@eghaviation
Pay via Venmo

MEI Training Binder

Complete Lesson Plan Compilation — Multi-Engine Instructor

EGH Aviation • FAA-S-ACS-25 (CFI Airplane ACS) • FAA-S-8081-9E (CFI Instrument PTS)

Table of Contents

MEI Guide · Foundational Compilation

CFI Airplane ACS Lessons · FAA-S-ACS-25

CFI Instrument PTS Lessons · FAA-S-8081-9E

MEI TRAINING BINDER

Volume 1 — Source Compilation

Multi-Engine-Specific Tasks

Compiled from the CFI Airplane ACS and the CFI Instrument PTS

Sources:

FAA-S-ACS-25 — Flight Instructor for Airplane Category ACS (Dec 2023)
FAA-S-8081-9E — Flight Instructor Instrument PTS (Airplane / Helicopter Rating)

Purpose of This Document

Lesson plans for an MEI add-on rating will not be standalone — they will span both the CFI Airplane ACS (FAA-S-ACS-25) and the CFI Instrument PTS (FAA-S-8081-9E). This compilation lists every task in either source that is multi-engine-specific, so that each future lesson can be mapped against the corresponding tasks from both documents.

Three categories are included:

- ACS tasks designated AMEL or AMES that are multi-engine-exclusive (the bulk of the MEI curriculum).
- PTS tasks designated Multiengine (the instrument-flight OEI subjects unique to the multi).
- ACS tasks shared with single-engine (ASEL/ASES) that must nevertheless be flown in the multi-engine airplane during the MEI add-on practical.

A required-tasks matrix from ACS Appendix 1 (for an applicant who already holds the Airplane Single-Engine CFI) is included at the end.

Part 1 — Multi-Engine-Exclusive Tasks from FAA-S-ACS-25 (CFI Airplane ACS)

These seven tasks appear in the Airplane CFI ACS with the designator (AMEL, AMES). They have no single-engine counterpart and are the core of MEI ground/flight instruction.

Summary Index — ACS ME-Exclusive Tasks

- Area II, Task P — One Engine Inoperative (OEI) Performance
- Area XII, Task E — Engine Failure During Takeoff Before VMC (Simulated)
- Area XII, Task F — Engine Failure After Liftoff (Simulated)
- Area XII, Task G — Approach and Landing with an Inoperative Engine (Simulated)
- Area XIII, Task A — Maneuvering with One Engine Inoperative
- Area XIII, Task B — VMC Demonstration
- Area XIII, Task C — Demonstration of Effects of Various Airspeeds and Configurations During Engine Inoperative Performance

Area II, Task P — One Engine Inoperative (OEI) Performance (AMEL, AMES)

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-9, FAA-H-8083-25; FAA-P-8740-66; POH/AFM

Objective: *To determine the applicant understands elements related to multiengine performance, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and provide effective instruction.*

> **Note** *Evaluator assesses the applicant's knowledge of at least two knowledge elements from this Task.*

KNOWLEDGE

AI.II.P.K1 Proficient use of appropriate performance charts, tables, graphs, or other data to determine airplane performance and limitations for all phases of flight.

AI.II.P.K2 Effects of exceeding limitations.

AI.II.P.K3 Effects of atmospheric conditions on performance.

AI.II.P.K4 Factors to be considered to determine required performance is within the airplane's single and multiengine capabilities.

AI.II.P.K5 Aerodynamics of OEI operation including:

- *a.* Critical engine
- *b.* Effects of bank angle on VMC
- *c.* Zero side slip
- *d.* Reasons for loss of directional control

AI.II.P.K6 The relationship between minimum control speed (VMC) and stall speed and the effect of density altitude on that relationship.

AI.II.P.K7 How to determine the best course of action after an engine failure.

RISK MANAGEMENT

AI.II.P.R1 Exceeding the critical angle of attack.

AI.II.P.R2 Loss of directional control.

AI.II.P.R3 Flying over terrain that exceeds the single engine service ceiling.

AI.II.P.R4 Fuel management.

SKILLS

AI.II.P.S1 Compute the expected single engine climb performance.

Area XII, Task E — Engine Failure During Takeoff Before VMC (Simulated) (AMEL, AMES)

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-9, FAA-H-8083-25; FAA-P-8740-66; POH/AFM

Objective: *To determine the applicant understands engine failure during takeoff, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and provide effective instruction.*

> **Note** *See ACS Appendix 2 (Safety of Flight) and Appendix 3 (Aircraft, Equipment, & Operational Requirements). Simulated engine failure on takeoff must be accomplished prior to reaching 50% of calculated VMC.*

KNOWLEDGE

AI.XII.E.K1 Factors affecting minimum controllable speed (VMC).

AI.XII.E.K2 VMC (red line) and best single-engine rate of climb airspeed (VYSE) (blue line).

AI.XII.E.K3 Accelerate/stop distance.

AI.XII.E.K4 Common errors related to this Task.

RISK MANAGEMENT

AI.XII.E.R1 Potential engine failure during takeoff.

AI.XII.E.R2 Configuring the airplane.

AI.XII.E.R3 Distractions, task prioritization, loss of situational awareness, or disorientation.

SKILLS

AI.XII.E.S1 Close the throttles smoothly and promptly when a simulated engine failure occurs.

AI.XII.E.S2 Maintain directional control and apply brakes (AMEL), or flight controls (AMES), as necessary.

AI.XII.E.S3 Analyze and correct common errors related to this Task.

Area XII, Task F — Engine Failure After Liftoff (Simulated) (AMEL, AMES)

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-9, FAA-H-8083-25; FAA-P-8740-66; POH/AFM

Objective: *To determine the applicant understands engine failure after liftoff, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and provide effective instruction.*

> **Note** *See ACS Appendix 2 (Safety of Flight) and Appendix 3. Simulated failure not until ≥ 400 ft AGL and VSSE/VXSE/VYSE attained.*

KNOWLEDGE

AI.XII.F.K1 Factors affecting minimum controllable speed (VMC).

AI.XII.F.K2 VMC (red line), VYSE (blue line), and safe single-engine speed (VSSE).

AI.XII.F.K3 Accelerate/stop and accelerate/go distances.

AI.XII.F.K4 How to identify, verify, feather, and secure an inoperative engine.

AI.XII.F.K5 Importance of drag reduction, including propeller feathering, gear and flap retraction, the manufacturer's recommended control input and its relation to zero sideslip.

AI.XII.F.K6 Simulated propeller feathering and the evaluator's zero-thrust procedures and responsibilities.

AI.XII.F.K7 Common errors related to this Task.

RISK MANAGEMENT

AI.XII.F.R1 Potential engine failure after lift-off.

AI.XII.F.R2 Collision hazards.

AI.XII.F.R3 Configuring the airplane.

AI.XII.F.R4 Low altitude maneuvering, including stall, spin, or controlled flight into terrain (CFIT).

AI.XII.F.R5 Distractions, task prioritization, loss of situational awareness, or disorientation.

SKILLS

AI.XII.F.S1 Promptly recognize an engine failure, maintain control, and use appropriate emergency procedures.

AI.XII.F.S2 Establish VYSE; if obstructions are present, establish best single-engine angle of climb speed (VXSE) or VMC +5 knots, whichever is greater, until obstructions are cleared. Then transition to VYSE.

AI.XII.F.S3 Reduce drag by retracting landing gear and flaps in accordance with the manufacturer's guidance.

AI.XII.F.S4 Simulate feathering the propeller on the inoperative engine (evaluator should then establish zero thrust on the inoperative engine).

AI.XII.F.S5 Use flight controls in the proper combination as recommended by the manufacturer, or as required to maintain best performance, and trim as required.

AI.XII.F.S6 Monitor the operating engine and aircraft systems and make adjustments as necessary.

AI.XII.F.S7 Recognize the airplane's performance capabilities. If a climb is not possible at VYSE, maintain VYSE and return to the departure airport for landing, or initiate an approach to the most suitable landing area available.

AI.XII.F.S8 Simulate securing the inoperative engine.

AI.XII.F.S9 Maintain heading ±10° and airspeed ±5 knots.

AI.XII.F.S10 Complete the appropriate checklist(s).

AI.XII.F.S11 Analyze and correct common errors related to this Task.

Area XII, Task G — Approach and Landing with an Inoperative Engine (Simulated) (AMEL, AMES)

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-9, FAA-H-8083-25; FAA-P-8740-66; POH/AFM

Objective: *To determine the applicant understands approach and landing with an inoperative engine, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and provide effective instruction.*

> **Note** *See ACS Appendix 2 (Safety of Flight) and Appendix 3.*

KNOWLEDGE

AI.XII.G.K1 Factors affecting minimum controllable speed (VMC).

AI.XII.G.K2 VMC (red line) and best single-engine rate of climb airspeed (VYSE) (blue line).

AI.XII.G.K3 How to identify, verify, feather, and secure an inoperative engine.

AI.XII.G.K4 Importance of drag reduction, including propeller feathering, gear and flap retraction, the manufacturer's recommended control input and its relation to zero sideslip.

AI.XII.G.K5 Applicant responsibilities during simulated feathering.

AI.XII.G.K6 Common errors related to this Task.

RISK MANAGEMENT

AI.XII.G.R1 Potential engine failure in flight or during an approach.

AI.XII.G.R2 Collision hazards.

AI.XII.G.R3 Configuring the airplane.

AI.XII.G.R4 Low altitude maneuvering, including stall, spin, or controlled flight into terrain (CFIT).

AI.XII.G.R5 Distractions, task prioritization, loss of situational awareness, or disorientation.

AI.XII.G.R6 Possible single-engine go-around.

SKILLS

AI.XII.G.S1 Promptly recognize an engine failure and maintain positive aircraft control.

AI.XII.G.S2 Set the engine controls, reduce drag, identify and verify the inoperative engine, and simulate feathering of the propeller on the inoperative engine (evaluator should then establish zero thrust on the inoperative engine).

AI.XII.G.S3 Follow the manufacturer's recommended emergency procedures and complete the appropriate checklist.

AI.XII.G.S4 Monitor the operating engine and aircraft systems and make adjustments as necessary.

AI.XII.G.S5 Maintain the manufacturer's recommended approach airspeed ±5 knots in the landing configuration with a stabilized approach, until landing is assured.

AI.XII.G.S6 Make smooth, timely, and correct control application before, during, and after touchdown.

AI.XII.G.S7 Touch down on the first one-third of available runway/landing surface, with no drift, and the airplane's longitudinal axis aligned with and over the runway center or landing path.

AI.XII.G.S8 Maintain directional control and appropriate crosswind correction throughout the approach and landing.

AI.XII.G.S9 Complete the appropriate checklist(s).

AI.XII.G.S10 Analyze and correct common errors related to this Task.

Area XIII, Task A — Maneuvering with One Engine Inoperative (AMEL, AMES)

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-9, FAA-H-8083-25; FAA-P-8740-66; POH/AFM

Objective: *To determine the applicant understands one engine inoperative, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and provide effective instruction.*

> **Note** *See ACS Appendix 2 (Safety of Flight).*

KNOWLEDGE

AI.XIII.A.K1 Factors affecting minimum controllable speed (VMC).

AI.XIII.A.K2 VMC (red line) and best single-engine rate of climb airspeed (VYSE) (blue line).

AI.XIII.A.K3 How to identify, verify, feather, and secure an inoperative engine.

AI.XIII.A.K4 Importance of drag reduction, including propeller feathering, gear and flap retraction, the manufacturer's recommended control input and its relation to zero sideslip.

AI.XIII.A.K5 Feathering, securing, unfeathering, and restarting.

AI.XIII.A.K6 Common errors related to this Task.

RISK MANAGEMENT

AI.XIII.A.R1 Potential engine failure during flight.

AI.XIII.A.R2 Collision hazards.

AI.XIII.A.R3 Configuring the airplane.

AI.XIII.A.R4 Low altitude maneuvering, including stall, spin, or controlled flight into terrain (CFIT).

AI.XIII.A.R5 Distractions, task prioritization, loss of situational awareness, or disorientation.

SKILLS

AI.XIII.A.S1 Recognize an engine failure, maintain control, use manufacturer's memory item procedures, and use appropriate emergency procedures.

AI.XIII.A.S2 Set the engine controls, identify and verify the inoperative engine, and feather the appropriate propeller.

AI.XIII.A.S3 Use flight controls in the proper combination as recommended by the manufacturer, or as required to maintain best performance, and trim as required.

AI.XIII.A.S4 Attempt to determine and resolve the reason for the engine failure.

AI.XIII.A.S5 Secure the inoperative engine and monitor the operating engine and make necessary adjustments.

AI.XIII.A.S6 Restart the inoperative engine using manufacturer's restart procedures.

AI.XIII.A.S7 Maintain altitude ±100 feet or minimum sink rate if applicable, airspeed ±10 knots, and selected headings ±10°.

AI.XIII.A.S8 Complete the appropriate checklist(s).

AI.XIII.A.S9 Analyze and correct common errors related to this Task.

Area XIII, Task B — VMC Demonstration (AMEL, AMES)

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-9, FAA-H-8083-25; FAA-P-8740-66; POH/AFM

Objective: *To determine the applicant understands VMC demonstration, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and provide effective instruction.*

> **Note** *See ACS Appendix 2 (Safety of Flight) and Appendix 3.*

KNOWLEDGE

AI.XIII.B.K1 Purpose of the maneuver.

AI.XIII.B.K2 Proper procedures for maneuver entry and safe recovery.

AI.XIII.B.K3 Factors affecting VMC and how VMC differs from stall speed (VS).

AI.XIII.B.K4 VMC (red line), VYSE (blue line), and safe single-engine speed (VSSE).

AI.XIII.B.K5 Cause of loss of directional control at airspeeds below VMC.

AI.XIII.B.K6 Common errors related to this Task.

RISK MANAGEMENT

AI.XIII.B.R1 Configuring the airplane.

AI.XIII.B.R2 Maneuvering with one engine inoperative.

AI.XIII.B.R3 Distractions, task prioritization, loss of situational awareness, or disorientation.

SKILLS

AI.XIII.B.S1 Configure the airplane in accordance with the manufacturer's recommendations; in the absence of those, then at safe single-engine speed (VSSE/VYSE), as appropriate, and:

- *a.* Landing gear retracted
- *b.* Flaps set for takeoff
- *c.* Cowl flaps set for takeoff
- *d.* Trim set for takeoff
- *e.* Propellers set for high RPM
- *f.* Power on critical engine reduced to idle and propeller windmilling
- *g.* Power on operating engine set to takeoff or maximum available power

AI.XIII.B.S2 Establish a single-engine climb attitude with the airspeed at approximately 10 knots above VSSE.

AI.XIII.B.S3 Establish a bank angle not to exceed 5° toward the operating engine, as required for best performance and controllability.

AI.XIII.B.S4 Increase the pitch attitude slowly to reduce the airspeed at approximately 1 knot per second while applying increased rudder pressure as needed to maintain directional control.

AI.XIII.B.S5 Recognize and recover at the first indication of loss of directional control, stall warning, or buffet.

AI.XIII.B.S6 Recover promptly by simultaneously reducing power sufficiently on the operating engine, decreasing the angle of attack as necessary to regain airspeed and directional control, and without adding power on the simulated failed engine.

AI.XIII.B.S7 Recover within 20° of entry heading.

AI.XIII.B.S8 Advance power smoothly on the operating engine and accelerate to VSSE/VYSE, as appropriate, ±5 knots during recovery.

AI.XIII.B.S9 Analyze and correct common errors related to this Task.

Area XIII, Task C — Demonstration of Effects of Various Airspeeds and Configurations During Engine Inoperative Performance (AMEL, AMES)

References: FAA-H-8083-2, FAA-H-8083-3, FAA-H-8083-9, FAA-H-8083-25; FAA-P-8740-66; POH/AFM

Objective: *To determine the applicant understands the effects of various airspeeds and configurations during engine inoperative performance, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and provide effective instruction.*

> **Note** *See ACS Appendix 2 (Safety of Flight) and Appendix 3.*

KNOWLEDGE

AI.XIII.C.K1 Purpose for and elements of demonstration of effects of various airspeeds and configurations during engine inoperative performance.

AI.XIII.C.K2 Selection of appropriate altitude for the demonstration.

AI.XIII.C.K3 Proper entry procedure to include pitch attitude, bank attitude, and airspeed.

AI.XIII.C.K4 Effects on performance of airspeed changes at, above, and below VYSE.

AI.XIII.C.K5 Effects on performance of various configurations including:

- *a.* Landing gear extended
- *b.* Wing flaps extended
- *c.* Landing gear and wing flaps extended
- *d.* Windmilling propeller on the inoperative engine

AI.XIII.C.K6 Airspeed control throughout the demonstration.

AI.XIII.C.K7 Smooth control technique and coordination throughout the demonstration.

AI.XIII.C.K8 Common errors related to this Task.

RISK MANAGEMENT

AI.XIII.C.R1 Altitude selection.

AI.XIII.C.R2 Entry and recovery procedures.

AI.XIII.C.R3 Loss of control or stall.

AI.XIII.C.R4 Configuring the airplane.

AI.XIII.C.R5 Collision hazards.

AI.XIII.C.R6 Distractions, task prioritization, loss of situational awareness, or disorientation.

SKILLS

AI.XIII.C.S1 Demonstrate, describe, and explain effects of various airspeeds and configurations during engine inoperative performance.

AI.XIII.C.S2 Demonstrate smooth control inputs when transitioning between various airspeeds and configurations, which include:

- *a.* Landing gear extended
- *b.* Wing flaps extended
- *c.* Landing gear and wing flaps extended
- *d.* Windmilling propeller on the inoperative engine

AI.XIII.C.S3 Maintain appropriate airspeed, attitude, and altitude combinations for the various configurations.

AI.XIII.C.S4 Return to normal cruise flight at the altitude and heading specified by the evaluator.

AI.XIII.C.S5 Analyze and correct common errors related to this Task.

Part 2 — Multi-Engine-Specific Tasks from FAA-S-8081-9E (CFI Instrument PTS)

These two tasks appear in Area IX (Emergency Operations) of the CFI Instrument PTS. Per the PTS area note, they apply only when the applicant brings a multiengine airplane for the practical test, in which case at least one of the two is mandatory. For an MEII (multi-engine instrument instructor) curriculum, both should be taught.

