



# Oral Exam Guide Update

## Multi-Engine

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With the following revisions, the *Multi-Engine Oral Exam Guide, 4th Edition* by Michael D. Hayes provides comprehensive preparation for the FAA Oral Exam for the Multi-Engine rating.

Page Number	Question Number	Explanation
viii	—	<i>In the list of references, change AC 61-23 to FAA-H-8083-25.</i>
1-4	4	<i>Add reference to end of question to read: (FAA-H-8083-3)</i>
1-6	9	<i>Change the reference and answer to read: (FAA-H-8083-3)</i> Landing gear retraction should normally occur after a positive rate of climb is established. Some AFM/POHs direct the pilot to apply the wheel brakes momentarily after lift-off to stop wheel rotation prior to landing gear retraction.
1-6	10	<i>Replace question and answer to read:</i> <b>10. At what point in the descent and approach for landing should the before-landing checklist be completed?</b> (FAA-H-8083-3) The traffic pattern and approach are typically flown at somewhat higher indicated airspeeds in a multi-engine airplane than most single-engine airplanes. The pilot should allow for this by getting an early start on the “before landing” checklist, which provides time for proper planning, spacing, and thinking well ahead of the airplane.
1-6	11	<i>Replace question and answer with the following:</i> <b>11. If a recommended airspeed is not provided by the manufacturer, what speed should be used for final approach to landing?</b> (FAA-H-8083-3) If a recommended speed is not furnished, the speed should be no slower than the single-engine best rate-of-climb speed ( $V_{YSE}$ ) until short final with the landing assured, but in no case less than critical engine-out minimum control speed ( $V_{MC}$ ).
1-9	1	<i>Change the reference and answer to read: (FAA-H-8083-3)</i> $V_R$ — Rotation speed. The speed at which back pressure is applied to rotate the airplane to a takeoff attitude. $V_{LOF}$ — Lift-off speed. The speed at which the airplane leaves the surface. ( <i>Note: some manufacturers reference takeoff performance data to <math>V_R</math>, others to <math>V_{LOF}</math>.</i> ) $V_X$ — Best angle of climb speed. The speed at which the airplane will gain the greatest altitude for a given distance of forward travel. $V_{XSE}$ — Best angle-of-climb speed with one engine inoperative. $V_Y$ — Best rate of climb speed. The speed at which the airplane will gain the most altitude for a given unit of time.

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Page Number	Question Number	Explanation
1-9	1	(Continued) $V_{YSE}$ — Best rate-of-climb speed with one engine inoperative. Marked with a blue radial line on most airspeed indicators. Above the single-engine absolute ceiling, $V_{YSE}$ yields the minimum rate of sink. $V_{SSE}$ — Safe, intentional one-engine-inoperative speed. Originally known as safe single-engine speed. It is the minimum speed to intentionally render the critical engine inoperative. $V_{MC}$ — Minimum control speed with the critical engine inoperative. Marked with a red radial line on most airspeed indicators. The minimum speed at which directional control can be maintained under a very specific set of circumstances outlined in 14 CFR Part 23, Airworthiness Standards.
1-10	2	<i>Change question to read:</i> <b>2. When is use of safe, intentional one-engine inoperative speed (<math>V_{SSE}</math>) recommended? (FAA-P-8740-19)</b>
1-10	3	<i>Change answer to read:</i> The accelerate-stop distance is the runway length required to accelerate to a specified speed (either $V_R$ or $V_{LOF}$ , as specified by the manufacturer), experience an engine failure, and bring the airplane to a complete stop.
1-12	9	<i>Add reference to read: (FAA-H-8083-3)</i>
1-12	11	<i>Replace question and answer with the following:</i> <b>11. What are several options that should be considered if attempting a short-field takeoff in a light-twin that has a best angle-of-climb speed which is less than 5 knots higher than <math>V_{MC}</math>? (FAA-H-8083-3)</b> Engine failure on takeoff, particularly with obstructions, is compounded by the low airspeeds and steep climb attitudes utilized in short-field takeoffs. $V_X$ and $V_{XSE}$ are often perilously close to $V_{MC}$ , leaving scant margin for error in the event of engine failure as $V_{XSE}$ is assumed. If flaps were used for takeoff, the engine failure situation becomes even more critical due to the additional drag incurred. If $V_X$ is less than 5 knots higher than $V_{MC}$ , give strong consideration to reducing useful load or using another runway in order to increase the takeoff margins so that a short-field technique will not be required.
1-14	16	<i>Replace question and answer with the following:</i> <b>16. What are the single-engine climb performance requirements for reciprocating engine-powered multi-engine airplanes? (FAA-H-8083-3)</b> The 14 CFR Part 23 requirements are as follows: a. <i>More than 6,000 pounds maximum weight and/or <math>V_{SO}</math> more than 61 knots:</i> The single-engine rate of climb in feet per minute at 5,000 feet MSL must be equal to at least $.027 V_{SO}^2$ . For airplanes type-certificated February 4, 1991 or after, the climb requirement is expressed in terms of a climb gradient, 1.5 percent. The climb gradient is not a direct equivalent of the $.027 V_{SO}^2$ formula. The date of type certification should not be confused with the airplane's model year; the type certification basis of many multi-engine airplanes dates back to CAR 3.

