIGHT TRAINING

#### Objective:

For the student to gain proficiency in specialty takeoffs and landings, engine-out procedures, and night operations.

#### Content

- \_\_\_ Preflight
- \_\_\_ Discuss supplemental oxygen
- \_\_\_ Differential taxiing
- \_\_\_ Short-field takeoff and climbout
- \_\_\_ Cruise configuration
- \_\_\_ 4-basic maneuvers, instrument, both engines
- \_\_\_ 4-basic maneuvers, instrument, single engine
- \_\_\_ Steep turns
- \_\_\_ Slow flight
- \_\_\_ Stalls
- \_\_\_ One-engine shutdown
- \_\_\_ Emergency gear extension
- \_\_\_ V<sub>MC</sub> demonstration
- \_\_\_ Drag demonstration
- \_\_\_ Identify, verify, feather dead engine
- \_\_\_ 4 basic maneuvers with feathered engine
- \_\_\_ Re-start engine
- \_\_\_ Short-field approach and landing
- \_\_\_ Postflight procedures

#### Completion Standards

Student must maintain altitude within 150 feet, air-speed within 15 knots, and heading within 15 degrees, while performing the maneuvers listed in the content of this lesson.

## LESSON 6 *Dual*

- 2.0 hours flight
- 2.0 hours cross-country
- 1.0 hour instrument work
- 2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to have a working understanding of the factors affecting multi-engine cruise flight.

#### Content

- \_\_\_ Cruise checklist
- \_\_\_ Engine failure during cruise flight
- \_\_\_ Drift down

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Chapter 6

### FLIGHT TRAINING

#### Objective:

For the student to gain proficiency in engine-out procedures, cross-country procedures, and instrument approaches (for instrument-rated students only).

#### Content

- \_\_\_ Preflight
- \_\_\_ Discuss performance ceilings and density altitude
- \_\_\_ Differential taxiing
- \_\_\_ Short-field takeoff and climbout
- \_\_\_ Round-robin cross-country flight
- \_\_\_ Simulated system failures (electrical, hydraulic, mechanical)
- \_\_\_ Holding pattern (both engines, single engine)
- \_\_\_ Precision approach (both engines, single engine)
- \_\_\_ Nonprecision approach (both engines, single engine)
- \_\_\_ Missed approach procedure (both engines, single engine)
- \_\_\_ Circle-to-land approach (single engine)
- \_\_\_ Postflight procedures

#### Completion Standards

Student must maintain altitude within 150 feet, air-speed within 15 knots, and heading within 15 degrees, while performing the maneuvers listed in the content of this lesson, and maintain approach minimums.

## LESSON 7 *Dual*

- 1.0 hour flight
- 0.3 hour instrument work
- 2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to have a working knowledge of the factors affecting multi-engine descent, approach and landing.

#### Content

- \_\_\_ Descent planning
- \_\_\_ Descent
- \_\_\_ Leveling off
- \_\_\_ Final approach
- \_\_\_ Landing distance
- \_\_\_ Stopping
- \_\_\_ Single-engine approach and landing
- \_\_\_ Landing with a propeller feathered

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Chapter 7

### FLIGHT TRAINING

#### Objective:

For the student to gain proficiency in single-engine operations.

#### Content

- \_\_\_ Preflight
- \_\_\_ Simulated engine failure on takeoff roll
- \_\_\_ Short-field takeoff
- \_\_\_ Engine failure at  $V_Y$  climb
- \_\_\_ Engine failure at  $V_X$  climb
- \_\_\_ Engine failure in steep turns
- \_\_\_ Engine failure in slow flight
- \_\_\_ Engine shut down and re-start
- \_\_\_ Engine failure in simulated go-around
- \_\_\_ Engine failure in landing configuration
- \_\_\_ Engine failure on approach
- \_\_\_ Engine failure on simulated go-around
- \_\_\_ Simulated feathered landing
- \_\_\_ Simulated single-engine landing
- \_\_\_ Simulated single-engine landing from an approach (instrument students only)
- \_\_\_ Postflight procedures

#### Completion Standards

Student must maintain control of the airplane throughout all emergency procedures and adhere to standards outlined in the ACS.

## LESSON 8 *Dual*

- 1.0 hour flight
- 0.3 hour instrument work
- 2.0 hours ground instruction

### GROUND TRAINING

#### Objective:

For the student to gain proficiency in all areas included in the Airman Certification Standards.

#### Content

- \_\_\_ Certificates and documents
- \_\_\_ Airplane systems
- \_\_\_ Normal procedures
- \_\_\_ Determining performance and flight planning
- \_\_\_ Minimum equipment list
- \_\_\_ Flight principles: engine inoperative
- \_\_\_ Ground operations
- \_\_\_ Normal and crosswind takeoff and climb
- \_\_\_ Maximum performance takeoff and climb
- \_\_\_ Instrument flight
- \_\_\_ Slow flight and stalls
- \_\_\_ Steep turns
- \_\_\_ Maneuvering with one engine inoperative
- \_\_\_ Drag demonstration
- \_\_\_  $V_{MC}$  demonstration
- \_\_\_ Engine failure en route
- \_\_\_ Engine failure on takeoff before  $V_{MC}$
- \_\_\_ Engine failure after liftoff
- \_\_\_ Approach and landing with an inoperative engine
- \_\_\_ Balked landing
- \_\_\_ Normal and crosswind approach and landing
- \_\_\_ Maximum performance approach and landing

#### Completion Standards

Student must complete all review questions following the assigned reading.

#### Assignment

*The Complete Multi-Engine Pilot*, Chapter 9; Airman Certification Standards; *Multi-Engine Oral Exam Guide*

### FLIGHT TRAINING

#### Objective:

For the student to demonstrate competency in passing the multi-engine checkride.

#### Content

- \_\_\_ Preflight
- \_\_\_ Differential taxiing
- \_\_\_ Starting and runup checks
- \_\_\_ Simulated engine failure on takeoff roll
- \_\_\_ Short-field takeoff
- \_\_\_ Normal and crosswind takeoff
- \_\_\_ Engine failure at  $V_Y$  climb
- \_\_\_ Engine failure at  $V_X$  climb
- \_\_\_  $V_{MC}$  demonstration
- \_\_\_ Drag demonstration
- \_\_\_ Steep turns
- \_\_\_ Slow flight
- \_\_\_ Stalls
- \_\_\_ Spin awareness
- \_\_\_ 4 basic maneuvers on instruments
- \_\_\_ Engine shut down and re-start
- \_\_\_ Engine failure in simulated go-around
- \_\_\_ Engine failure in landing configuration
- \_\_\_ Engine failure on approach
- \_\_\_ Simulated feathered landing
- \_\_\_ Simulated single-engine landing
- \_\_\_ 2-engine instrument approach (precision or nonprecision), instrument students only
- \_\_\_ Single-engine approach (precision or non-precision), instrument students only
- \_\_\_ Go-around procedures
- \_\_\_ Normal and/or crosswind landing
- \_\_\_ Short-field approach and landing
- \_\_\_ Postflight procedures

#### Completion Standards

All maneuvers must be completed according to Airman Certification Standards, and the Multi-Engine Written Exam must be passed with a minimum 80% score (See Appendix B).