Summary Index — PTS Multiengine Tasks

- Area IX, Task C — Engine Failure During Straight-and-Level Flight and Turns (Multiengine)
- Area IX, Task D — Instrument Approach—One Engine Inoperative (Multiengine)

Area IX, Task C — Engine Failure During Straight-and-Level Flight and Turns (Multiengine)

References: 14 CFR part 91; FAA-H-8083-9; FAA-S-ACS-6; FAA-S-ACS-8; Aircraft Flight Manual

> **Note** *PTS-wide note: TASKS C and D are omitted unless the applicant furnishes a multiengine airplane for the practical test, in which case TASK C or D is mandatory.*

Objective: *To determine the applicant exhibits instructional knowledge of engine failure during straight-and-level flight and turns, solely by reference to instruments.*

ELEMENT 1 — INSTRUCTIONAL KNOWLEDGE (DESCRIBE)

- Appropriate methods to be used for identifying and verifying the inoperative engine.
- Technique for maintaining positive aircraft control by reference to instruments.
- Importance of accurately assessing the aircraft's performance capability with regard to action that maintains altitude or minimum sink rate considering existing conditions.

ELEMENT 2 — COMMON ERRORS (DESCRIBE)

- Failure to recognize an inoperative engine.
- Hazards of improperly identifying and verifying the inoperative engine.
- Failure to properly adjust engine controls and reduce drag.
- Failure to establish and maintain the best engine inoperative airspeed.
- Failure to follow the prescribed checklist.
- Failure to establish and maintain the recommended flight attitude for best performance.
- Failure to maintain positive aircraft control while maneuvering.
- Hazards of exceeding the aircraft's operating limitations.
- Faulty basic instrument flying technique.

ELEMENTS 3 & 4 — DEMONSTRATION

- Demonstrates and simultaneously explains straight-and-level flight and turns after engine failure, solely by reference to instruments, from an instructional standpoint.
- Analyzes and corrects simulated common errors related to straight-and-level flight and turns after engine failure, solely by reference to instruments.

Area IX, Task D — Instrument Approach—One Engine Inoperative (Multiengine)

References: 14 CFR part 91; FAA-H-8083-9; FAA-S-ACS-8, FAA-S-ACS-14; Aircraft Flight Manual

Objective: *To determine the applicant exhibits instructional knowledge of an instrument approach with one engine inoperative.*

ELEMENT 1 — INSTRUCTIONAL KNOWLEDGE (DESCRIBE)

- Maintenance of altitude, airspeed and track appropriate to the phase of flight or approach segment.
- Procedure if unable to comply with an ATC clearance or instruction.

- Application of necessary adjustments to the published MDA and visibility criteria for the aircraft approach category.
- Establishment and maintenance of an appropriate rate of descent during the final approach segment.
- Factors that should be considered in determining whether: (1) the approach should be continued straight-in to a landing; or (2) a circling approach to a landing should be performed.

ELEMENT 2 — COMMON ERRORS (DESCRIBE)

- Failure to have essential knowledge of the information that appears on the selected instrument approach chart.
- Failure to use proper communications procedures.
- Noncompliance with ATC clearances.
- Incorrect use of navigation equipment.
- Failure to identify and verify the inoperative engine and to follow the emergency checklist.
- Inappropriate procedure in the adjustment of engine controls and the reduction of drag.
- Inappropriate procedure in the establishment and maintenance of the best engine inoperative airspeed.
- Failure to establish and maintain the proper flight attitude for best performance.
- Failure to maintain positive aircraft control.
- Faulty basic instrument flying technique.
- Inappropriate descent below the MDA or DH.
- Faulty technique during roundout and touchdown.

ELEMENTS 3 & 4 — DEMONSTRATION

- Demonstrates and simultaneously explains an instrument approach with one engine inoperative from an instructional standpoint.
- Analyzes and corrects simulated common errors related to an instrument approach with one engine inoperative.

Part 3 — Shared ACS Tasks That Must Be Flown in the Multi

These tasks list both single-engine and multi-engine class designators. They are not multi-engine-unique in content, but the ACS Appendix 1 add-on matrix and Area Notes require that they be demonstrated in the multi-engine airplane during the MEI add-on practical. Lesson plans should explicitly note the multi-engine considerations (e.g., asymmetric thrust during taxi, drag of the unfeathered prop, performance-charting both engines).

Task	Title (class designator)
V.D	Taxiing, Airport Signs, and Lighting (ASEL, AMEL)
V.E	Taxiing and Sailing (ASES, AMES)
VII.E	Short-Field Takeoff and Maximum Performance Climb (ASEL, AMEL)
VII.F	Short-Field Approach and Landing (ASEL, AMEL)
VII.G	Confined Area Takeoff and Max Performance Climb (ASES, AMES)
VII.H	Confined Area Approach and Landing (ASES, AMES)
VII.I	Glassy Water Takeoff and Climb (ASES, AMES)
VII.J	Glassy Water Approach and Landing (ASES, AMES)
VII.K	Rough Water Takeoff and Climb (ASES, AMES)
VII.L	Rough Water Approach and Landing (ASES, AMES)
II.L	Water and Seaplane Characteristics, Seaplane Bases, Maritime Rules (ASES, AMES)
XIV.A	After Landing, Parking, and Securing (ASEL, AMEL)
XIV.B	Seaplane Post-Landing Procedures (ASES, AMES)

Part 4 — ACS Appendix 1 Required-Tasks Matrix for an AMEL Add-On

From FAA-S-ACS-25 Appendix 1, "Addition of an Airplane Multiengine Rating to an Existing Flight Instructor Certificate" (ASE column), combined with each Area's task-selection note:

Area of Operation	AMEL Add-on Tasks Required (Holder of ASE Cert)	Where Defined
I. Fundamentals of Instructing	None (initial only)	App. 1 table
II. Technical Subject Areas	C (Weather), K (Endorsements), P (OEI Performance), + 1 other	II. Note + App. 1
III. Preflight Preparation	None	App. 1 table
IV. Preflight Lesson on a Maneuver	None	App. 1 table
V. Preflight Procedures	At least one Task (D – Taxiing for AMEL; or E – Taxiing & Sailing for AMES)	V. Note + App. 1
VI. Airport and Seaplane Base Ops	None for AMEL applicants; * for AMES	App. 1 table
VII. Takeoffs, Landings, Go-Arounds	At least 2 takeoff and 2 landing Tasks (incl. Short-Field E/F for AMEL; Confined/Glassy/Rough G–L for AMES; plus Normal A/B, Go-Around N)	VII. Note + App. 1
VIII. Fundamentals of Flight	None for AMEL	App. 1 table
IX. Performance & Ground Reference	Task A (Steep Turns) and Task E (Ground Reference Maneuvers) – at minimum	IX. Note
X. Slow Flight, Stalls, and Spins	Task A (Slow Flight) and one of Task C / D / E (Power-Off, Power-On, or Accelerated Stall)	X. Note
XI. Basic Instrument Maneuvers	None for AMEL	App. 1 table
XII. Emergency Operations	Task E OR F (Engine Failure Before VMC / After Liftoff); Task G (OEI Approach & Landing); + at least 1 other Task	XII. Note
XIII. Multiengine Operations	ALL Tasks (A, B, C) – mandatory for AMEL/AMES	XIII. Note
XIV. Postflight Procedures	Task A (AMEL) or Task B (AMES)	XIV. Note

References from the source: ACS Area-level Notes appear immediately under each Area of Operation header in the document body; Appendix 1 contains the master matrix on pp. 96-98.

Part 5 — Multiengine Considerations (ACS Appendix 2 Excerpt)

Standing safety-of-flight guidance the FAA imposes on every ME-specific maneuver. Build these constraints directly into each lesson plan's risk-management and "completion standards" sections.

Multiengine Considerations (ACS Appendix 2 — Safety of Flight excerpt)

Quoted directly from FAA-S-ACS-25 Appendix 2:

On multiengine practical tests, where the failure of the most critical engine after liftoff is required, the evaluator must consider local atmospheric conditions, terrain, and type of aircraft used. The evaluator must NOT simulate failure of an engine until attaining an altitude of at least 400 ft AGL and at least minimum single-engine speed (VSSE), best single-engine angle-of-climb speed (VXSE), or best single-engine rate-of-climb (VYSE).

The applicant must supply an airplane that does not prohibit the demonstration of feathering the propeller in flight. (An applicant holding an unrestricted AMEL rating may add AMES in an AMES without feathering capability.) FSTD use is limited to approved 14 CFR 61.64 curricula.

For safety reasons, when conducted in the airplane, Tasks that require feathering or shutdown may be performed only under conditions and at a position and altitude where a safe landing on an established airport is possible if there is difficulty unfeathering the propeller or restarting the engine. The evaluator must select an appropriate altitude for the maneuver.

Engine failure (simulated) during takeoff should be accomplished prior to reaching 50 percent of the calculated VMC.

If the manufacturer's checklist calls for feathering the propeller in a power-off glide, during training and certification the applicant should be required to simulate feathering rather than actually feather, and the evaluator should establish zero thrust.

Part 6 — How These Tasks Group for Lesson-Planning

A working suggestion for spanning both sources when lessons are built next:

Ground-only blocks

- OEI Aerodynamics & Performance — pulls from ACS II.P (K1-K7, R1-R4).
- VMC Theory & Limitations — pulls from ACS XIII.B (K1-K6) and reinforces XII.E/F K1, K2.
- Systems, Drag Reduction, Feathering — pulls from XII.F K4-K6, XIII.A K3-K5.
- Regulatory / Endorsements — ACS II.K (shared) with ME-specific endorsements emphasized.

Flight blocks (VFR)

- Slow Flight, Stalls, Steep Turns, Ground Reference — ACS Area X (A + C/D/E), IX (A, E) flown in the multi.
- OEI Maneuvering Aloft — ACS XIII.A, then XIII.C (configuration effects).
- VMC Demo — ACS XIII.B (entry, recognition, recovery within 20°).
- Takeoff/Landing OEI Sequence — ACS XII.E → XII.F → XII.G chained as the takeoff/climb/approach/landing OEI continuum.

Flight blocks (IFR / MEII)

- Instrument Cruise OEI — PTS IX.C.
- Instrument Approach OEI — PTS IX.D.

Each lesson plan should therefore carry a header that lists every applicable Task code from both sources, e.g.: "Lesson 7 — VMC Demonstration & Recovery: ACS XIII.B; supporting refs ACS II.P (K5, K6), XII.F (K1, K2), XIII.A (K1-K4)."

Area II, Task P - One Engine Inoperative (OEI) Performance

Ground-School Anchor • THE BACKBONE OF THE MEI ORAL EXAM • MEI Add-On

ACS Reference & Objective

FAA-S-ACS-25, Area II, Task P — **One Engine Inoperative (OEI) Performance (AMEL, AMES)**. To determine the applicant understands elements related to multiengine performance, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and **provide effective instruction**.

Objective: MEI applicant **explains and teaches** OEI aerodynamics — critical engine, factors affecting V_{MC}, zero sideslip, the V_{MC}/V_S convergence at altitude, windmilling drag and feathering, and the accelerate-stop / accelerate-go decision — and **computes expected SE climb performance** from the AFM to evaluate whether the planned flight is within **the airplane's single-engine capability**.

Why This Task Matters & Materials

Every other multi-engine task (V_{MC} demo, engine failure after liftoff, OEI maneuvering, engine-out approach & landing) **references the aerodynamics built here**. The most-cited cause of MEI applicant failure is weak verbal mastery of **critical engine, SMACFUM, zero sideslip, and the takeoff decision**. Teach this lesson **first**; teach it cold.

Time: 2.0–2.5 hr ground. **References:** AFH (FAA-H-8083-3) Ch. 13; PHAK (FAA-H-8083-25); **FAA-P-8740-66 "Flying Light Twins Safely"**; 14 CFR **61.195(f)**, **23.149**; aircraft POH/AFM.

ACS Task P — Knowledge / Risk / Skill

Code	Element
K1–K3	Performance **charts/tables/graphs**; effects of exceeding limitations; effects of **atmospheric conditions**
K4	Determine performance is within **SE & ME capability**
K5	**OEI aerodynamics:** critical engine, bank/V_{MC}, zero sideslip, loss of directional control
K6	**V_{MC} vs V_S**; effect of **density altitude**
K7	**Best course of action** after engine failure
R1–R4	Critical AOA; LOC; terrain > SE service ceiling; **fuel management**
S1	**Compute expected single-engine climb performance**

MEI Qualifications — 14 CFR 61.195(f)

Before providing instruction in a multiengine airplane **as PIC**, the MEI must have logged at least:

Requirement	Amount
PIC time in the same category & class as the airplane to be used	**15 hours**
PIC time in the same make & model as the airplane to be used	**5 hours**

Track these in your logbook before signing up the first multi student in any given make & model. Expect a question on the oral asking you to **quote the rule**.

BACKBONE OF THE MEI ORAL: This single ACS task is the foundation of essentially every question asked during the MEI **ground portion of the practical exam**. The DPE will probe critical engine geometry, the SMACFUM V_{MC} factors, zero sideslip, the V_{MC}/V_S convergence, windmilling vs feathering drag, and the takeoff accelerate-stop / accelerate-go decision — in any order, for as long as it takes to find a soft spot. **Own this material verbally, cold, with figures drawn from memory on a whiteboard.** Every downstream MEI flight task (V_{MC} demo, engine failure after liftoff, OEI approach) is graded against the aerodynamics taught here. If the applicant cannot teach Task P fluently, the rest of the practical is in jeopardy.

TOPIC 2

Multiengine V-Speeds — The Color-Coded Survival Map

Figure 13-1. *Airspeed indicator markings for a multiengine airplane*

AFH Fig 13-1 — Airspeed Indicator Markings, Multiengine Airplane

*The multiengine ASI carries two markings the single-engine ASI does not: a **RED radial line** at V_{MC} — below this speed directional control with the critical engine inoperative is not assured — and a **BLUE radial line** at V_{YSE}, best single-engine rate-of-climb speed.*

Multiengine V-Speeds — Memorize Cold

Mark	V-Speed	Definition	Why It Matters
RED radial	V_{MC}	Minimum control airspeed with **critical engine inoperative**	Below red, full rudder cannot counter the asymmetric yaw — **loss of directional control**
BLUE radial	V_{YSE}	Best **single-engine rate**-of-climb (most altitude per minute)	**Every OEI procedure: pitch for blue line.**
(no mark)	V_{SSE}	Safe single-engine speed — minimum for **intentional** engine cuts	Never simulate an engine failure below V_{SSE}
(no mark)	V_{XSE}	Best **single-engine angle**-of-climb (most altitude per NM)	Used to clear obstacles after engine failure on departure
WHITE arc	V_{SO}–V_{FE}	**Flap operating range**	Lower = stall in landing config; upper = max flap extension
GREEN arc	V_{S1}–V_{NO}	**Normal operating range**	Below V_{S1}, clean stall; above V_{NO}, smooth air only
YELLOW arc	V_{NO}–V_{NE}	**Caution range** — smooth air only	Turbulence can exceed limit load
RED radial (top)	V_{NE}	Never-exceed speed	Structural redline

Instructor Note: Quick-reference for the local Seminole (PA-44): *V_{MC} **56 KIAS** (red); V_{YSE} **88 KIAS** (blue); V_{SSE} **82 KIAS**; V_{XSE} **82 KIAS**; V_{SO} **55 KIAS**; V_{S1} **57 KIAS**; V_{FE} **111 KIAS**; V_{NO} **169 KIAS**; V_{NE} **202 KIAS**. Have the student write these on a sticky note for the panel before every multi flight, then quiz them cold during preflight.*

TOPIC 3

Critical Engine — P-A-S-T and Why the Left Engine Loses

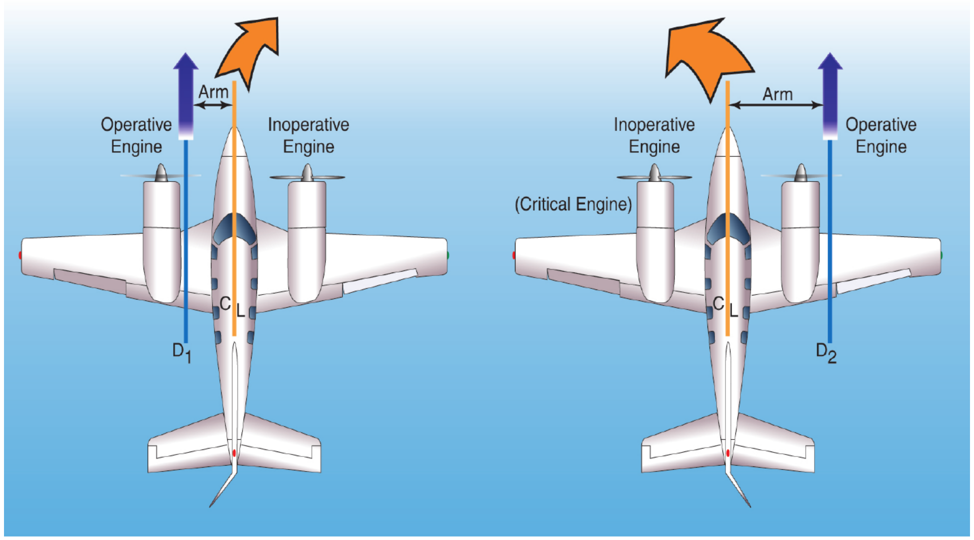


Figure 13-12. *Forces created during single-engine operation.*

AFH Fig 13-12 — Forces Created During Single-Engine Operation

*On a conventional U.S.-built twin (both props rotate **clockwise** viewed from behind), each propeller's **descending blade** produces more thrust than the ascending blade. The **right** engine's descending blade is **farther from the fuselage centerline** than the left's ($D_2 > D_1$), so losing the **LEFT** engine leaves the longer thrust-arm right engine producing the worst yawing moment — that is why the **left engine is critical**.*

P-A-S-T — The Four Factors

	Factor	What It Does
P	**P-factor**	Descending blade has higher AOA & produces more thrust. Right engine's descending blade is **farther outboard** — longer thrust arm. Loss of **LEFT** ⇒ bigger yawing moment.
A	**Accelerated slipstream**	Slipstream over the wing behind each prop raises that wing's lift. Right engine's slipstream is **farther outboard** — loss of **LEFT** leaves the operating right engine making more rolling moment.
S	**Spiraling slipstream**	Clockwise slipstream off the LEFT prop hits the **left side of the vertical tail**, providing a small yaw that **aids** the rudder. Lose the left and that helpful yaw disappears.
T	**Torque**	Engine torque rolls the airframe **opposite** prop rotation. The operating right engine rolls the airplane **left** — **toward the dead engine**. Compounds the loss-of-left case.

Memory hook: "**Dead foot, dead engine.**" The foot not pressing the rudder belongs on the dead engine's side — you need rudder on the **live** side to counter the yaw.

Counter-Rotating Twins — No Critical Engine

Some light twins (Piper Seminole PA-44, Beech Duchess, Cessna T-303) use **counter-rotating propellers**: left engine turns clockwise (viewed from behind), right engine turns counter-clockwise. The descending blades of both engines are **on the inboard side of each nacelle**, so the thrust arm is the same on both sides. **No critical engine.** The MEI applicant must still be able to **explain why** — not just say "there isn't one."