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<b>Page Number</b>	<b>Question Number</b>	<b>Explanation</b>
1-14	16	(Continued)  b. <i>6,000 pounds or less maximum weight and <math>V_{SO}</math> 61 knots or less:</i> The single-engine rate of climb at 5,000 feet MSL must simply be determined. The rate of climb could be a negative number. There is no requirement for a single-engine positive rate of climb at 5,000 feet or any other altitude. For light-twins type-certificated February 4, 1991 or after, the single-engine climb gradient (positive or negative) is simply determined.
1-15	17	<i>Change reference and answer to read: (FAA-H-8083-25)</i>  The service ceiling is the maximum density altitude where the best rate-of-climb airspeed will produce a 100 feet-per-minute climb at maximum weight while in a clean configuration with maximum continuous power.
1-15	18	<i>Change reference to read: (FAA-P-8740-19)</i>
1-15	19	<i>Add reference to read: (FAA-H-8083-3)</i>
1-15	21	<i>Replace question and answer with the following:</i> <b>21. Define the term “climb gradient.” (FAA-H-8083-3)</b>  Climb gradient can be expressed as a percentage or as a ratio. It is most frequently expressed in terms of altitude gain per 100 feet of horizontal distance, whereupon it is stated as a percentage. A 1.5 percent climb gradient is an altitude gain of one and one-half feet per 100 feet of horizontal travel. It may also be expressed as a function of altitude gain per nautical mile, or as a ratio of the horizontal distance to the vertical distance (50:1, for example).
1-16	27	<i>Add a new question after current question 26; renumber existing Question 27:</i> <b>27. What is meant by the term “drift down”?</b> (FAA-H-8083-3)  If an airplane is above its single-engine absolute ceiling at the time of engine failure, it will slowly lose altitude. The airplane will then “drift down” to its single-engine absolute ceiling. The pilot should maintain $V_{YSE}$ to minimize the rate of altitude loss. The “drift down” rate will be greatest immediately following the failure and will decrease as the single-engine ceiling is approached.
1-17	1	<i>Change reference to read: (FAA-H-8083-25)</i>
1-18	4	<i>Replace question and answer with the following:</i> <b>4. What is the definition of the terms standard empty weight, basic empty weight and licensed empty weight?</b> (FAA-H-8083-3)  <i>Standard empty weight (GAMA) is the weight of a standard airplane including unusable fuel, full operating fluids, and full oil.</i>  <i>Basic empty weight (GAMA) is the standard empty weight plus optional equipment. Optional equipment includes the weight of all equipment installed beyond standard.</i>  <i>Licensed empty weight includes the standard airplane, optional equipment, full hydraulic fluid, unusable fuel, and undrainable oil.</i>  <i>Note: The major difference between the two formats (GAMA and the old) is that basic empty weight includes full oil, and licensed empty weight does not.</i>