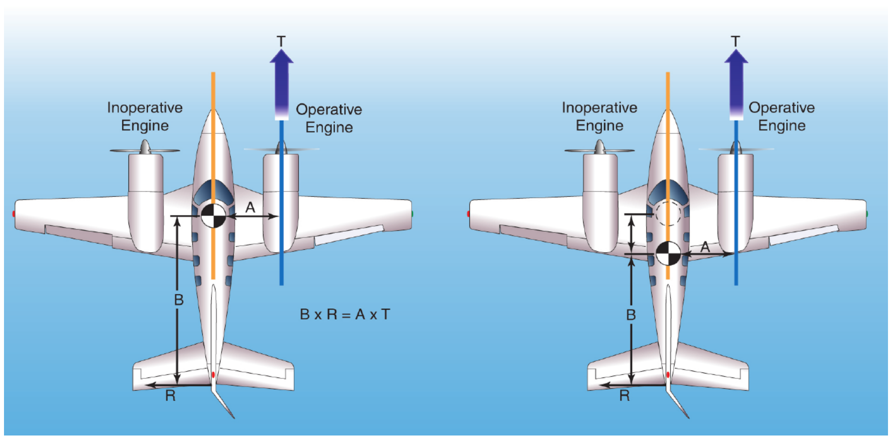
Loss of Directional Control - Mechanics

Asymmetric thrust produces a yawing moment about the vertical axis. The rudder must produce an equal and opposite moment. Rudder force varies as the **square of airspeed**; below V_{MC}, even **full** rudder cannot balance the yaw. The airplane then yaws toward the dead engine, the dead-engine wing drops, and the airplane rolls inverted — the classic V_{MC} roll. **Recovery:** reduce power on the operating engine (removes the yaw source) and **lower the nose** (regains airspeed and rudder authority).

> ***Teach It: Teaching sequence:*** *start with a desktop model. Show how losing the longer thrust arm (LEFT on a conventional twin) creates the bigger moment.* ***Then*** *walk P, A, S, T one at a time. Close by drawing rudder force vs asymmetric-thrust yawing moment on the tail and labeling the airspeed at which they balance:* $\boldsymbol{V_{MC}}$.

TOPIC 4 — Factors Affecting V_{MC} — SMACFUM

	Stands For	Why V_{MC} Was Determined This Way (most-adverse for certification)
S	**Standard** day at sea level	Highest air density ⇒ **most thrust** from the operating engine ⇒ most yaw to counter
M	**Max** power on the operating engine	Full asymmetric thrust = maximum yawing moment, OGE
A	**Aft** CG (most rearward)	Short tail arm ⇒ less rudder moment for the same deflection ⇒ **V_{MC} rises**
C	**Critical** engine windmilling	Worst engine creates worst yaw; **windmilling** prop adds drag & more yaw (*not* feathered)
F	**Flaps** up, gear up	**Gear retracted** removes the keel effect; **flaps up** is the cert config for V_{MC}
U	**Up to 5°** of bank into the operating engine	Cert permits **up to 5°** into operating. **~3 KIAS per degree** reduction in V_{MC} — wings level is optimistic
M	**Most** unfavorable weight	V_{MC} tested at the **most unfavorable weight**. V_{MC} typically **increases as weight is reduced** (less lift component to assist rudder)



AFH Fig 13-13 — Effect of CG Location on Yaw
*B × R = A × T. **Aft** CG (right) shortens rudder arm **B**, so a given rudder force **R** produces less yawing moment. V_{MC} is determined at **most-aft** CG.*

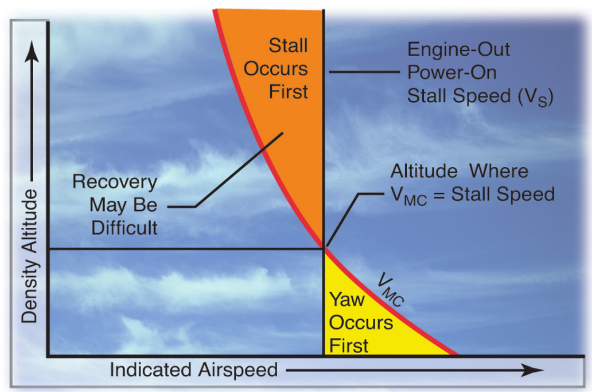


Figure 13-14. *Graph depicting relationship of V_{MC} to V_S.*

AFH Fig 13-14 — V_{MC} vs V_S — Density-Altitude Trap
*V_{MC} (red) **decreases** with altitude; V_S indicated is **flat**. They converge. **Above** the crossing: **asymmetric stall** → **spin**. Recover at first indication of stall warning or buffet.*

CRITICAL: Density altitude limits an actual V_{MC} demonstration. Per the AFH, an actual V_{MC} demo may not be possible at high density altitude or in airplanes where V_{MC} is equal to or less than V_S. In that case, V_{MC} is demonstrated by an **artificial** limiting rudder travel technique — a speed is set well above V_S (~20 kt) and rudder authority is the limit. **Recover any V_{MC} demo at the first indication of LOC: heading change, stall warning, or buffet** — do not let the airplane reach V_S.

TOPIC 5

Zero Sideslip — How to Actually Fly With One Engine Inoperative

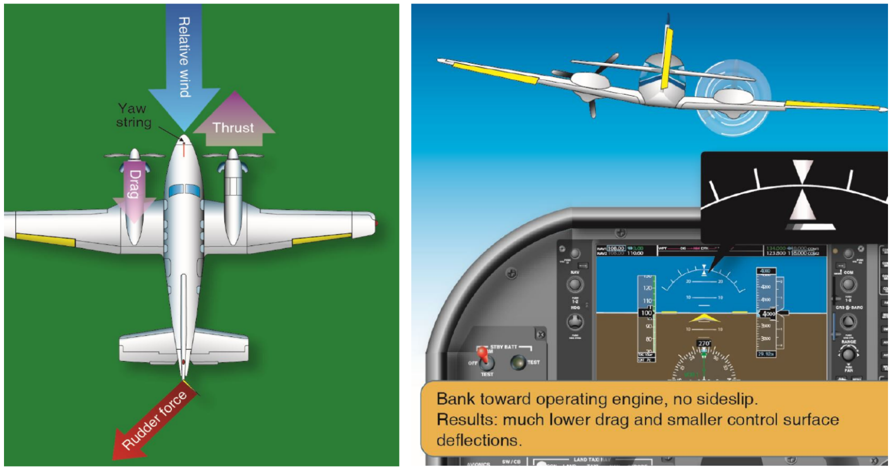


Figure 13-17. *Zero sideslip engine-out flight.*

AFH Fig 13-17 — Zero Sideslip Engine-Out Flight
*Bank toward the operating engine, **no sideslip**. Result: **much lower drag**, smaller control-surface deflections, and **maximum climb performance**. The only configuration in which the AFM's SE climb numbers are valid.*

Zero Sideslip — The Configuration

Configuration	Bank	Ball	Result
Wings level, ball centered	0°	Centered	**Sideslip toward dead engine**; fuselage broadside to wind; **major drag**
Wings level, ball deflected	0°	Toward operating	Less sideslip; rudder offset still creates drag
ZERO SIDESLIP	**~2° into operating**	**Half-ball toward operating**	**Minimum drag**; SE climb book numbers **valid**
Excess bank	> 5°	Past half-ball	Operating wing low ⇒ sideslip the other way; drag returns; V_{MC} lower but performance suffers

Teaching cue: “**Raise the dead.**” The dead engine's wing goes **up** (bank toward the live engine). Ball goes **toward the live engine too**. Both controls point at the engine that's still working.

How to Fly the Configuration

After engine failure: identify, verify, feather; then trim for V_{YSE} and establish zero sideslip. **Roll ~2° toward the operating engine** with aileron, **add rudder toward the operating engine** until the ball sits **about half-deflected** toward the operating engine. The yaw string (if installed) aligns with the longitudinal axis. Trim out the rudder pressure; trim out the aileron pressure if able.

What Goes Wrong

- **Wings level, ball centered.** Familiar SE habit, but fuselage broadsides the wind ⇒ significant drag, climb degraded, V_{MC} higher than published.
- **Excess bank (>5°)**. Sideslip reverses; drag returns; control surfaces saturate.
- **Bank into the dead engine.** V_{MC} rises sharply, possibly **above current airspeed** ⇒ immediate LOC.

How Long Should the Configuration Be Held?

Zero sideslip is the cruise configuration for the rest of the OEI flight. **It is the configuration that earns the book numbers used for SE climb, SE service ceiling, and drift-down planning.** Hold it from feather through approach. On final, with landing gear & landing flaps, the bank may be reduced — but trim and rudder pressure continue to make the operating side the “down” side.

> ***Teach It: In the airplane:*** *the inclinometer and yaw string are the two outputs the student actually flies. Make them **name the ball position** aloud during every OEI maneuver (“half-ball into the live engine”). Once it's verbal, it sticks.*

TOPIC 6 Windmilling vs Feathering — The Drag Difference That Decides Survival

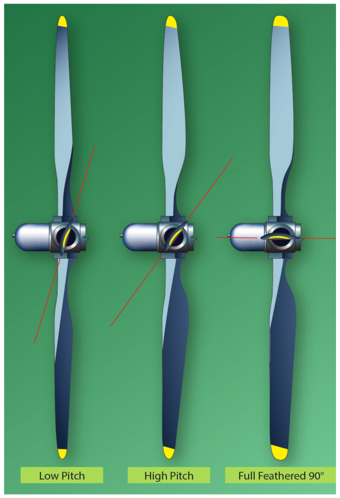


Figure 13-2. *Feathered propeller.*

AFH Fig 13-2 — Feathered Propeller
*Low pitch (high-RPM cruise), high pitch (low-RPM cruise), **full feathered 90°** (blade edge-on to the wind = knife edge, near-zero drag and zero rotation).*

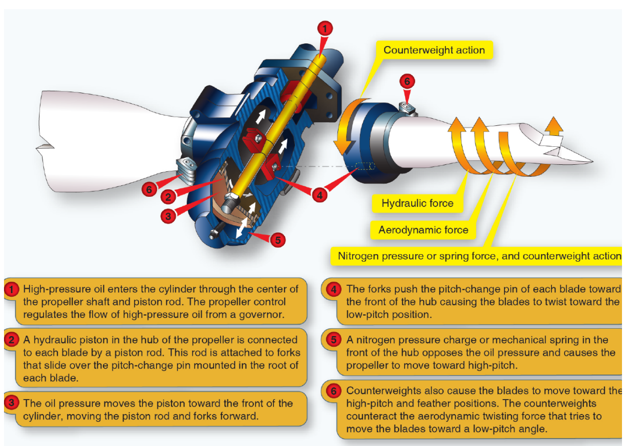


Figure 13-4. *Pitch change forces.*

AFH Fig 13-4 — Pitch Change Forces (Internal Mechanism)
*Inside the hub: oil pressure drives blades toward **low pitch**; aerodynamic forces, counterweights, and nitrogen spring drive blades **toward feather** if oil is lost.*

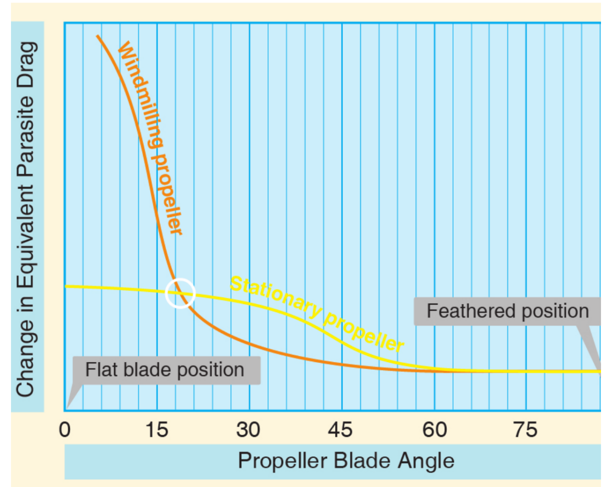


Figure 13-3. *Propeller drag contribution.*

AFH Fig 13-3 — Propeller Drag Contribution
***Windmilling drag is dramatic** — equivalent to a flat plate the size of the prop disk. Stationary is less. **Feathered is nearly zero.** This is why feathering is the difference between climbing and descending.*

Why a Feathered Prop Saves the Airplane

A windmilling propeller is **not** producing thrust — the air drives the blades, which drive the engine. Blade angles are **low pitch**, broadside to the wind, creating drag like a **flat disk**. On most light twins that drag reduces climb performance to **zero or negative**. Feathering rotates the blade to **~90°** — knife edge to the wind. Drag drops to almost nothing. AFM SE climb numbers **assume feathered**.

Pull-To-Feather Mechanism

Constant-speed prop is held at its operating blade angle by **engine oil pressure** (toward low pitch) opposed by **counterweight, nitrogen-spring, and aerodynamic** forces (toward feather). Pulling the prop control fully aft **dumps oil** from the hub; counterweights and nitrogen spring drive the blades to feather. Total time: **~10 seconds**.

> ***Restart:** An **unfeathering accumulator** stores reserve oil. To restart: prop control forward ⇒ oil released into hub ⇒ blades rotate back to low pitch ⇒ engine windmills for restart.*

TOPIC 7

Engine Failure on Takeoff — Accelerate-Stop / Accelerate-Go / Area of Decision

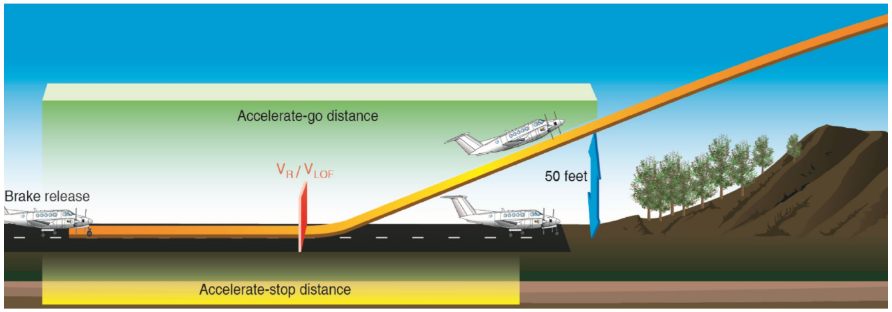


Figure 13-5A. *Accelerate-stop distance and accelerate-go distance.*

AFH Fig 13-5A — Accelerate-Stop & Accelerate-Go

__Accelerate-stop__ = distance to accel to V_R/V_{LOF}, lose an engine, and stop. __Accelerate-go__ = distance to accel, lose an engine, and climb to __50 ft__ on the remaining engine.

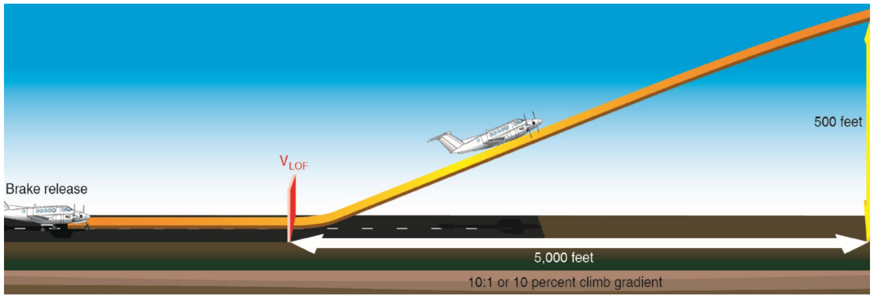


Figure 13-5B. *Climb gradient.*

› The all-engine service ceiling of multiengine airplanes is the highest altitude at which the airplane can

AFH Fig 13-5B — Climb Gradient

Gradient = altitude gained per unit distance. __10:1 = 10%__ (500 ft per 5,000 ft). Unlike ROC, gradient is affected by wind. Required for obstacle-departure analysis.

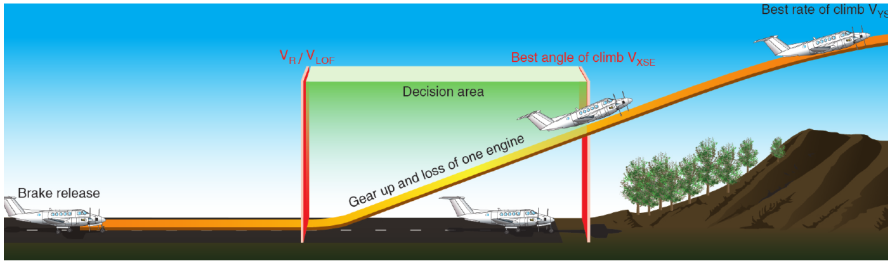


Figure 13-6. *Area of decision for engine failure after lift-off.*

AFH Fig 13-6 — Area of Decision

Between V_R/V_{LOF} and reaching V_{XSE}/V_{YSE} above obstacles, the airplane is __airborne, gear up, but climb is not guaranteed__. __Brief the answer for this region every takeoff.__

Decision Logic — What to Do, When

Phase	Engine Failure Response
Before V_R on runway	**Abort.** Throttles, brakes, directional control
After V_R, runway remaining	**Land straight ahead** if possible — better than decision area
Airborne, gear up, in decision area	If SE climb insufficient for terrain: **land ahead**. If sufficient: **identify-verify-feather, blue line, return**
Above 400 ft AGL at V_{YSE}	Standard OEI procedure — climb, troubleshoot, return

CRITICAL: POTENTIAL FAIL ITEM — ACCELERATE-STOP / ACCELERATE-GO. Examiners routinely ask the MEI applicant to **compute accelerate-stop, accelerate-go, SE ROC, and SE service ceiling for the actual day of the practical**, AFM in hand. **If the applicant cannot do this fluently, or has not prepared the numbers, this task can be a bust.** Arrive with **printed AFM chart computations** for the day's weight, pressure altitude, temperature, wind, and runway — and be ready to **repeat the math on a fresh problem the examiner invents**. Drill this every flight.

TOPIC 8

Common Errors, Ground Discussion Script & Skills Assessment

Common Applicant Errors (MEI Oral)

Error	Root Cause / Fix
Cannot articulate P-A-S-T (most-cited oral failure)	Memorized "left is critical" without explanation. **Fix:** draw Fig 13-12 from memory; mark descending blade locations; point to the longer thrust arm.
SMACFUM letters missed or wrong	Recites factors but cannot tie them to the **certification condition**. **Fix:** for each letter, state **why** it is the worst-case for V_{MC}.
Confuses bank-into-operating direction	Says "bank toward the dead engine." **No** — bank into the operating, "**raise the dead**."
Wrong ball direction	Centers the ball. **No** — ball toward the operating engine.
Misses V_{MC}/V_S convergence	Recites factors but cannot say why density altitude is dangerous. **Fix:** redraw Fig 13-14 from memory.
Accel-stop / accel-go not prepared	**Potential fail item.** Compute SE ROC, SE service ceiling, accel-stop, accel-go for the day of the checkride.
Forgets 'feathered' in the SE climb caveats	Quotes book numbers without stating assumptions. **Always state:** feathered, gear/flaps up, V_{YSE}, zero sideslip.

Instructor Ground Discussion Script

Setup: POH out (PA-44 or local twin), whiteboard, AFH Ch. 13 figures printed or screen-mirrored, density-altitude chart, V_{MC}/V_S graph.

1. (15 min) 61.195(f): student states the 15-hr and 5-hr rules cold.

2. (15 min) V-speeds: walk Fig 13-1, student names red/blue, then the airplane's actual numbers from memory.

3. (15 min) Critical engine: draw Fig 13-12 from memory, name P-A-S-T.

4. (20 min) SMACFUM: build the table on the board, ask "why?" for every letter. Close on Fig 13-14 — the density-altitude convergence.

5. (10 min) Zero sideslip: walk Fig 13-17; have student name bank/ball.

6. (15 min) Windmilling vs feathering: Fig 13-3 first (the drag chart), then Fig 13-2 (blade angles), then Fig 13-4 (mechanism).

7. (20 min) Accelerate-stop/go: AFM, student computes today's numbers; you invent a fresh problem (higher temp, heavier weight); student redoes it.

Skills Assessment — Oral Quiz

#	Question	Looking For
1	Quote 14 CFR 61.195(f).	**15 hours PIC in category & class**, plus **5 hours PIC in make & model**, before instructing in a multiengine airplane.
2	Critical engine on a conventional twin, and why?	**Left.** Cite P-A-S-T; right engine's descending blade is farther from centerline ⇒ longer thrust arm.
3	List the seven SMACFUM factors.	**S**tandard day at sea level, **M**ax power on operating engine, **A**ft CG, **C**ritical engine windmilling, **F**laps up / gear up, **U**p to 5° bank into operating engine, **M**ost unfavorable weight.
4	Why is windmilling drag so much worse than feathered?	Low-pitch blades broadside to wind = flat-disk drag. Feathered = blade is a knife edge, near-zero drag. See Fig 13-3.

#	Question	Looking For
5	Describe zero sideslip with indications.	**~2° bank into the operating engine**; **ball half-deflected toward operating**. Minimum drag; AFM SE climb numbers valid.
6	Why is the density-altitude V_{MC}/V_S convergence dangerous?	V_{MC} decreases with altitude, V_S indicated unchanged. They converge; above the crossing the airplane **stalls with asymmetric thrust** ⇒ spin.
7	Define accelerate-stop and accelerate-go distance.	**Accel-stop:** accelerate to V_R, lose engine, full stop. **Accel-go:** accelerate to V_R, lose engine, climb to 50 ft on remaining engine.
8	Engine failure airborne in the decision area — what is your decision?	If SE climb insufficient: **land ahead** in best terrain. If SE climb available: **identify-verify-feather, blue line, return**.

Instructor Note: Completion Standard: *Applicant **explains and teaches** the OEI ground-school syllabus without prompt: quotes **14 CFR 61.195(f)**; names every **V-speed** and the airplane's numbers; identifies the **critical engine** with full **P-A-S-T** explanation; lists and explains every letter of **SMACFUM**; defines zero sideslip with correct **bank and ball**; explains the **V_{MC}/V_S convergence**; contrasts **windmilling and feathered** drag; **computes** accelerate-stop, accelerate-go, SE rate of climb, and SE service ceiling from the AFM for the current conditions; demonstrates effective **instructional method**. The lesson is complete when the applicant can answer any oral question above **without notes**, draw any figure above **from memory on a whiteboard**, and recompute any chart problem the examiner invents.*

Return to Table of Contents »

Area XII, Task E - Engine Failure During Takeoff Before V_{MC} (Simulated)

Flight Lesson • REJECTED TAKEOFF / LOW-SPEED ABORT BEFORE V_{MC} • MEI Add-On

ACS Reference & Objective

FAA-S-ACS-25, Area XII, Task E — **Engine Failure During Takeoff Before V_{MC} (Simulated) (AMEL, AMES)**. To determine the applicant understands engine failure during takeoff, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and **provide effective instruction**.

Objective: MEI applicant **demonstrates and simultaneously explains** a rejected-takeoff response to a simulated engine failure introduced during the takeoff roll at very low speed. The student instructor will **close both throttles smoothly and promptly**, maintain directional control with rudder and brakes, hold runway centerline, and **analyze and correct common errors** — while explaining each action aloud as if instructing.

Lesson Sequence & Materials

Time: 0.3 hr pre-flight brief + 1.0–1.2 hr flight (3–5 reject evolutions) + 0.3 hr debrief. **References:** AFH (FAA-H-8083-3) Ch. 13; PHAK Ch. 12; **FAA-P-8740-66 "Flying Light Twins Safely"**; POH/AFM — emergency procedures & performance section; ACS Appendix 2 "Safety of Flight."

Sequence: (1) Ground brief V-speeds, accelerate-stop, the decision regions, and today's **50% V_{MC} abort threshold**. (2) Takeoff briefing the student will give aloud before every roll. (3) CFI introduces simulated failure at <28 KIAS (PA-44). (4) Student aborts; taxi back; debrief. (5) Repeat to standard.

ACS Task E — Knowledge / Risk / Skill

Code	Element
K1	**Factors affecting V_{MC}** (SMACFUM)
K2	V_{MC} (red line) and V_{YSE} (blue line)
K3	**Accelerate/stop distance** — compute & brief
K4	Common errors related to this Task
R1	Potential **engine failure during takeoff**
R2	**Configuring the airplane** (flaps, trim, fuel, mixture)
R3	**Distractions**, task prioritization, loss of SA, disorientation
S1	**Close the throttles smoothly and promptly** on simulated failure
S2	Maintain **directional control** and apply brakes (AMEL) or flight controls (AMES) as necessary
S3	**Analyze and correct** common errors related to this Task

Completion Standards (Today)

On **at least three** simulated failures during the takeoff roll, applicant (a) **closes both throttles within ~1 second** of the simulated failure; (b) maintains **runway centerline within one centerline stripe** with rudder and differential braking as needed; (c) **verbalizes the corrective action** as it is performed (teaching aloud); (d) brings the airplane to a controlled stop with adequate runway remaining and **without locking a wheel** or veering off the prepared surface.

SAFETY OF FLIGHT - ACS APPENDIX 2: Simulated engine failure on takeoff must be accomplished PRIOR to reaching 50% of the calculated V_{MC}. At or above 50% V_{MC}, the asymmetric thrust an abrupt single-engine cut produces is sufficient to cause loss of directional control on the runway. **Calculate today's V_{MC} and the 50%-of-V_{MC} abort gate before engine start, write it on the kneeboard, and brief it aloud before every takeoff.** Engine failure at or above 50% V_{MC} — whether in training or on a real departure — belongs to **Task F (Engine Failure After Liftoff)** or to the **continue-takeoff** branch of the takeoff decision; it is NOT trained as a runway abort.

PHASE 1 — Pre-Takeoff Ground Briefing — V-Speeds, Accelerate-Stop, the 50% Gate

Step 1 — V-Speeds for Today's Airplane

Student writes the airplane's V-speeds on the kneeboard and reads them aloud. The **red line** (V_{MC}) and **blue line** (V_{YSE}) anchor the entire OEI envelope. Below the red line, full rudder will not counter the asymmetric yaw from a critical-engine failure — the airplane **cannot maintain directional control** in the air. On the runway, the airplane below 50% of V_{MC} is slow enough that **brakes and rudder steering remain effective**; that is why we abort below the 50% gate and fly through (or treat as Task F) above it.

V-Speed (PA-44 ref.)	Value	What It Means Today
V_{MC} (red)	**56 KIAS**	Min control speed, critical engine inop, certification conditions
50% V_{MC} (abort gate)	**~28 KIAS**	**CFI introduces simulated failure BELOW this speed.**
V_R / V_{LOF}	75 / 80 KIAS	Rotate / lift-off; above here a runway abort may not be feasible
V_{YSE} (blue)	**88 KIAS**	Best SE rate of climb — the airborne target speed (Task F)
V_{SSE}	82 KIAS	Min speed for **intentional** engine cuts — airborne use only

Instructor Note: PA-44 numbers shown as reference. *For any other airplane, pull V_{MC} from Section 1 (Limitations) of the POH/AFM and recompute the 50% gate. Write both on the kneeboard.* ***If you cannot state today's 50%-V_{MC} abort speed cold, do not depart.***

Step 2 — Accelerate-Stop & the Three Takeoff Regions

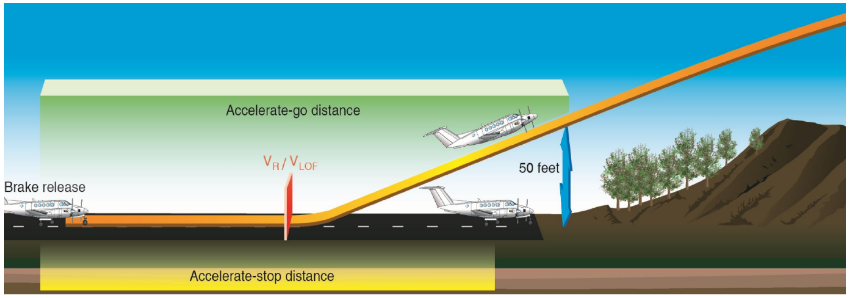


Figure 13-5A. *Accelerate-stop distance and accelerate-go distance.*

AFH Fig 13-5A — Accelerate-Stop & Accelerate-Go
Accelerate-stop*: distance to accelerate to V_R/V_{LOF}, experience an engine failure, and bring the airplane to a complete stop on the runway. Computed from POH every flight.* ***Today's task lives entirely inside the left side of this chart*** *— we never go airborne with a simulated failure.*

Region	Speed Range	Engine-Failure Response
1. Low-speed reject zone	**0 → 50% V_{MC}**	**ABORT.** Both throttles closed, brakes, rudder, stay on the runway. **This is the only zone Task E covers.**
2. High-speed reject zone	50% V_{MC} → V_R	Abort if runway remaining; otherwise commit to continued takeoff. **Not trained with a simulated cut** — risk of LOC.
3. Airborne / area of decision	V_R → clear of obstacles @ V_{YSE}	Task F territory: **fly the airplane first**, pitch for blue line, identify-verify-feather, return.

Why 50% of V_{MC}? Below that speed, propeller asymmetric thrust and P-factor are not yet developed enough to overpower rudder + nosewheel + brakes. The airplane behaves like a single-engine taxi excursion — recoverable with prompt throttle reduction. Above 50% V_{MC}, an abrupt cut starts producing yaw and roll forces close to the certification limit, and a simulated training cut can become a real loss-of-control event before the student reacts.

CRITICAL: BEFORE EVERY TAKEOFF ROLL TODAY: Student verbalizes — **(1)** today's V_{MC} = ___ ; **(2)** today's **50% V_{MC} abort gate = ___ KIAS**; **(3)** “If the CFI calls or simulates a failure below ___ KIAS, I will close both throttles, maintain centerline, brake as required, and stop on the runway.” **No takeoff begins without this brief.**

PHASE 2 — In-Airplane Sequence — Roll, Reject, Recover, Repeat

Step 3 — Pre-Takeoff Briefing (Student Aloud)

Lined up on centerline, brakes held, before throttle advance. Student delivers this brief aloud, every roll, every time:

- "Runway ___, length ___ feet, dry, winds ___."
- "V_{MC} ___ KIAS, 50% gate ___ **KIAS**, V_R ___, V_{YSE} ___."
- "**Below** ___ **KIAS** — abort: throttles closed, brakes, centerline."
- "**Above** ___ **KIAS, before V_R** — abort if runway remaining; otherwise fly the airplane."
- "**After V_R** — positive rate, gear up, blue line, identify/verify/feather above 400 AGL."
- "Trim set, mixtures rich, props forward, flaps takeoff, fuel on, lights, transponder. **Ready.**"

Step 4 — The Roll & the Simulated Failure

Student releases brakes, advances throttles smoothly to takeoff power, calls **"airspeed alive"** as the ASI begins to indicate. The CFI — from the right seat with throttle-hand guard already in place — introduces the simulated failure by **retarding one throttle to idle while clearly calling 'SIMULATED ENGINE FAILURE'**. This occurs at a CFI-selected airspeed **strictly below the 50%-V_{MC} gate** (PA-44: <28 KIAS).

> ***CFI Safety Note: CFI hand discipline:*** *Right hand on the throttles from brake release through stop. Verbalize the cut **before** the throttle moves so the student is never surprised by a silent power loss. **Never** introduce a failure once the ASI passes the 50% gate — if you missed the window, let the takeoff continue and brief Task F or a normal liftoff instead.*

Step 5 — Student Reject Procedure (Skill S1, S2)

#	Action	Verbalized Teaching Cue
1	**Both throttles to idle** — smoothly, promptly, in one motion	"Throttles closed."
2	**Maintain centerline** with rudder; nosewheel steering as speed drops	"Right rudder/left rudder — on centerline."
3	**Brakes as required** — smooth, even; no skid, no locked wheel	"Brakes — firm and even."
4	**Flaps as installed** per POH for max braking; **do not retract** until clear of runway	"Flaps stay; aerodynamic drag helping us stop."
5	Bring airplane to a **full stop on the runway**; assess runway remaining	"Stopped — on centerline — runway remaining."
6	Clear runway when able; **cleanup checklist**; advise tower "rejected takeoff for training"	"Clear of runway, cleanup flow, ATC advised."

Step 6 — Debrief on Taxi & Repeat

On the taxi back, the student **self-critiques** aloud: throttle-closure timing, directional control, braking smoothness, any centerline deviation, and what cue was missed (if any). CFI confirms or corrects. Plan **3–5 evolutions** per lesson with the CFI **varying which throttle is retarded** and **varying the cut speed** within the <50% V_{MC} window to prevent anticipation. **End each takeoff with a normal departure** only after a clean reject demonstration has been graded.

> ***Ops Note: Tower / Ground Coordination:*** *Request "multiple short-field departures with low-speed rejected-takeoff training on the runway, full stops, exit at midfield or end as able." Many towers will assign a longer runway or a quieter window. **Brief the student that an actual abort during training is identical to the simulated procedure** — the only difference is who closed the throttle.*

PHASE 3 — Common Errors, Risk Management & Completion Standards

Common Applicant Errors (Skill S3)

Error	Root Cause / Fix
Slow throttle reduction	Student waits to confirm the failure. **Fix:** the CFI's verbal call IS the confirmation; closing both throttles is the **first** action, not the third.
Closes only one throttle	Trained habit from single-engine. **Fix:** in the twin the "dead throttle" is unknown at the moment of failure — close **both**, sort it on the rollout.
Drifts off centerline / over-controls rudder	Confused by which engine quit. **Fix:** fly the runway, not the engine — rudder pressure to keep the centerline stripe under the nose.
Locked-wheel braking / skid	Stomps brakes. **Fix:** smooth, firm, even pressure; modulate if wheels stop rotating; use full runway length rather than maximum deceleration.
Retracts flaps prematurely	Trained habit. **Fix:** flaps stay until clear of runway — they help decelerate and they unload nosewheel.
Forgets to verbalize / teach aloud	Reverts to private-pilot habits. **Fix:** every action gets a teaching cue; this is the MEI standard, not a checkride flourish.
Anticipates the cut	Student tenses, eyes the CFI's hand. **Fix:** CFI varies cut speed and engine; student keeps eyes **outside, down the runway**.
Cut introduced too late (>50% V_{MC})	**CFI error.** Abort the exercise; let the takeoff continue; debrief and re-set the gate for the next attempt.

Risk Management (R1–R3)

Risk	Mitigation
R1 — Engine failure on takeoff	Compute accelerate-stop for today; verify it fits available runway with margin; brief abort & continue criteria aloud.
R2 — Configuration	Flaps, trim, fuel selectors, mixtures, props, cowl flaps confirmed before brake release; nothing changes during the reject except throttles & brakes.
R3 — Distraction / SA loss	Sterile cockpit from line-up to stop; CFI handles radios during the reject; student's only job is throttle, rudder, brake.

Debrief Script (15 min, post-flight)

1. Review reject timings — CFI calls each evolution by tach time; student rates own throttle-closure latency.
2. Review centerline tracking — ground-track recall, any rudder over-control.
3. Review the **50% V_{MC} gate** — restate the number and why we never cut above it on the runway.
4. Tie to **Task F** — what changes when the cut comes after V_R; preview next lesson.
5. Endorse logbook; assign POH performance section + AFH Ch. 13 pp. on accelerate-stop as reading for next session.

> ***Completion: Completion Standard (today):*** *Applicant performs* ***at least three clean evolutions*** *meeting throttle, centerline, braking, and teach-aloud standards on the front of this lesson plan, on a variety of cut speeds and a variety of engines, with* ***no CFI intervention****. Sign off Task E only after the applicant can also* ***brief the entire procedure on the ground unprompted****.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	# Reject Evolutions	Aircraft / N#	CFI/MEI Signature & Cert #

Return to Table of Contents »

Area XII, Task F - Engine Failure After Liftoff (Simulated)

Flight Lesson • OEI CLIMB-OUT / IDENTIFY-VERIFY-FEATHER-SECURE / RETURN • MEI Add-On

ACS Reference & Objective

FAA-S-ACS-25, Area XII, Task F — **Engine Failure After Liftoff (Simulated) (AMEL, AMES)**. To determine the applicant understands engine failure after liftoff, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and **provide effective instruction**.

Objective: MEI applicant **demonstrates and simultaneously explains** the response to a simulated engine failure introduced after the airplane is safely established in the OEI climb envelope. The student instructor will maintain directional and pitch control, **establish V_{YSE}** (or V_{XSE} / V_{MC}+5 for obstacles), **reduce drag** (gear/flaps), **identify, verify, feather, and secure** the inoperative engine, fly a **zero-sideslip** OEI profile, and return to land — while explaining each action aloud as if instructing.

Lesson Sequence & Materials

Time: 0.4 hr pre-flight brief + 1.2–1.5 hr flight (3–4 climb-out evolutions + OEI return) + 0.3 hr debrief. **References:** AFH (FAA-H-8083-3) Ch. 13; PHAK Ch. 12; **FAA-P-8740-66 "Flying Light Twins Safely"**; POH/AFM emergency procedures & performance section; ACS Appendix 2 "Safety of Flight."

Sequence: (1) Ground brief V_{MC} / V_{YSE} / V_{XSE} / V_{SSE}, the takeoff decision tree, IVFS flow, drag reduction, zero-sideslip concept, and today's **400 AGL / V_{SSE} entry gate**. (2) Takeoff brief the student gives aloud before each roll. (3) Normal takeoff — CFI introduces simulated failure **only after** 400 AGL and V_{SSE}. (4) Student flies the OEI profile and returns. (5) Debrief / repeat.