Page Number	Question Number	Explanation
1-19	5	<p><i>Replace question and answer with the following:</i></p> <p><b>5. Define the following terms: maximum ramp weight, maximum takeoff weight, maximum landing weight, zero fuel weight. (FAA-H-8083-3)</b></p> <p><i>Maximum ramp weight</i>—Some multi-engine airplanes have a ramp weight, which is in excess of the maximum takeoff weight. The ramp weight is an allowance for fuel burned during taxi and runup, permitting a takeoff at full maximum takeoff weight.</p> <p><i>Maximum takeoff weight</i>—The maximum allowable weight at the start of the takeoff run.</p> <p><i>Maximum landing weight</i>—The greatest weight that an aircraft normally is allowed to have when it lands. This requires preflight planning of fuel burn to ensure that the airplane weight upon arrival at destination will be at or below the maximum landing weight. In the event of an emergency requiring an immediate landing, the pilot should recognize that the structural margins designed into the airplane are not fully available when over landing weight.</p> <p><i>Zero fuel weight</i>—The maximum allowable weight of the airplane and payload, assuming there is no usable fuel on board. The actual airplane is not devoid of fuel at the time of loading but is merely a calculation that assumes it was. If a zero fuel weight limitation is published, then all weight in excess of that figure must consist of usable fuel. The purpose of a zero fuel weight is to limit load forces on the wing spars with heavy fuselage loads.</p>
1-19	6	<p><i>Change reference and answer to read: (FAA-H-8083-3)</i></p> <p>“Payload” is the weight of occupants, cargo, and baggage. Assuming maximum fuel, the payload is the difference between the weight of the fueled airplane and the maximum takeoff weight.</p>
2-3	1	<p><i>Add reference and change answer to read: (FAA-H-8083-3)</i></p> <ol style="list-style-type: none"> <li>CG position</li> <li>Weight</li> <li>Density altitude</li> <li>Propeller (windmilling or feathered)</li> <li>Sideslip condition</li> </ol>
2-3	2	<p><i>Add reference and change answer to read: (FAA-H-8083-3)</i></p> <ol style="list-style-type: none"> <li>Rearward CG location</li> <li>Decrease in weight</li> <li>Decrease in density altitude (increase in air density)</li> <li>Propeller windmilling</li> <li>Sideslip condition (lack of bank towards the operative engine)</li> </ol> <p><i>Note:</i> Any possible benefit that extended flaps and/or gear may have on <math>V_{MC}</math> is greatly offset by the decrease in climb performance as a result of the increased parasite/induced drag. The affect of flaps and/or gear extended versus retracted on <math>V_{MC}</math> is not determined in the certification process.</p>
2-3	3	<p><i>Replace answer with the following:</i></p> <p><math>V_{MC}</math> increases as the center of gravity is moved aft. The moment arm of the rudder is reduced, and therefore its effectiveness is reduced as the center of gravity is moved aft. At the same time, the moment arm of the propeller blade is increased, aggravating asymmetrical thrust. Therefore the aft-most CG limit is the most unfavorable CG position.</p>

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2-4	4	<p><i>Add reference and replace answer with the following: (FAA-H-8083-3)</i></p> <p><math>V_{MC}</math> is unaffected by weight in straight and level flight. <math>V_{MC}</math> will be affected by the aircraft's weight in turning (banked) flight. When an aircraft is banked, a component of the aircraft weight acts with the horizontal component of lift to create a more effective sideslip toward the operative engine. <math>V_{MC}</math> increases as weight is reduced. Currently, 14 CFR Part 23 calls for <math>V_{MC}</math> to be determined at the most unfavorable weight. For twins certificated under CAR 3 or early 14 CFR Part 23, the weight at which <math>V_{MC}</math> was determined was not specified.</p>
2-4	6	<i>Delete question and answer.</i>
2-4	7	<i>Delete question and answer.</i>
2-7	17	<p><i>Change question to read:</i></p> <p><b>17. What is <math>V_{MC}</math> and how is it determined by the manufacturer?</b> (14 CFR 23.149)</p>
2-9	5	<p><i>Add reference and change answer to read: (FAA-H-8083-3)</i></p> <p>If a spin is entered, most manufacturers recommend immediately retarding both throttles to idle, applying full rudder opposite the direction of rotation, and applying full forward elevator/stabilator pressure (with ailerons neutral). These actions should be taken as near simultaneously as possible. The controls should then be held in that position. Recovery, if possible, will take considerable altitude. The longer the delay from entry until taking corrective action, the less likely that recovery will be successful.</p>
2-11	8	<p><i>Change question and answer to read:</i></p> <p><b>8. In an engine-out emergency, what is the correct amount of bank angle and ball displacement to establish a zero-sideslip condition?</b> (FAA-H-8083-3)</p> <p>The precise condition of zero sideslip (bank angle and ball position) varies slightly from model to model, and with available power and airspeed. If the airplane is not equipped with counter-rotating propellers, it will also vary slightly with the engine failed due to P-factor. The actual bank angle for zero sideslip varies among airplanes from one and one-half to two and one-half degrees. The position of the ball varies from one-third to one-half of a ball width from instrument center.</p>