ACS Task F — Knowledge / Risk / Skill

Code	Element
K1	**Factors affecting V_{MC}** (SMACFUM)
K2	V_{MC} (red), V_{YSE} (blue), V_{SSE}
K3	**Accelerate/stop** & **accelerate/go** distances
K4	**Identify, verify, feather, and secure** the inoperative engine
K5	**Drag reduction** (feather / gear / flaps); mfr control input & **zero sideslip**
K6	**Simulated feathering** & CFI's **zero-thrust** procedure
K7	Common errors related to this Task
R1–R5	Engine failure after liftoff; collision hazards; configuration; **low-altitude maneuvering (stall/spin/CFIT)**; distractions / SA loss
S1–S5	Recognize, maintain control; **establish V_{YSE}** (or V_{XSE}/V_{MC}+5 with obstacles); **reduce drag**; simulate **feather**; mfr control inputs / zero sideslip; trim
S6–S11	Monitor operating engine; recognize performance & **return** if no climb; simulate **secure**; **hdg ±10° / IAS ±5 kt**; complete checklists; analyze & correct errors

Completion Standards (Today)

On **at least three** simulated failures after liftoff, applicant (a) maintains **positive aircraft control** at or above V_{YSE}; (b) completes the **identify / verify / simulated feather** flow before any further configuration change; (c) **reduces drag** per POH and flies a **zero-sideslip** bank-into-good-engine profile; (d) holds **heading ±10° and airspeed ±5 kt** throughout the OEI climb and pattern return; (e) **verbalizes every action** as it is performed (teaching aloud); (f) completes the OEI return and approach (briefed to Task G).

SAFETY OF FLIGHT - ACS APPENDIX 2: **Simulated engine failure after liftoff must NOT be introduced until the airplane has attained at least 400 feet AGL and at least V_{SSE}, V_{XSE}, or V_{YSE}.** Below those thresholds, an abrupt single-engine cut sets up the classic stall/V_{MC}-roll/CFIT chain that has destroyed light twins on training departures for fifty years. **Confirm both numbers aloud before brake release on every takeoff:** the 400 AGL altitude gate and today's V_{SSE} speed gate. If either is not yet satisfied, the CFI does not introduce a failure — the airplane completes a normal climb to the gate, then the evolution begins.

PHASE 1 Pre-Takeoff Ground Briefing — V-Speeds, IVFS, Drag & Zero Sideslip

Step 1 — V-Speeds & the 400 AGL / V_{SSE} Entry Gate

Student writes the airplane's V-speeds on the kneeboard and reads them aloud. **V_{MC}** (red line) is the absolute floor of controllability OEI; **V_{YSE}** (blue line) is the climb target after a failure; **V_{SSE}** is the manufacturer's minimum airspeed for **intentional** engine cuts. Combine V_{SSE} with the **400 AGL altitude gate** from the ACS and you have today's two-part entry criterion for the simulated failure.

V-Speed (PA-44 ref.)	Value	Role on Today's Climb-Out
V_{MC} (red)	**56 KIAS**	Floor. Below = full rudder will not hold heading OEI.
V_R / V_{LOF}	75 / 80 KIAS	Rotate / lift-off — not yet in the failure-entry envelope.
V_{YSE} (blue)	**88 KIAS**	**Pitch target after the failure.** Best SE rate of climb.
V_{XSE}	82 KIAS	Best SE angle — use to clear obstacles, then transition to V_{YSE}.
V_{SSE} (entry gate)	**82 KIAS**	**CFI may NOT introduce a cut below this speed.**
400 ft AGL (gate)	**+400 AGL**	**CFI may NOT introduce a cut below this altitude.**

> ***Instructor Note: If you cannot recite today's V_{SSE} and the 400 AGL gate cold, do not depart.*** *For airplanes other than the PA-44, pull V_{MC}, V_{YSE}, V_{XSE}, and V_{SSE} from POH Section 1/2 and write them on the kneeboard.*

Step 2 — The OEI Climb-Out Decision Tree

Below V_R: Task E territory — reject. **V_R to 400 AGL / V_{SSE}:** no simulated cut today; in a real failure here, the options are land-straight-ahead vs continue, weighed against runway remaining, gear position, obstacles, and climb gradient. **At/above 400 AGL and V_{SSE}:** Task F entry envelope — CFI may introduce a simulated failure; student flies the OEI climb-out and IVFS flow.

Step 3 — IVFS Flow (K4) & the Memory Items

#	Step	Cue / Cross-Check
1	**Maintain control** — pitch for V_{YSE}, wings level, rudder to stop yaw	"Pitch & rudder — blue line."
2	**Mixtures, props, throttles** — FULL FORWARD	"Max available power, both levers."
3	**Flaps UP** / **Gear UP** (when positive rate, no runway remaining)	Drag reduction (K5)
4	**Identify** — "Dead foot, dead engine."	Foot that ISN'T pressing rudder = the dead side
5	**Verify** — close suspect throttle slowly; expect no yaw change	If yaw worsens — wrong engine; reopen, try other
6	**Feather** the inop prop (simulated — CFI sets zero thrust)	Drag drops dramatically (see Fig 13-2)
7	**Secure** — mixture cut-off, mags off, fuel off, alt off, cowl flap closed (simulated)	Engine-failure-in-flight checklist

Step 4 — Drag Reduction & Zero Sideslip (K5)

A windmilling prop on the dead engine produces drag roughly equivalent to a flat disc of the same diameter — **feathering it can recover the entire single-engine climb gradient**. Likewise, gear and flap retraction per POH are the difference between a level OEI cruise and a 200 fpm climb. Once cleaned up, the airplane is flown **banked ~2–3° into the good engine with ~half a ball deflected** toward the good engine — the manufacturer-recommended "zero-sideslip" attitude that minimizes induced drag and restores the published V_{YSE} climb.

> ***CFI Safety Note: CFI zero-thrust procedure (K6):*** *When the student calls "feather," the CFI sets the failed-engine throttle to the airplane's published zero-thrust setting (PA-44: approx. 12" MP, prop fwd)* ***without*** *actually feathering. This simulates feathered drag and lets the student continue the secure-engine flow and OEI pattern with a restartable powerplant.*

CRITICAL: BEFORE EVERY TAKEOFF ROLL TODAY: Student verbalizes — **(1)** "Below V_R — abort." **(2)** "V_R to 400 AGL / V_{SSE} — no training cut; in a real failure, land straight ahead unless climb is assured." **(3)** "At/above **400 AGL and V_{SSE} ___ KIAS** — if the CFI calls or simulates a failure, I will fly the airplane to V_{YSE}, identify, verify, simulate feather, secure, and return." **No takeoff begins without this brief.**

PHASE 2 — In-Airplane Sequence — Climb, Cut at the Gate, Fly the OEI Profile, Return

Step 5 — Normal Takeoff & Climb to the Entry Gate

Student executes a standard takeoff: lined up on centerline, brakes held, throttles smoothly to full, "airspeed alive," rotate at V_R, pitch for V_Y, positive rate — **gear up**, flaps up at appropriate altitude per POH. Climb continues normally **until both gates are satisfied: 400 ft AGL AND ≥ V_{SSE}**. Only inside that envelope does the CFI become free to introduce a simulated failure.

Step 6 — The CFI Simulated Failure

From the right seat with the throttle-hand guard in place, the CFI **smoothly retards one throttle** (alternating which engine across evolutions) while clearly announcing "**SIMULATED ENGINE FAILURE**." The CFI's role from this point is to guard the throttles, monitor the operating engine, and stand by to set **zero thrust** when the student calls "feather." At no point does the CFI pull a mixture, fuel selector, or magneto in flight — only the throttle.

> ***CFI Safety Note: CFI hand discipline:*** *Right hand stays on the throttles. Verbalize the cut* ***before*** *the lever moves.* ***Never*** *introduce a failure inside the below-gate envelope; if the student rotates late or climbs slowly, let the climb continue and brief a normal pattern instead. If at any time during the exercise the airplane's pitch, bank, or airspeed approaches an unsafe condition, the CFI* ***restores power on the simulated-failed engine immediately*** *and announces "I have the controls."*

Step 7 — Return for OEI Approach (tie to Task G)

Once cleaned up, trimmed, and stabilized at V_{YSE}, the student flies a **shallow-bank (max 15°) pattern** to the runway in use, briefs ATC ("simulated engine failure, request closed traffic / immediate return"), extends gear & final flaps only when the runway is assured, and lands. The OEI approach itself is graded under Task G; today, the standard is a safe arrival with the OEI configuration and zero-sideslip technique maintained throughout.

Step 8 — Student OEI Climb-Out Response (S1–S10)

#	Action	Verbalized Teaching Cue
1	**Pitch for V_{YSE}** (V_{XSE}/V_{MC}+5 if obstacles); rudder to stop yaw; wings near level	"Blue line — rudder — wings level."
2	**Max power / Mixtures & Props forward / Throttles forward**	"Mixtures, props, throttles — full forward."
3	**Drag — Flaps UP, Gear UP** per POH (positive rate, no usable runway)	"Flaps up — gear up — clean."
4	**Identify** — "Dead foot, dead engine."	"Right foot light — right engine dead."
5	**Verify** — slowly retard suspected throttle; expect no yaw change	"Throttle back — no yaw change — confirmed."
6	**Feather** (simulated — CFI sets zero thrust)	"Feathering — drag reducing."
7	**Secure** — mixture, mags, fuel, alt, cowl flap (touch-drill only)	"Engine secured — checklist complete."
8	**Zero sideslip:** 2–3° bank into good engine; ~half-ball deflection toward good engine; trim	"Bank into the good engine — trim out."
9	**Monitor** good engine: temps, pressures, fuel; **climb gradient** assessed	"Good engine is happy — climbing at ___ fpm."
10	**Decide:** climb assured? Continue. No climb? **Maintain V_{YSE} and return** or pick the best landing area	"Return to the field — left base 27."
11	**ATC / passenger brief** / appropriate **checklist** complete	"Mayday/PAN — declare — checklist."

> ***Ops Note: Tower / Ground Coordination:*** *Request "closed traffic with simulated engine-out climb-out training, full stops or low approach." Brief the student that the OEI pattern uses* ***shallow bank, V_{YSE} on downwind, gear and final flaps withheld until landing is assured****.* ***Brief that if an actual failure occurs during training, the procedure is identical to the simulated one*** *— the only difference is whether the failed engine can be restarted.*

PHASE 3 Common Errors, Risk Management & Completion Standards

Common Applicant Errors (Skill S11)

Error	Root Cause / Fix
Pitches for V_Y instead of V_{YSE}	Single-engine reflex. **Fix:** V_{YSE} is the OEI climb target — blue line, every time, before configuration changes.
Identifies the wrong engine	Confused by yaw under stress. **Fix:** *dead foot = dead engine*; **always verify with throttle** before any irreversible action.
Feathers (or attempts to) the operating engine	Skipped the *verify* step. **Fix:** no mixture/feather lever moves until a slow throttle reduction on the suspect side produces **no** yaw change.
Forgets drag reduction (gear/flaps stay out)	Fixation on the failure. **Fix:** "**clean up first, diagnose second**" — the airplane will not climb dirty OEI.
Wings level instead of zero-sideslip	Trained instinct. **Fix:** 2–3° bank **into the good engine**, ball ~half toward good engine; restores published V_{YSE} performance.
Allows IAS to decay below V_{YSE}	Trying to out-climb the problem. **Fix:** trade altitude for V_{YSE} — the airplane stalls or hits V_{MC} if you don't.
Steep bank in the OEI pattern	Default pattern habit. **Fix:** cap bank at **15°**; widen the pattern or fly straight-in if needed.
Lowers gear / final flaps too early on the return	Pattern muscle memory. **Fix:** "runway assured" first — drag commits you to landing OEI.
Forgets to verbalize / teach aloud	Reverts to private-pilot habits. **Fix:** every action gets a teaching cue; that is the MEI standard.
CFI cut introduced too low/slow	**CFI error.** Abort the exercise; restore power; climb to the gate; re-attempt.

Risk Management (R1–R5)

Risk	Mitigation
R1 — Engine failure after liftoff	Compute accelerate-go & SE climb gradient for today's weight, altitude, temp; verify climb is realistic before departure.
R2 — Collision hazards	VFR scan during OEI work; ATC briefed ("simulated engine-out, returning"); traffic advisories continuous on the return.
R3 — Configuration	Flaps, trim, fuel, mixtures, props, cowl flaps confirmed before brake release; clean-up sequence per POH after the simulated failure.
R4 — Low-altitude maneuvering (stall/spin/CFIT)	**400 AGL / V_{SSE} gate is non-negotiable**; cap bank at 15°; trade altitude for V_{YSE}; CFI recovers immediately on any unsafe trend.
R5 — Distraction / SA loss	Sterile cockpit through the cut; CFI manages radios on the recovery; student's priorities are **aviate — navigate — communicate**, in that order.

Debrief Script (15–20 min, post-flight)

1. Review each evolution: gate entry (alt & speed), identification accuracy, **verify** step performed, drag-reduction sequence, sideslip indication.
2. Review climb performance — what fpm was achieved at V_{YSE}? Was return the correct decision?
3. Restate the **400 AGL / V_{SSE} gate** and why it is the floor.
4. Tie to **Task G** — preview OEI approach & landing.
5. Endorse logbook; assign POH OEI performance section + AFH Ch. 13 (feathering, zero sideslip, OEI climb performance) as reading.

> ***Completion: Completion Standard (today):*** *Applicant flies* ***at least three clean evolutions*** *meeting the V_{YSE}, IVFS, drag-reduction, zero-sideslip, hdg ±10°, and IAS ±5 kt standards on the front of this lesson plan, with* ***no CFI intervention****. Sign off Task F only after the applicant can also* ***brief the entire procedure on the ground unprompted****, including the manufacturer's zero-thrust setting and the SE climb gradient for today's weight/altitude/temperature.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	# OEI Evolutions	Aircraft / N#	CFI/MEI Signature & Cert #

Return to Table of Contents »

Area XII, Task G - Approach and Landing with an Inoperative Engine (Simulated)

Flight Lesson • OEI PATTERN / STABILIZED APPROACH / ZERO-THRUST LANDING • MEI Add-On

ACS Reference & Objective

FAA-S-ACS-25, Area XII, Task G — **Approach and Landing with an Inoperative Engine (Simulated) (AMEL, AMES)**. To determine the applicant understands OEI approach and landing, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and **provide effective instruction**.

Objective: MEI applicant **demonstrates and simultaneously explains** an OEI approach and landing with the failed engine simulated-feathered to **zero thrust**. The student instructor flies a stabilized, configuration-disciplined OEI pattern; arrives on final at the manufacturer's recommended approach speed **±5 kt** in the landing configuration; lands on the **first one-third** of usable runway with no drift, longitudinal axis aligned with centerline; and verbalizes each action as instruction throughout.

Lesson Sequence & Materials

Time: 0.4 hr pre-flight brief + 1.2–1.5 hr flight (3–4 OEI patterns to a full stop, at least one to a zero-thrust landing) + 0.3 hr debrief. **References:** AFH (FAA-H-8083-3) Ch. 13; PHAK Ch. 12; **FAA-P-8740-66 "Flying Light Twins Safely"**; POH/AFM emergency procedures, OEI approach airspeeds, landing-distance & SE go-around data; ACS Appendix 2.

Sequence: (1) Ground brief OEI pattern geometry, configuration discipline, the "runway-assured" gate, the SE go-around limitation, and the zero-thrust landing demo. (2) Climb to safe altitude, simulate failure outside the pattern, clean up and trim at V_{YSE}. (3) Enter the OEI pattern, fly a stabilized approach at V_{REF}/POH speed, configure only when landing is assured, land OEI. (4) At least one full landing with zero-thrust set on the failed engine. (5) Debrief / repeat.

ACS Task G — Knowledge / Risk / Skill

Code	Element
K1	**Factors affecting V_{MC}**
K2	**V_{MC}** (red) & **V_{YSE}** (blue)
K3	**Identify, verify, feather, secure** the inoperative engine
K4	**Drag reduction** (feather/gear/flaps), mfr control input & **zero sideslip**
K5	**Applicant responsibilities during simulated feathering**
K6	Common errors related to this Task
R1–R3	Engine failure in flight / on approach; collision hazards; configuring the airplane
R4–R5	**Low-altitude maneuvering (stall/spin/CFIT)**; distractions / task prioritization / SA loss / disorientation
R6	**Possible single-engine go-around** (and its limits)
S1–S4	Recognize failure / pos. control; engine controls / drag / identify-verify-simulate-feather; mfr emerg procedures & checklist; monitor operating engine
S5–S7	**POH approach IAS ±5 kt**, stabilized, in landing config **until landing assured**; smooth/timely controls thru touchdown; **first 1/3 of runway**, no drift, axis aligned
S8–S10	Directional control / crosswind correction; complete checklist(s); analyze & correct errors

Completion Standards (Today)

On **at least three** OEI patterns (at least one terminating with a full **zero-thrust** landing), applicant (a) flies a **stabilized** OEI approach at **V_{REF} ±5 kt**; (b) maintains **zero sideslip**, ball ~half toward the good engine; (c) defers **gear and final flaps until landing is assured**; (d) touches down on the **first one-third** of usable runway, **no drift**, longitudinal axis aligned with centerline; (e) **verbalizes every action** as instruction; (f) completes appropriate checklist(s) and articulates the SE go-around limitation.

SAFETY OF FLIGHT - ACS APPENDIX 2: The applicant must simultaneously demonstrate and explain at least one landing with a simulated feathered propeller, with the powerplant set to zero thrust. Once committed to the OEI landing — gear down and final flaps extended — **a single-engine go-around in most light twins is not a guaranteed maneuver.** The decision to land must be made before that commitment. Below the manufacturer's decision altitude (typically near final-flap extension or ~200 ft AGL), **land — even off-airport — rather than attempt a single-engine go-around.** Brief this rule aloud before every OEI approach today.

PHASE 1 Pre-Flight Ground Briefing — OEI Pattern, Configuration Discipline & Decision Point

Step 1 — OEI Approach Airspeeds & the Zero-Thrust Concept

Student writes the airplane's published OEI approach speeds on the kneeboard and reads them aloud. **V_{YSE}** (blue line) is held all the way around the pattern until final approach; **V_{REF}** (POH approach speed for the gross weight, often V_{YSE} minus 5–10 kt, or 1.3 V_{S0}) is the target on final. **Zero thrust** is the manufacturer's throttle setting (PA-44: ~12" MP, prop fwd) that produces the same net drag as a feathered propeller without actually feathering — it is what the CFI sets when the student calls "feather" so that an actual restart is possible.

Speed / Gate (PA-44 ref.)	Value	Role on the OEI Pattern
V_{MC} (red)	**56 KIAS**	Absolute floor. Never see this needle in the pattern.
V_{YSE} (blue)	**88 KIAS**	Downwind & base — the working speed.
V_{REF} (final, POH)	**~82 KIAS**	Final approach airspeed; **±5 kt** per S5.
V_{SO}	57 KIAS	Reference for crosswind & touchdown energy.
Zero-thrust MP / RPM	**~12" / fwd**	CFI sets when student calls "feather."
Runway-assured gate	**Gear & final flaps**	**Past this gate = committed to land.**
SE go-around decision pt.	**~200 AGL**	**Below: land. Do not attempt SE go-around.**

> ***Instructor Note: Pull V_{YSE}, V_{REF}, and the zero-thrust setting from POH Section 1/3 for the airplane being flown.*** *Numbers above are for the PA-44 Seminole and must be replaced for any other airframe before brake release.*

Step 2 — The SE Go-Around Limitation (R6)

Most light twins cannot guarantee a positive climb gradient OEI in the landing configuration (gear down, full flaps, low IAS). The only reliable way to recover performance is to clean up — flaps, gear, pitch for V_{YSE}, accept the altitude loss — which on short final means losing the runway and likely hitting the ground first. **Therefore: the OEI landing is a one-shot evolution. Configure only when landing is assured. Once past the runway-assured gate, commit and land — even off-airport — rather than attempt a single-engine go-around at low altitude.**

Step 3 — OEI Pattern Geometry & Configuration Sequence

#	Position	Configuration / Speed / Action
1	**Setup (outside pattern, 3000+ AGL)**	CFI cut; clean up & trim at **V_{YSE}**; **simulate feather**; CFI sets **zero thrust**.
2	**Pattern entry / Downwind**	Gear UP, flaps UP, **V_{YSE}**; abeam numbers, **before-landing flow** (gear & flaps still up).
3	**Base**	Wider/longer than normal; bank ≤ **15°**; **V_{YSE}**; approach flaps per POH if appropriate.
4	**Final — before runway assured**	**V_{YSE}** initially, slowing to **V_{REF}**; **gear still up**; full flaps NOT extended.
5	**Runway assured (~200–500 AGL)**	**Gear DOWN**; **Final flaps** per POH; **commit to land**; V_{REF} ±5 kt.
6	**Short final / threshold**	Cross threshold at **V_{REF}**; reduce zero-thrust as needed; operating throttle to idle in the flare.
7	**Touchdown / rollout**	**First 1/3** of usable runway; **no drift**; axis aligned; directional control with rudder.

Step 4 — Applicant Responsibilities During Simulated Feathering (K5)

When the student calls **"feather"**, they must (1) **confirm the engine has been correctly identified and verified** before the call; (2) **positively identify the feather lever / prop control by touch** (no movement) and announce it; (3) allow the CFI to set zero thrust without further input; (4) **continue the secure flow as a touch-drill** (mixture, mags, fuel, alt, cowl flap) without actually moving the controls; and (5) maintain **V_{YSE}**, zero sideslip, and the planned ground track throughout. The student is the PIC of the airplane — the CFI manages the simulation.

> ***Stabilized OEI Approach: Stabilized approach criteria (apply on every OEI final):*** *on speed (V_{REF} ±5 kt), on glidepath (PAPI/VASI on speed or visual reference), in configuration (gear & final flaps once committed), in trim, zero sideslip, descent rate ≤ ~700 fpm, by* ***500 ft AGL. Unstable by 500 AGL on the OEI side means commit to land long or accept the off-airport option — do NOT salvage with power and bank.***

CRITICAL: BEFORE EVERY OEI APPROACH TODAY: Student verbalizes — **(1)** "V_{REF} today is ___ KIAS, ±5." **(2)** "I will fly V_{YSE} in the pattern, slow to V_{REF} on final." **(3)** "Gear and final flaps are withheld until runway is assured." **(4)** "Below ~200 AGL on the OEI side, I will not attempt a single-engine go-around — I will land, even off-airport." **(5)** "One landing today will be with zero thrust set; the CFI will set it when I call feather."

PHASE 2

In-Airplane Sequence — Setup, OEI Pattern, Stabilized Approach & Zero-Thrust Landing

Step 5 — Setup at Altitude (outside the pattern)

Climb to **3,000 ft AGL minimum** in the practice area. With the student in level cruise, the CFI announces and introduces a simulated failure by smoothly retarding one throttle (alternating engines across evolutions). Student executes the Task F flow — pitch/rudder, max power, drag clean-up, identify, verify, **simulate feather**. At the "feather" call, the CFI sets **zero thrust** on the failed engine. Student trims for V_{YSE}, banks slightly into the good engine for zero sideslip, completes the secure touch-drill, and **announces the field of intended landing**.

Step 6 — OEI Pattern Entry & Coordination

Student calls ATC: **"Simulated engine failure, request closed traffic, request long final / extended downwind."** The OEI pattern is flown **wider and longer** than normal: bank capped at **15°**, V_{YSE} downwind and base, configuration changes deferred. Student briefs the runway, the wind, the touchdown aim point, and the off-airport contingency aloud while flying the pattern.

> ***CFI Safety Note: CFI hand discipline:*** *Right hand stays on the throttles to guard against an unexpected restoration or to recover the airplane instantly. Verbalize zero thrust before setting it.* ***If at any point the airplane goes unstable on the OEI side — airspeed below V_{YSE}, bank > 20°, descent rate > 1000 fpm, or any sign of V_{MC} roll — CFI restores power immediately, announces "I have the controls," and the evolution ends.*** *Power restoration on the final descent below ~200 AGL must be SMOOTH; an abrupt asymmetric thrust application at low IAS will roll the airplane.*

Step 7 — The Zero-Thrust Landing Demo (S2, ACS para. requirement)

At least one landing during this lesson must be conducted with the CFI's zero-thrust setting maintained through touchdown and rollout (no real-time throttle restoration on the failed side). Brief this aloud: "This pattern is the zero-thrust landing — the failed engine stays at zero thrust until we are stopped." Touchdown energy and rollout drag will feel different than a both-engine landing — the student must plan for that.

Step 8 — Student OEI Approach & Landing (S1–S9)

#	Action	Verbalized Teaching Cue
1	**Downwind, abeam numbers:** V_{YSE}, before-landing flow (touch), **gear/flaps UP**	"Blue line — flow complete — clean."
2	**Base turn:** bank ≤ **15°**, V_{YSE}, approach flaps per POH if appropriate	"Shallow turn — blue line — aim point set."
3	**Final, prior to runway assured:** V_{YSE} slowing to V_{REF}, **gear still UP**	"Slowing to V_{REF} — gear still up."
4	**Runway assured call** (visual: landing in the touchdown zone is guaranteed even if good engine fails now)	"Runway assured — committing to land."
5	**Gear DOWN — Final flaps — GUMPS**; trim for **V_{REF} ±5 kt**	"Gear down — flaps full — GUMPS — V_{REF}."
6	**Stabilized check (500 AGL):** on speed, on path, in trim, zero sideslip, ≤ ~700 fpm	"Stabilized — on speed — on path."
7	**Short final:** cross threshold at V_{REF}; operating throttle smoothly to idle in flare	"Threshold at V_{REF} — idle — flare."
8	**Touchdown: first 1/3** of usable runway, **no drift**, axis aligned with centerline	"Mains — nose — centerline."
9	**Rollout:** rudder for directional control; aileron into any crosswind; brakes as required	"Rudder — aileron into the wind — brakes."
10	**After-landing flow / checklist**; restore failed engine to normal idle once clear of the runway	"Clear of runway — restore — after-landing flow."
11	**Self-critique:** aim point, speed, sideslip, touchdown point, axis, directional control	"What I would do better next time is …"

> ***Ops Note: Tower / Ground Coordination:*** *Request* ***"closed traffic with simulated engine-out approaches, extended downwind, at least one full stop."*** *Brief that the OEI pattern is wider and final is longer than normal traffic.* ***If an actual failure occurs during training, the procedure is identical to the simulated one*** *— the only difference is that the failed engine cannot be restored. Tell tower if you need a runway change to align with the wind or to land into predictable terrain.*

PHASE 3 Common Errors, Risk Management & Completion Standards

Common Applicant Errors (Skill S10)

Error	Root Cause / Fix
Extends gear and/or final flaps too early	Pattern muscle memory. **Fix:** “runway assured” first; drag = commitment OEI.
Flies the OEI final at V_{YSE} all the way to the flare	Forgot the POH approach speed. **Fix:** bleed from V_{YSE} to V_{REF} once runway assured; cross threshold on V_{REF}.
Allows IAS to decay below V_{REF} on final	Trying to stretch glide. **Fix:** lower the nose, accept the aim-point shift, NEVER trade speed for altitude OEI.
Steep bank on base / turn to final	Default pattern habit. **Fix:** cap at **15°**; widen pattern; fly straight-in if needed.
Wings level instead of zero-sideslip	Trained instinct. **Fix:** 2–3° bank **into the good engine**; ball ~half toward good engine.
Lands long or off the first 1/3 of runway	Aim-point drift, high energy. **Fix:** pick aim point on base, hold it; stable V_{REF}; idle in flare.
Drift on touchdown / axis not aligned	Late crosswind correction. **Fix:** side-slip on short final; rudder for axis, aileron for drift.
Attempts a single-engine go-around at low altitude	Did not commit when the runway was assured. **Fix:** the decision is made **before** gear/final flaps, not after.
Forgets the after-landing / secure-engine checklist	Adrenaline let-down post-touchdown. **Fix:** flow-then-checklist clear of the runway; do not skip.
Skips verbalizing the teaching cues	Reverts to private-pilot habits. **Fix:** every action gets a teaching cue; that is the MEI standard.

Risk Management (R1–R6)

Risk	Mitigation
R1 — Engine failure in flight / on approach	Compute SE landing distance & verify no-wind glide reaches a usable surface; brief the off-airport option.
R2 — Collision hazards	Brief ATC; extended pattern increases conflict with normal traffic; visual scan continuous; lights ON.
R3 — Configuring the airplane	Gear/flap discipline tied to **runway assured**; GUMPS at the commit point; no early configuration.
R4 — Low-altitude maneuvering (stall/spin/CFIT)	Cap bank at 15°; never below V_{REF} on final; CFI recovers immediately on any unsafe trend.
R5 — Distraction / SA loss / disorientation	Sterile-cockpit through the cut; CFI handles non-essential radios; student priorities are **aviate — navigate — communicate**.
R6 — Possible single-engine go-around	**Treat as a high-risk maneuver.** Decision is made **before** commitment to land. Below decision pt., **land**, even off-airport.

Debrief Script (15–20 min, post-flight)

1. Review each pattern: V_{YSE} downwind/base, V_{REF} on final, configuration timing, runway-assured call, stabilized criteria at 500 AGL.
2. Review touchdown: aim point, axis alignment, drift, first 1/3 standard.
3. Replay the **zero-thrust landing** — what was different in feel?
4. Re-state the **SE go-around limitation** and the decision point.
5. Endorse logbook; assign POH OEI approach & landing section + AFH Ch. 13 (single-engine approach, landing, go-around limitations) as reading.

> ***Completion: Completion Standard (today):*** *Applicant flies* ***at least three OEI patterns to a full stop****, at least one with* ***zero thrust maintained through touchdown and rollout****, meeting the V_{REF} ±5 kt, stabilized, zero-sideslip, first-1/3, no-drift, axis-aligned standards on the front of this lesson plan, with* ***no CFI intervention****. Sign off Task G only after the applicant can also* ***articulate the SE go-around limitation unprompted*** *and brief the decision point for the airplane being flown.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	# OEI Landings (incl. ZT)	Aircraft / N#	CFI/MEI Signature & Cert #

Return to Table of Contents »

Area XIII, Task A - Maneuvering with One Engine Inoperative

Flight Lesson • IDENTIFY / VERIFY / FEATHER / SECURE / FLY V_{YSE} • MEI Add-On

ACS Reference & Objective

FAA-S-ACS-25, Area XIII, Task A — **Maneuvering with One Engine Inoperative (AMEL, AMES)**. To determine the applicant understands one engine inoperative operation, can apply that knowledge, manage associated risks, demonstrate appropriate skills, and **provide effective instruction**.

Objective: MEI applicant **demonstrates and simultaneously explains** the recognition, identification, verification, and securing of a failed engine, and then maneuvers the airplane in straight-and-level flight, climbs, turns, and descents on one engine at V_{YSE} with **zero sideslip**. Demonstrates an in-flight restart in accordance with the POH and verbalizes each action as instruction.

Lesson Sequence & Materials

Time: 0.4 hr pre-flight brief + 1.3–1.6 hr flight (3–4 simulated failures, at least one in-flight restart per POH) + 0.3 hr debrief. **References:** AFH (FAA-H-8083-3) Ch. 13; PHAK Ch. 12; **FAA-P-8740-66 "Flying Light Twins Safely"**; POH/AFM emergency & airstart procedures; ACS Appendix 2 / Safety of Flight.

Sequence: (1) Ground brief V_{MC}/V_{YSE}/V_{SSE}, the identify-verify-feather-secure flow, drag reduction, zero sideslip, and the restart logic. (2) Climb to ≥ 3,000 ft AGL in the practice area. (3) Simulated failure outside the pattern — student executes the full flow. (4) OEI maneuvering: straight-and-level, climbs, turns (both directions), descents at **altitude ±100 ft**, **airspeed ±10 kt**, **heading ±10°**. (5) Restart per POH; alternate engines across evolutions. (6) Debrief.

ACS Task A — Knowledge / Risk / Skill

Code	Element
K1	**Factors affecting V_{MC}**
K2	V_{MC} (red) & V_{YSE} (blue)
K3	**Identify, verify, feather, secure** the inoperative engine
K4	**Drag reduction** (feather/gear/flap), mfr control input & **zero sideslip**
K5	**Feathering, securing, unfeathering, restarting**
K6	Common errors related to this Task
R1–R2	Potential engine failure during flight; collision hazards
R3	Configuring the airplane
R4	**Low-altitude maneuvering** (stall / spin / CFIT)
R5	Distractions, task prioritization, SA loss, disorientation
S1–S2	Recognize failure, maintain control, use mfr memory items; set engine controls, identify-verify, **feather**
S3–S4	Flight controls in proper combination for best performance, trim; determine & resolve the cause
S5–S6	**Secure** failed engine, monitor operating engine; **restart** per POH
S7–S9	**Altitude ±100 ft, airspeed ±10 kt, heading ±10°**; complete checklists; analyze & correct common errors

Completion Standards (Today)

On **at least three** simulated failures (alternating engines), applicant (a) executes the **identify-verify-feather-secure** flow without prompting; (b) trims to V_{YSE} and maintains **zero sideslip** (2–3° bank into the good engine, ball ~half-deflected toward the good engine); (c) holds **altitude ±100 ft**, **airspeed ±10 kt**, **heading ±10°** through straight-and-level, climbs, turns, and descents; (d) **restarts** the engine per POH on at least one evolution; (e) **verbalizes every action** as instruction; (f) completes appropriate checklist(s) and articulates common errors.

SAFETY OF FLIGHT - ACS APPENDIX 2: All shutdown, feather, and restart work is conducted at a SAFE ALTITUDE (≥ 3,000 ft AGL) over terrain free of obstacles, in clear air, within power-off glide distance of a suitable landing surface. Actual feathering and unfeathering is permitted only when authorized by the POH for training, within cold-soak limits. Otherwise, the failed engine is simulated with the manufacturer's **zero-thrust** throttle/prop setting. **Never use mixture or fuel selector to simulate failure below safe altitude.** If at any point the airplane goes unstable on the OEI side (IAS < V_{YSE}, bank > 20°, V_{MC} roll trend, descent > 1,000 fpm), CFI restores power smoothly, announces "I have the controls," and the evolution ends.

PHASE 1 — Pre-Flight Ground Briefing — V_{MC}/V_{YSE}, Identify-Verify-Feather-Secure & Restart

Step 1 — Critical Airspeeds (K1, K2)

Student writes the airplane's critical OEI airspeeds on the kneeboard and reads them aloud. **V_{MC}** (red radial) is the minimum airspeed at which directional control can be maintained with the critical engine windmilling, max continuous power on the operating engine, gear up, flaps takeoff, CG at aft limit, up to 5° bank into the good engine, at sea level. **V_{YSE}** (blue radial) is best single-engine rate of climb. **V_{SSE}** is the minimum safe single-engine speed for intentional engine cuts in training.

Speed (PA-44 ref.)	Value	Role
V_{MC} (red radial)	**56 KIAS**	Absolute directional-control floor — never below.
V_{YSE} (blue radial)	**88 KIAS**	Best SE rate of climb — the working speed OEI.
V_{SSE}	**82 KIAS**	Minimum for intentional cuts in training.
V_X / V_{XSE}	82 KIAS	Best SE angle of climb (obstacle clearance).
V_{SO}	57 KIAS	Reference for stall margin; near V_{MC}.

> ***K1 - V_{MC} Factors: V_{MC} factors (memorize):*** *CG **aft** increases V_{MC}; **higher density altitude lowers V_{MC}** (less thrust asymmetry) but also lowers stall margin — V_{MC} can fall **below** V_S at altitude, masking the warning. Bank into the good engine (up to 5°) lowers V_{MC}; wings level or bank into the dead engine raises it sharply. Windmilling prop, gear up, flaps takeoff — the "worst case" certification condition.*

Step 2 — The Identify-Verify-Feather-Secure Flow (K3, S1–S2)

(1) Recognize / control: yaw & roll toward the dead engine; **pitch for V_{YSE}, rudder to stop the yaw, level the wings, then 2–3° into the good engine**. **(2) Maximize / clean up:** mixtures — props — throttles FULL FWD; flaps UP; gear UP (if not landing-assured). **(3) Identify:** "dead foot, dead engine." **(4) Verify:** retard suspect throttle — if yaw does not change, that side is dead. **(5) Feather** the verified engine. **(6) Secure:** mixture ICO, mags OFF, fuel selector OFF, alternator OFF, cowl flap CLOSED, fuel pump as required — per POH.

Step 3 — Drag Reduction & Zero Sideslip (K4)

After a failure with a windmilling propeller, the airplane is in its **highest-drag** configuration. **The single largest drag reduction available is feathering the failed prop** (AFH Fig. 13-3: windmilling prop can produce more drag than the original thrust). Then gear up, flaps up, cowl flap closed on the failed side, cowl flap open on the operating side as needed for CHT.

Zero sideslip is the rudder + bank combination that aligns the relative wind with the longitudinal axis, eliminating the side-force and the drag penalty of crabbed flight OEI. Practically: **rudder enough to stop the yaw, then 2–3° of bank into the good engine**; the inclinometer ball will be displaced **~half a ball-width toward the good engine**. Wings-level (ball centered) costs ~80–100 fpm of climb; bank into the dead engine is worse and raises V_{MC}.