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2-12	1	<i>Add reference to read: (FAA-H-8083-3)</i>
2-13	4	<p><i>Change answer to read:</i></p> <p>The memory items from the “engine failure after takeoff” checklist should be promptly executed to configure the airplane for climb. The specific procedures to follow will be found in the AFM/POH and checklist for the particular airplane. A typical “engine failure after takeoff” emergency checklist is depicted below. <b>Bold-faced</b> items require immediate action and are to be accomplished from memory.</p> <ul style="list-style-type: none"> <li><b>a. Airspeed</b> ..... <b>Maintain V<sub>YSE</sub></b></li> <li><b>b. Mixtures</b> ..... <b>RICH</b></li> <li><b>c. Propellers</b> ..... <b>HIGH RPM</b></li> <li><b>d. Throttles</b> ..... <b>FULL POWER</b></li> <li><b>e. Flaps</b> ..... <b>UP</b></li> <li><b>f. Landing Gear</b> ..... <b>UP</b></li> <li><b>g. Identify</b> ..... <b>Determine failed engine</b></li> <li><b>h. Verify</b> ..... <b>Close throttle of failed engine</b></li> <li><b>i. Propeller</b> ..... <b>FEATHER</b></li> <li>j. Trim Tabs ..... ADJUST</li> <li>k. Failed Engine ..... SECURE</li> <li>l. As soon as practical ..... LAND</li> </ul>
2-13	6	<p><i>Change answer to read:</i></p> <p>If an engine fails below V<sub>MC</sub> while the airplane is on the ground, the takeoff must be rejected. Directional control can only be maintained by promptly closing both throttles and using rudder and brakes as required. If an engine fails below V<sub>MC</sub> while airborne, directional control is not possible with the remaining engine producing takeoff power. On takeoffs, therefore, the airplane should never be airborne before the airspeed reaches and exceeds V<sub>MC</sub>.</p>
2-15	15	<p><i>Replace question and answer with the following:</i></p> <p><b>15. If engine failure occurs immediately after takeoff (airborne and gear down), what procedure is recommended? (FAA-H-8083-3)</b></p> <p>If engine failure occurs prior to selecting the landing gear to the UP position, close both throttles and land on the remaining runway or overrun. Depending upon how quickly the pilot reacts to the sudden yaw, the airplane may run off the side of the runway by the time action is taken. There are really no other practical options. The chances of maintaining directional control while retracting the flaps (if extended), landing gear, feathering the propeller, and accelerating are minimal. On some airplanes with a single-engine-driven hydraulic pump, failure of that engine means the only way to raise the landing gear is to allow the engine to windmill or to use a hand pump. This is not a viable alternative during takeoff.</p>

Page Number	Question Number	Explanation
2-16	16	<p><i>Replace question and answer with the following:</i></p> <p><b>16. If an engine failure occurs after takeoff (airborne and gear up), and climb performance is inadequate, what procedure is recommended? (FAA-H-8083-3)</b></p> <p>When operating near or above the single-engine ceiling and an engine failure is experienced shortly after lift-off, a landing must be accomplished on whatever essentially lies ahead. There is also the option of continuing ahead, in a descent at <math>V_{YSE}</math> with the remaining engine producing power, as long as the pilot is not tempted to remain airborne beyond the airplane's performance capability. Remaining airborne, bleeding off airspeed in a futile attempt to maintain altitude is almost invariably fatal. Landing under control is paramount. The greatest hazard in a single-engine takeoff is attempting to fly when it is not within the performance capability of the airplane to do so. An accident is inevitable.</p>
2-16	17	<p><i>Add new question after current question 16; renumber existing questions.</i></p> <p><b>17. If an engine failure occurs immediately after takeoff (airborne and gear up) and climb performance is adequate, what are the four main areas of concern? (FAA-H-8083-3)</b></p> <ol style="list-style-type: none"> <li><b>Control</b>—first priority is control of the airplane. Use aileron and rudder aggressively, if necessary, to counteract the yaw and roll from asymmetrical thrust.</li> <li><b>Configuration</b>—the memory items from the “engine failure after takeoff” checklist should be promptly executed to configure the airplane for climb.</li> <li><b>Climb</b>—As soon as directional control is established and the airplane configured for climb, the bank angle should be reduced to that producing best climb performance.</li> <li><b>Checklist</b>—Having accomplished the memory items from the “engine failure after takeoff” checklist, the printed copy should be reviewed as time permits. The “securing failed engine” checklist should then be accomplished.</li> </ol>
2-17	19	<p><i>Change the last sentence of the explanation to read:</i></p> <p>... If the airplane is above its single-engine absolute ceiling at the time of engine failure, it will slowly lose altitude.</p>
2-18	22	<p><i>Replace answer with the following:</i></p> <ol style="list-style-type: none"> <li>The approach and landing with one engine inoperative is essentially the same as a two-engine approach and landing. The traffic pattern should be flown at similar altitudes, airspeeds, and key positions as a two-engine approach.</li> <li>With adequate airspeed and performance, the landing gear can still be extended on the downwind leg. In which case it should be confirmed DOWN no later than abeam the intended point of landing.</li> <li>Performance permitting, initial extension of wing flaps (<math>10^\circ</math>, typically) and a descent from pattern altitude can also be initiated on the downwind leg. The airspeed should be no slower than <math>V_{YSE}</math>.</li> <li>On the base leg, if performance is adequate, the flaps may be extended to an intermediate setting (<math>25^\circ</math>, typically). If the performance is inadequate, as measured by a decay in airspeed or high sink rate, delay further flap extension until closer to the runway. <math>V_{YSE}</math> is still the minimum airspeed to maintain.</li> <li>On final approach, a normal, <math>3^\circ</math> glidepath to a landing is desirable. VASI or other vertical path lighting aids should be utilized if available. Slightly steeper approaches may be acceptable. However, a long, flat, low approach should be avoided. Large, sudden power applications or reductions should also be avoided. Maintain <math>V_{YSE}</math> until the landing is assured, then slow to <math>1.3 V_{SO}</math> or the AFM/POH recommended speed. The final flap setting may be delayed until the landing is assured, or the airplane may be landed with partial flaps.</li> </ol>