> ***Pick (a). Always. Three control options, decreasing performance:*** *(a) bank 2–3° into good engine + partial rudder, ball half-toward good engine — **zero sideslip (best)**; (b) wings-level + full rudder, ball centered — coordinated but inefficient; (c) wings-level + partial rudder, ball toward dead engine — **raises V_{MC}, do NOT use**.*

Step 4 — Restart Logic (K5, S6)

An in-flight restart is attempted **only after** the cause of failure is understood and resolved (S4) and the POH airstart envelope is satisfied (altitude, airspeed, time since shutdown, cold-soak limits). Typical PA-44 sequence: throttle CRACKED, prop control FWD, mixture RICH, fuel selector ON, fuel pump ON, mags BOTH, starter ENGAGE; once running, set low power and monitor CHT/oil temp before bringing the engine up to matched cruise power. **If the prop will not unfeather or the cause is unresolved, leave it shut down and land.**

> ***Common Errors (K6): K6 - Common knowledge gaps to address in the brief:*** *confusing V_{MC} with V_S; misnaming the critical engine; skipping the verify step; touching the wrong throttle / prop / mixture lever; banking into the dead engine; over-banking past 5°; pulling the operating throttle to control yaw; restart attempts outside POH limits.*

CRITICAL: BEFORE EVERY CUT TODAY: Student verbalizes — **(1)** "V_{SSE} ___ KIAS, V_{YSE} ___ KIAS, V_{MC} ___ KIAS." **(2)** "Critical engine today is the LEFT." **(3)** "On a cut: pitch for V_{YSE}, rudder to stop yaw, max power, clean up, identify, verify, feather, secure." **(4)** "I will not retard a throttle / mixture / fuel selector below V_{SSE} or below 3,000 ft AGL." **(5)** "If anything becomes unsafe, CFI has the controls."

PHASE 2 — In-Airplane Sequence — Setup, Simulated Failure, OEI Maneuvering & Restart

Step 5 — Setup at Altitude (S1 prep)

Climb to **at least 3,000 ft AGL** in the practice area, over terrain free of obstructions, within power-off glide of a suitable surface, in clear air with positive cloud clearance. Complete **clearing turns**, set cruise power, trim for level flight at ≥ $\mathbf{V_{SSE}}$, establish ground reference for heading. Student briefs the practice area, the wind, the nearest landing surfaces, and the maneuver aloud.

Step 6 — CFI Introduces the Failure

CFI announces “simulated failure” and smoothly retards one throttle to idle (alternating engines across evolutions; the LEFT is the critical engine in the PA-44 and most U.S. light twins — cut it on at least one evolution today). **Student is expected to react within 2 seconds of yaw onset.** CFI's hand stays on the throttles to guard against an unplanned restoration and to recover the airplane instantly.

> ***CFI Safety Note: CFI cuts only at ≥ V_{SSE} and at safe altitude.*** *Below V_{SSE}, demonstrate with simulated zero thrust on a pre-briefed engine — never with mixture or fuel selector below safe altitude. After the student has the airplane cleaned up, trimmed at V_{YSE}, and ball half-toward good engine,* ***CFI sets zero thrust*** *(PA-44: ~12" MP, prop forward) on the failed engine for the remainder of the maneuver. Verbalize zero thrust before setting it.*

Step 7 — Tolerances (S7)

Parameter	Tolerance	Where Measured
Altitude	**±100 ft**	Straight-and-level, level turns, descent rollout.
Airspeed	**±10 kt**	V_{YSE} climb / level / descent.
Heading	**±10°**	Straight legs & turn rollouts.
Bank (turns)	**15° max**	Standard OEI turn discipline.
Sideslip	**Zero (ball half-good)**	Continuous, every phase OEI.

Step 8 — Student OEI Flow & Maneuvering (S1–S6)

#	Action	Verbalized Teaching Cue
1	**Recognize** yaw/roll — pitch to V_{YSE}, rudder, wings level, 2–3° into good engine	“Yaw — rudder — blue line — bank good.”
2	**Maximize:** mixtures — props — throttles **FULL FWD**	“Mixtures, props, throttles — firewall.”
3	**Clean up:** flaps UP, gear UP, cowl flaps as required	“Flaps up — gear up — clean.”
4	**Identify:** “dead foot, dead engine” — announce which engine	“Dead foot left — dead engine left.”
5	**Verify:** retard the suspect throttle — no yaw change confirms	“Verify left — no change — confirmed.”
6	**Feather** (CFI sets zero thrust at the “feather” call; or actual feather per POH if briefed)	“Feather left — prop to feather.”
7	**Secure** per POH: mixture ICO, mags OFF, fuel OFF, alt OFF, cowl CLOSED (touch-drill if simulated)	“Secure left — flow then checklist.”
8	**Trim for V_{YSE}**, ball half toward good engine, monitor operating engine & CHT	“Trimmed at blue — ball half right — monitor.”
9	**Straight-and-level OEI:** ±100 ft, ±10 kt, ±10° heading	“Holding altitude — blue — on heading.”
10	**Turns OEI:** 90° both directions, **15° bank max**, V_{YSE}, ball half toward good engine	“Shallow turn — blue — ball stays right.”
11	**Descent OEI:** reduce power on operating engine, V_{YSE} or POH descent speed, level off ±100 ft	“Power back — blue — level at target.”
12	**Restart per POH:** cause resolved → throttle cracked, prop fwd, mix rich, fuel ON, pump ON, mags BOTH, starter	“Cause OK — starting per POH — monitor temps.”
13	**Match power, retrim, checklist complete**; return to normal two-engine cruise	“Matched — retrimmed — checklist complete.”

> ***Ops Note: ATC / Practice-Area Coordination:*** *Advertise “multi-engine training, simulated engine failures, altitude blocks 3,000–5,000 AGL.” Squawk the assigned VFR or practice code.* ***If an actual failure occurs during training, the procedure is identical to the simulated one*** *— the only difference is that the failed engine cannot be restored, and the priority immediately becomes selecting a landing surface and flying V_{YSE} to it.*

PHASE 3 — Common Errors, Risk Management & Completion Standards

Common Applicant Errors (Skill S9)

Error	Root Cause / Fix
Late recognition of the failure	Eyes inside / not scanning. **Fix:** yaw & roll are the first cues; primary scan goes outside on the cut.
Pitches for altitude instead of V_{YSE}	Single-engine instinct. **Fix:** "blue line first" — trade altitude for V_{YSE}, never the other way.
Skips verify, feathers a good engine	Hurry. **Fix:** the verify step is non-negotiable — retard the suspect throttle and confirm no yaw change.
Touches wrong lever (good throttle/prop/mixture)	Spatial confusion under load. **Fix:** point-and-call — eyes to the lever, finger on the lever, name it, then move it.
Wings level (ball centered) instead of zero sideslip	Trained instinct. **Fix:** 2–3° bank **into the good engine**, ball ~half toward the good engine.
Banks into the dead engine	Cross-controlled instinct. **Fix:** rudder stops yaw FIRST, then bank into the good engine.
Exceeds 15° bank in OEI turns	Pattern habit. **Fix:** cap at 15°; widen turns; accept the larger turn radius OEI.
Holds altitude by reducing operating power	Backwards logic. **Fix:** power stays max until matched climb is established — trade altitude for V_{YSE} instead.
Restart attempted before cause resolved	Skipped S4. **Fix:** troubleshoot first; restart only if cause is understood and within POH airstart envelope.
Stops verbalizing (CFI mode lapses)	Task saturation. **Fix:** every action gets a teaching cue — that is the MEI standard.

Risk Management (R1–R5)

Risk	Mitigation
R1 — Potential engine failure during flight	Conduct at ≥ 3,000 AGL within power-off glide of a suitable surface; pre-brief the off-field option.
R2 — Collision hazards	Clearing turns before each cut; advertise on the practice freq.; lights ON; continuous visual scan.
R3 — Configuring the airplane	Cuts only at ≥ V_{SSE}; mixtures/props/throttles flow memorized; touch-drill secure if simulated.
R4 — Low-altitude maneuvering (stall/spin/CFIT)	Cap bank at 15°; never below V_{YSE} except on intentional level-offs; CFI recovers on any unsafe trend.
R5 — Distraction / SA loss / disorientation	Sterile-cockpit through the cut; CFI handles non-essential radios; student priorities are **aviate — navigate — communicate**.

Debrief Script (15–20 min, post-flight)

1. Replay each cut: recognition time, control inputs, flow order, identify/verify discipline, feather/secure quality.
2. Review zero sideslip: where was the ball? bank attitude? performance felt during turns?
3. Review tolerances: altitude ±100, IAS ±10, heading ±10; where were the misses, and why?
4. Restart: was the cause resolved before the attempt? POH airstart envelope satisfied?
5. Endorse logbook; assign POH airstart procedure + AFH Ch. 13 (OEI maneuvering & restart) + FAA-P-8740-66 as reading. Next lesson: Task B (V_{MC} demonstration).

Completion: Completion Standard (today): *Applicant executes **at least three simulated failures** (alternating engines, including the critical engine), performs the full **identify-verify-feather-secure** flow without prompting, maneuvers OEI at V_{YSE} with zero sideslip within **±100 ft / ±10 kt / ±10°**, restarts per POH on at least one evolution, with **no CFI intervention**. Sign off Task A only after the applicant can also **explain V_{MC} factors and zero sideslip unprompted**.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	# Simulated Failures	Aircraft / N#	CFI/MEI Signature & Cert #

Return to Table of Contents »

Area XIII, Task B - V_{MC} Demonstration

Flight Lesson • RECOGNIZE THE APPROACH TO V_{MC} — RECOVER BEFORE CONTROL IS LOST • MEI Add-On

ACS Reference & Objective

FAA-S-ACS-25, Area XIII, Task B — **V_{MC} Demonstration (AMEL)**. To determine the applicant understands the aerodynamic and operational factors that establish V_{MC}, can recognize the **three indications** of an approach to loss of directional control, executes the **standard recovery**, manages associated risks, and **provides effective instruction** on the maneuver.

Objective: MEI applicant **demonstrates and simultaneously explains** a V_{MC} demonstration: configures the airplane to the worst-case certification condition (less the windmilling prop), decelerates the airspeed at approximately **one knot per second** on the simulated-failed engine at idle until the FIRST of **(a) loss of directional control**, **(b) aerodynamic buffet**, or **(c) stall warning**, then executes the **recovery** — reduce power on the operating engine, lower the nose, regain V_{YSE}, restore coordinated flight.

Lesson Sequence & Materials

Time: 0.5 hr pre-flight brief + 1.0–1.3 hr flight (3 demos, alternating engines — **critical engine first** in at least one evolution) + 0.4 hr debrief. **References:** AFH (FAA-H-8083-3) Ch. 13 "V_{MC} Demonstration"; PHAK Ch. 12; **FAA-P-8740-66 "Flying Light Twins Safely"**; POH/AFM published V_{MC}; ACS Appendix 2 / Safety of Flight; **14 CFR 23.149** (V_{MC} certification definition).

Sequence: (1) Ground brief V_{MC} aerodynamics, the certification configuration, the three recovery triggers, and the recovery procedure. (2) Climb to ≥ **5,000 ft AGL** — a **higher** floor than other OEI maneuvers, because the demo intentionally approaches loss of control and may lose altitude in recovery. (3) Configure, enter, recognize, and recover. (4) Repeat 3 times (alternating engines). (5) Debrief.

ACS Task B — Knowledge / Risk / Skill

Code	Element
K1	**Factors affecting V_{MC}** and how each factor moves the number
K2	**V_{MC} vs. stall awareness** during the maneuver ($V_{MC} \leq V_S$ at altitude)
K3	**Recovery procedure** — the three triggers and the three actions
K4	Common errors related to this Task
R1	Potential engine failure during the demonstration
R2	Configuring the airplane (gear/flap/power)
R3	**Stall / spin / loss of control** at high pitch, low airspeed, asymmetric thrust
R4	Distractions, task prioritization, SA loss
S1	**Configure** per ACS / POH demonstration profile
S2	Establish single-engine climb attitude at ≈ **10 KIAS above V_{SSE}**
S3	Reduce airspeed at **~1 KIAS per second**; recognize and recover at the **FIRST** of: loss of directional control, aerodynamic buffet, or **stall warning**
S4	**Use the recovery**: reduce power on the operating engine, pitch nose down, regain V_{YSE}
S5	Recover with loss of **no more than 100 ft** of altitude and within **±20°** of entry heading
S6	Manage workload; teach while doing

Completion Standards (Today)

On **three** demonstrations (alternating engines — critical engine on at least one), applicant (a) configures per the profile and verbalizes each step; (b) **recognizes the FIRST of the three triggers** and initiates recovery **without prompting**; (c) executes the recovery — **reduce power on operating engine, lower the nose, accelerate to V_{YSE}**, restore coordinated OEI flight; (d) loses **no more than 100 ft** in recovery and ends within **±20°** of entry heading; (e) **verbalizes every action as instruction**; (f) articulates V_{MC} factors and common errors unprompted.

THIS IS THE LESSON YOU TRAIN FOR: Every prior maneuver in the multi-engine syllabus has been preparation for **this**. Slow flight built your stall recognition. Steep turns built your bank-and-rudder discipline. OEI airwork built your feet, your scan, and your zero-sideslip habit. All of it converges **here**: at decreasing airspeed, on one engine, at full asymmetric thrust, with the airplane's directional authority running out beneath you. **The V_{MC} roll — not the engine failure itself — is what kills light twins.** This lesson is the inoculation. If the applicant can do nothing else well, the applicant must be able to do this: **recognize the approach, and recover BEFORE control is lost.**

PHASE 1 — Pre-Flight Ground Briefing — Why V_{MC} Exists, the Three Triggers, the Recovery

Step 1 — What V_{MC} Actually Is (K1)

Per **14 CFR 23.149**, V_{MC} is the minimum airspeed at which, with the **critical engine suddenly inoperative**, the airplane can be controlled and maintained in straight flight with no more than **5° of bank into the operating engine**. The published V_{MC} (red radial) is determined at the **worst-case** certification condition: **most aft CG, max takeoff power, gear up, flaps takeoff, windmilling prop on the failed engine, up to 5° bank into good engine, sea level / standard day**. Change any of these and the actual V_{MC} of the day will be different from the red line.

Factor	Direction	Why
CG aft	V_{MC} ↑	Shorter rudder moment arm → less yaw authority.
CG fwd	V_{MC} ↓	Longer moment arm → more yaw authority.
Density altitude ↑	V_{MC} ↓	Less thrust on good engine → less asymmetry.
Windmilling prop on dead eng	V_{MC} ↑	Adds drag aft of CG, worsening yaw.
Bank into good engine	V_{MC} ↓	Horizontal lift component opposes the yaw.
Wings level / bank into dead	V_{MC} ↑	No or adverse horizontal lift component.
Flaps / gear extended	V_{MC} ↓	More drag → less acceleration of yaw rate.

> ***K2 - V_{MC} vs. Stall: Why density altitude matters most for safety:*** *at altitude, the good engine produces less thrust, so V_{MC} drops **below** V_S. The airplane will **stall before** it loses directional control. **That stall, with full asymmetric thrust, is a spin entry.** This is exactly why the demo is flown at altitude with the simulated failure at **idle** (not zero thrust) and why the three triggers all live above V_{MC}, never at it.*

Step 2 — The Demonstration Profile

Climb to ≥ **5,000 ft AGL**, clearing turns, ground reference heading, in clear air over terrain free of obstacles, within power-off glide of a suitable surface. Set **gear UP, flaps UP, cowl flaps as required, propellers HIGH RPM, mixtures RICH**. Slow to **V_{SSE} + ~10 kt** (PA-44: ~95 KIAS). Smoothly retard the **critical-engine** throttle to **IDLE** (windmilling, not feathered — this is the high-drag certification condition). Advance the operating-engine throttle to **full takeoff power**. Establish a **single-engine climb attitude**, **bank up to 5° into the operating engine**, ball ~half toward good engine, rudder to hold heading.

Step 3 — Entry: Decelerate at ~1 KIAS per second

Hold the climb attitude and let the airspeed bleed at approximately **one knot per second** — this is the *deceleration rate*, not an airspeed target. Faster than that masks the cues and gives no time to recognize the trigger. Eyes are **outside** on yaw and pitch attitude; scan returns to airspeed and ball only periodically. CFI's hand stays on the throttles, ready to restore power instantly.

Step 4 — The THREE Recovery Triggers (K3, S3)

Recovery is initiated at the **FIRST** indication of any one of these three — **not all three, not the worst one, the FIRST one**:

#	Trigger	What it looks/feels like
1	**Loss of directional control**	Yaw the rudder cannot stop; the nose tracks toward the dead engine even with full rudder.
2	**Aerodynamic buffet**	Airframe shake / first nibble of the wing — the impending stall felt through the seat and yoke.
3	**Stall warning**	Stall warning horn, light, or shaker activates — impending stall regardless of indicated airspeed.

Step 5 — The Recovery (S4, S5)

Three actions, in this order, simultaneously if possible: (1) **Reduce power on the OPERATING engine** — removes the asymmetric yaw at its source and is the single most important action. (2) **Lower the nose** — trade altitude for airspeed; pitch below the horizon as needed. (3) **Roll wings level** (or maintain the 5° bank into good engine, depending on examiner technique) and use rudder to align the nose with the entry heading. Once airspeed is at or above **V_{YSE}** (PA-44: 88 KIAS) and directional control is firmly re-established, **smoothly restore power** on the operating engine and resume single-engine climb. Loss of altitude: **no more than 100 ft**. Heading: **±20°**.

> ***The order matters: Why reduce power FIRST, not pitch first:*** *the killer is the asymmetric thrust, not the airspeed. Pitching down alone keeps the yaw moment intact and can let the airplane roll over the top before the nose comes down. Reducing power on the operating engine **removes the rolling moment immediately**. Once the airplane is no longer trying to roll, you have time to lower the nose and reaccelerate. This sequence is the difference between a recovery and a V_{MC} roll.*

CRITICAL: BEFORE EVERY DEMO TODAY: Student verbalizes — **(1)** "Decelerate at ONE KNOT per SECOND — rate, not airspeed." **(2)** "Watching for the FIRST of: loss of directional control, aerodynamic buffet, or stall warning." **(3)** "On any trigger: power back on the good engine, nose down, wings level, recover to V_{YSE}." **(4)** "I will not reach V_{MC}, exceed 20° of bank, or pitch above 10° nose-high. If anything is unsafe, CFI has the controls."