<b>Page Number</b>	<b>Question Number</b>	<b>Explanation</b>
2-18	23	<i>Delete question and answer.</i>
2-19	24	<p><i>Change reference and answer to read: (FAA-H-8083-3)</i></p> <p>Single-engine go-arounds must be avoided. As a practical matter in single-engine approaches, once the airplane is on final approach with landing gear and flaps extended, it is committed to land. If not on the intended runway, then on another runway, a taxiway, or grassy infield. The light-twin does not have the performance to climb on one engine with landing gear and flaps extended. Considerable altitude will be lost while maintaining <math>V_{YSE}</math> and retracting landing gear and flaps. Losses of 500 feet or more are not unusual. If the landing gear has been lowered with an alternate means of extension, retraction may not be possible, virtually negating any climb capability.</p>
4-10	Section O	<p><i>Change Section O to read:</i></p> <ol style="list-style-type: none"> <li>1. Recognize simulated engine failure promptly, maintain control, and utilize appropriate emergency procedures.</li> <li>2. Reduce drag, identify and verify the inoperative engine after simulated engine failure.</li> <li>3. Simulate feathering the propeller on the inoperative engine. Examiner shall then establish zero-thrust on the inoperative engine.</li> <li>4. Establish <math>V_{YSE}</math>. If obstructions are present, establish <math>V_{XSE}</math> or <math>V_{MC} + 5</math> knots, whichever is greater, until obstructions are cleared, then transition to <math>V_{YSE}</math>.</li> <li>5. Bank toward the operating engine as required for best performance.</li> <li>6. Monitor operating engine and make adjustments as necessary.</li> <li>7. Recognize the airplane's performance capabilities. If a climb is not possible at <math>V_{YSE}</math>, maintain <math>V_{YSE}</math> and return to the departure airport for landing, or initiate an approach to the most suitable landing area available.</li> <li>8. Secure the (simulated) inoperative engine.</li> <li>9. Maintain heading, <math>\pm 10^\circ</math>, and airspeed, <math>\pm 5</math> knots.</li> <li>10. Complete appropriate emergency checklist.</li> </ol> <p><i>Note:</i> On multi-engine practical tests where the failure of the most critical engine after lift off is required, the examiner must give consideration to local atmospheric conditions, terrain, and type of aircraft used. However, the failure of an engine shall not be simulated until attaining at least <math>V_{SSE}/V_{YSE}</math> and at an altitude not lower than 200 feet AGL.</p>
4-11	Section P	<p><i>Add the following after #8 at the bottom of the page:</i></p> <p><i>Note:</i> During simulated engine failures on multi-engine practical tests the examiner shall set zero thrust after the applicant has simulated feathering the propeller. The examiner shall require the applicant to demonstrate at least one landing with a simulated-feathered propeller with the engine set to zero thrust.</p>