PHASE 2 — In-Airplane Sequence — Setup, Configuration, Entry, Recognition, Recovery

Step 6 — Setup at Altitude (S1 prep)

Climb to ≥ **5,000 ft AGL** in the practice area (higher floor than Task A because this maneuver intentionally approaches loss of control). Complete **two 90° clearing turns**. Verify no traffic above or below. Note ground reference heading, the nearest landing surfaces, fuel balance, and CHT/oil temps both engines. Student briefs aloud: "Critical engine today is the LEFT. Recovery on the first of loss of directional control, buffet, or 57 KIAS."

Step 7 — Configuration (S1)

Item	Setting	Why
Gear	**UP**	Less drag → certification config (less the windmilling prop).
Flaps	**UP**	Per profile; gear/flap retraction lowers actual V_{MC}.
Cowl flaps	As required	Operating engine CHT management at high power, low IAS.
Propellers	**HIGH RPM (full fwd)**	Max thrust available on operating engine.
Mixtures	**RICH**	Detonation margin at full power.
Critical engine	Throttle **IDLE**	Windmilling prop simulates the failure; **do NOT feather**.
Operating engine	Throttle **FULL FWD**	Worst-case asymmetric thrust = certification condition.
Bank	**Up to 5° into good engine**	Mirrors 23.149 max-bank assumption; lower V_{MC}.
Entry IAS	**V_{SSE} + 10 kt** (~95)	Above V_{SSE}; safe deceleration start.

> ***Configuration Note: Why throttle IDLE, not feather, not zero thrust:*** *V_{MC} is certified with a **windmilling** prop — the high-drag case. Feathering would lower the actual V_{MC} below the published number and invalidate the demo. Zero thrust splits the difference and is not the certification condition either. **Idle, windmilling.***

Step 8 — Student Demonstration Flow (S1–S5)

#	Action	Verbalized Teaching Cue
1	**Clearing turns**, ground heading, 5,000+ AGL confirmed	"Area clear — 5,200 AGL — heading 270."
2	**Configure:** gear up, flaps up, props fwd, mix rich	"Clean configuration — props and mixtures forward."
3	**Slow to V_{SSE}+10** (~95 KIAS), trim	"Decelerating to 95 — setting demo entry speed."
4	**Retard critical-engine throttle to IDLE** (windmilling)	"Critical engine to idle — left, idle."
5	**Operating engine FULL POWER** — right rudder, 5° bank into good engine	"Right throttle full forward — rudder — five degrees right bank."
6	**Pitch up to climb attitude**; control deceleration at **~1 KIAS per second** (rate, not target)	"Climb attitude — decelerating one knot per second."
7	Eyes outside — rudder pressure builds; **watch for the FIRST trigger**	"Rudder pressure building — watching for first sign."
8a	Trigger 1: **nose moves toward dead engine despite full rudder**	"Loss of directional control — recovering NOW."
8b	Trigger 2: **buffet / stall warning / first nibble**	"Buffet — recovering NOW."
8c	Trigger 3: **stall warning** (horn / light / shaker)	"Stall warning — recovering NOW."
9	**RECOVER:** good-engine throttle BACK, nose DOWN, wings LEVEL	"Power back — nose down — wings level."
10	**Accelerate to V_{YSE}** (88 KIAS), rudder to entry heading	"Through blue — rolling to heading 270."
11	**Restore operating-engine power smoothly**; restore critical engine to matched cruise power	"Right power back up — left throttle matched."
12	**Verify:** altitude loss ≤ 100 ft; heading within ±20°	"Lost 70 feet — heading 275 — within tolerance."

CRITICAL: HARD ABORTS — CFI restores power and takes the airplane if ANY of the following occur: (a) airspeed reaches the published V_{MC} (PA-44: 56 KIAS); (b) bank exceeds 20° in any direction; (c) pitch exceeds **10° nose-high** in entry or 15° nose-low in recovery; (d) the student fixates inside and does not recognize the first trigger; (e) any roll trend toward the dead engine that rudder is not arresting. **The CFI's hand stays on the throttles throughout the demonstration.**

PHASE 3

Common Errors, Risk Management & Completion Standards

Common Applicant Errors (K4)

Error	Root Cause / Fix
Holds the demo past the first trigger	Wants to "see V_{MC}." **Fix:** the demo ends at the FIRST trigger, every time — not the worst, not all three. We never reach V_{MC}.
Lowers the nose BEFORE reducing good-engine power	Single-engine instinct from the airplane handbook. **Fix:** power first removes the rolling moment at its source; pitch alone leaves the roll intact.
Feathers the simulated-failed engine	Confuses Task B with Task A. **Fix:** V_{MC} is certified with a windmilling prop — idle throttle only, no feather.
Pitches too steeply on entry (>10° nose-high)	Trying to bleed airspeed faster. **Fix:** shallow climb attitude, let it slow at ~1 kt/sec; the pitch is for attitude, not deceleration.
Wings level (or banked into dead engine)	Coordinated-flight habit. **Fix:** 5° bank INTO the good engine throughout entry — that is the certification condition.
Stops verbalizing under load (CFI mode lapses)	Task saturation. **Fix:** every action gets a teaching cue; the cue itself paces the maneuver.
Decelerates too fast (more than 1 kt/sec)	Pitches too aggressively at entry. **Fix:** the rate is the ACS standard — faster than 1 kt/sec masks the cues and gives no time to recognize the trigger before V_{MC} arrives.
Over-banks in recovery (>20°)	Rolling level too aggressively after pitch-down. **Fix:** rudder and a smooth roll to wings level — not a yank.
Does not return to V_{YSE} before restoring power	Hurries the restore. **Fix:** airspeed at or above 88 KIAS FIRST, then smoothly bring the operating engine back up.
Cannot articulate why V_{MC} rises with aft CG	Memorized the list, not the aerodynamics. **Fix:** rudder is the lever arm; aft CG shortens it — less arm, more speed needed for the same moment.

Risk Management (R1–R4)

Risk	Mitigation
R1 — Engine failure during the demo	≥ 5,000 AGL within power-off glide; suitable surface pre-briefed; CFI hand on throttles ready to restore good engine instantly.
R2 — Misconfiguration	Verbalized config flow before retarding the throttle; gear up, flaps up, props fwd, mix rich, cowl as required, bank set.
R3 — Stall / spin / loss of control	Three triggers all live ABOVE V_{MC}; hard aborts at 56 KIAS, 20° bank, 10° nose-high; CFI takes airplane on any of these.
R4 — Distraction / SA loss	Sterile cockpit through the demo; CFI handles radios; clearing turns before every evolution.

Debrief Script (15–20 min, post-flight)

1. Replay each demo: configuration verbalized? deceleration rate? WHICH trigger fired first? recovery order correct (power-pitch-bank)?
2. Tolerances: altitude loss ≤ 100 ft, heading ±20°, never reached published V_{MC}.
3. K1 oral check: ask the applicant to walk through each V_{MC} factor and explain the aerodynamic reason — not just the direction.
4. K2 oral check: at what altitude does $V_{MC} \le V_S$ for this airplane? What does that mean for the demo?
5. Endorse logbook; assign AFH Ch. 13 (V_{MC} Demo) + FAA-P-8740-66 re-read + 14 CFR 23.149. Next lesson: Task C (engine failure during takeoff before V_{MC}).

> ***Completion: Completion Standard (today):*** *Applicant performs* ***three demonstrations*** *(alternating engines, critical engine on at least one), recognizes the FIRST trigger* ***without prompting****, executes the* ***power-pitch-bank*** *recovery in the correct order, loses ≤* ***100 ft*** *in recovery, ends within* ***±20°*** *of entry heading,* ***never reaches published*** V_{MC}*, and* ***verbalizes every action as instruction****. Sign off Task B only after the applicant can also explain the K1 factors and the K2* V_{MC}*-vs-*V_S *relationship unprompted.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	# V_{MC} Demos	Aircraft / N#	CFI/MEI Signature & Cert #

Area XIII, Task C — Effects of Various Airspeeds & Configurations on OEI Performance

Flight Lesson • CONFIGURATION IS OEI PERFORMANCE — PROP, FLAPS, GEAR, DEAD ENGINE • MEI Add-On

ACS Reference & Objective

FAA-S-ACS-25, Area XIII, Task C — **Demonstration of Effects of Various Airspeeds and Configurations during Engine Inoperative Performance (AMEL)**. To determine the applicant understands how airspeed selection and each drag-producing configuration item (gear, flaps, windmilling prop) **quantitatively degrades single-engine climb performance**, can manage associated risks, demonstrate smooth transitions between configurations, and **provides effective instruction** on the relationship between configuration and OEI capability.

Objective: MEI applicant **demonstrates and simultaneously explains** the effects on OEI rate of climb and controllability of: **(a) airspeed at, above, and below V_{YSE}** (K4); and **(b) four discrete configuration cases** — landing gear extended, flaps extended, gear+flaps extended, and a windmilling prop on the inoperative engine (K5a–d) — then **cleans up** in the correct priority and returns to normal cruise at the altitude and heading specified.

Lesson Sequence & Materials

Time: 0.5 hr pre-flight brief + 1.1–1.4 hr flight (four config cases + V_{YSE}-bracket comparison + cleanup) + 0.4 hr debrief. **References:** AFH (FAA-H-8083-3) Ch. 13 "Multiengine Flight"; PHAK (FAA-H-8083-25) Ch. 12; **FAA-P-8740-66 "Flying Light Twins Safely"**; POH/AFM OEI climb charts & V-speeds; ACS Appendix 2 / Safety of Flight.

Sequence: (1) Ground brief the drag budget, the four configuration cases, and the airspeed bracket around V_{YSE}. (2) Climb to ≥ **3,000 ft AGL** in the practice area. (3) Establish a baseline: clean / feathered / V_{YSE}. (4) Demonstrate each configuration case, recording rate of climb and rudder/aileron required. (5) Bracket V_{YSE} (–5, on speed, +5, +10) at the worst case to show the performance curve. (6) **Clean up in the correct priority** and return to cruise. (7) Debrief.

ACS Task C — Knowledge / Risk / Skill

Code	Element
K1/K2	**Purpose** of demo & **altitude selection**
K3	**Entry procedure** — pitch, bank, airspeed
K4	**Effect of airspeed** at, above, below V_{YSE} (climb-performance curve)
K5	**Effect of configuration:** (a) gear extended, (b) flaps extended, (c) gear+flaps, (d) **windmilling prop**
K6/K7	**Airspeed control**; smooth control & coordination
K8	Common errors related to this Task
R1/R2	**Altitude selection**; entry & recovery procedures
R3	**Loss of control / stall** (low speed + asymmetric)
R4	**Configuring the airplane** (wrong lever, wrong order)
R5/R6	Collision hazards; distraction, task prioritization, SA loss
S1	Demonstrate, describe, explain the effects
S2	**Smooth transitions** across all four configuration cases
S3	Maintain appropriate **airspeed/attitude/altitude** each config
S4	**Return to cruise** at altitude/heading specified by evaluator
S5	Analyze and correct common errors

Completion Standards (Today)

Across the demonstration the applicant: **(a)** selects an altitude ≥ **3,000 ft AGL** in clear air over suitable terrain; **(b)** establishes a baseline at V_{YSE} with the inoperative engine **feathered** (or zero-thrust per CFI discretion) and reads the resulting ROC; **(c)** demonstrates each of the four K5 configurations, **verbalizing the ROC penalty and the control input change**; **(d)** brackets V_{YSE} at –5 / on speed / +5 / +10 KIAS to show the curve; **(e)** cleans up **in the correct priority** (prop, flaps, gear, secure dead engine); **(f)** returns to cruise altitude **±100 ft** and heading **±10°**; **(g)** articulates K1–K8 unprompted.

PATTERN IS THE TEST — ALTITUDE IS THE CLASSROOM: Most DPEs will not call for Task C as an isolated maneuver — they will grade the applicant's understanding of configuration effects **implicitly during the single-engine pattern** (Area XII Tasks E, F, G). The pattern is where it counts. But the pattern is the wrong place to *learn* the relationship. At 1,200 ft AGL on the downwind with a fire-walled good engine, there is no time to discover that the gear-down windmilling-prop combination is a **descent profile**, not a climb profile. **That discovery happens HERE**, at altitude, in the practice area, where the airplane is allowed to descend while the applicant watches the VSI tell the story. The intuition built today — **PROP, FLAPS, GEAR, DEAD ENGINE** — is what the applicant's hand will reach for in the pattern tomorrow.

PHASE 1 — Pre-Flight Ground Briefing — The Drag Budget, the Four Cases, the Cleanup Priority

Step 1 — What Single-Engine Climb Actually Means (K1)

On one engine, the airplane has lost roughly **half its thrust** but only a small fraction of its drag — net result is a **~80%+ loss of excess thrust horsepower**, the only quantity that produces climb. The PA-44 (sea level, gross, feathered, clean, V_{YSE}) climbs about **205 ft/min**; every drag item we add or every knot we are off V_{YSE} eats directly into that small surplus. **OEI climb is a drag-management problem, not a thrust problem.**

Step 2 — The Four Configuration Cases (K5)

Case	Configuration	Approx ROC Penalty
Baseline	Gear UP, Flaps UP, dead eng **FEATHERED**, V_{YSE}	~205 ft/min climb (book reference)
K5a	Gear **DOWN**, flaps UP, feathered, V_{YSE}	**–250 to –300 ft/min** → near-zero or descent
K5b	Gear UP, **flaps approach (10°-25°)**, feathered, V_{YSE}	**–150 ft/min approx** per notch; full flaps > gear
K5c	Gear **DOWN** + **flaps DOWN**, feathered, V_{YSE}	**Descent**: typically 300–500 ft/min DOWN
K5d	**Windmilling prop** on dead engine (gear/flaps UP), V_{YSE}	**~–300 ft/min** — the single largest penalty

> ***On the numbers: Numbers vary by airplane, density altitude, and weight.*** *Use the actual POH chart, not the rule of thumb. The point of the demonstration is for the applicant to* ***see and feel*** *the relative magnitudes — windmilling prop > gear+flaps > gear > flaps > baseline — not to memorize a number.*

Step 3 — The Cleanup Priority (S2)

When configuration is killing climb performance, items come off in **highest-drag-first** order. The mnemonic the applicant must have ready:

PROP — FLAPS — GEAR — DEAD ENGINE.

Prop first because the windmilling prop is the single largest drag item. Flaps next (one notch at a time, watching speed). Gear next. **Then** identify, verify, feather the failed engine. Order matters because each step buys back climb capability that the next step depends on.

Step 4 — Effects of Airspeed at, above, below V_{YSE} (K4)

V_{YSE} is the speed for **best rate of climb** on one engine — the top of the OEI power-required-vs-power-available curve. The curve is **narrow and asymmetric**:

Airspeed	Effect on ROC	Why
Below V_{YSE} (toward V_{XSE}/V_{MC})	ROC **drops sharply**; controllability also degrades	Induced drag rises rapidly on the back side of the power curve; rudder authority decays toward V_{MC}.
At V_{YSE} (88 KIAS)	**Best ROC** available for the configuration	Minimum total drag for the OEI condition; certified blue line.
Slightly above V_{YSE} (+5 to +10)	ROC degrades **gently**	Parasite drag climbs slowly with V^2; recoverable in the pattern by trading a few knots.
Well above V_{YSE} (+20+)	Significant ROC loss; may revert to **level or descent**	Parasite drag dominates; no longer a climb speed.

> ***Asymmetry of the curve: The asymmetry is what to teach:*** *being* ***5 KIAS slow*** *hurts more than being* ***5 KIAS fast****, because the slow side runs into induced-drag rise AND rudder authority loss simultaneously.* ***If in doubt in the pattern, pitch for blue, never below it.***

Step 5 — The Demonstration Profile (K2, K3)

Altitude: ≥ **3,000 ft AGL** over terrain free of obstacles, within power-off glide of a suitable surface, clear of cloud and traffic. **Entry:** established at V_{YSE} in level flight, simulated failure on the critical engine (left for PA-44), **zero thrust set** on the dead engine (full feather permitted only if POH allows and cold-soak considered), operating engine power as required to hold altitude initially. **Pitch:** established for V_{YSE}. **Bank:** up to **5° into the operating engine**, ball slightly out toward good engine (zero sideslip).

> ***K2 — Why 3,000 AGL: Altitude floor is LOWER than Task B*** *(5,000 AGL) because Task C is not a controllability demonstration — we do not approach V_{MC}.* ***Floor is HIGHER than airwork in Task A*** *(3,000 AGL nominal) because we are deliberately operating in a* ***descent profile*** *in cases K5a, K5c, and K5d, and need room to recover altitude and configuration without busting the floor.*

CRITICAL: BEFORE EVERY CONFIGURATION CHANGE TODAY: Student verbalizes — **(1)** "Going to gear DOWN — expect ~250 ft/min loss — rudder will lighten." **(2)** "Speed on V_{YSE}, altitude 5,200, heading 270." **(3)** "If anything is unsafe — cleanup in priority: PROP, FLAPS, GEAR." **(4)** "Hard floor 3,000 AGL — recover and reset above 3,500." No configuration change happens until each line is spoken — the verbalization paces the maneuver and is itself a K6/K7 standard.

PHASE 2 — In-Airplane Sequence — Setup, Four-Case Matrix, Airspeed Bracket, Cleanup

Step 6 — Setup & Baseline (S1 prep, S3)

Climb to ≥ **4,000 ft AGL** in the practice area to provide 1,000 ft of margin above the 3,000 AGL hard floor. Complete **two 90° clearing turns**. Note ground reference heading (prefer into-wind to minimize ground track drift), nearest suitable surfaces, fuel balance, CHT/oil temps both engines. **Configure baseline:** gear UP, flaps UP, props HIGH RPM, mixtures RICH, cowl flaps as required. Stabilize at **V_{YSE} (88 KIAS)** level. Simulated failure on the **critical engine (LEFT for PA-44)**: throttle to **zero thrust setting** (per POH; typically ~12–15" MP). Operating engine power as required. **Read and call the baseline VSI**: this is the anchor against which every configuration case will be compared.

Step 7 — The Four-Case Matrix (S1, S2, S3)

Each case: **brief, configure, stabilize, read VSI, verbalize delta, return to baseline**. Throughout, hold heading ±10°, speed on V_{YSE} ±5 KIAS. Bank **up to 5° into good engine**, zero sideslip (ball ~half toward good engine).

#	Case	Configure / Stabilize / Read / Reset
1	**Baseline** Clean, feathered (or zero thrust)	Anchor reading. Call: "Clean baseline — *+200 ft/min*." Hold 30 sec, log VSI.
2	**K5a — Gear DOWN**	Gear down (verify 3 green). Hold V_{YSE} — nose will need to come down. Call: "Gear down — *VSI dropped 250 — now –50 ft/min.*" Gear UP — restabilize baseline.
3	**K5b — Flaps APPROACH (~25°)**	Flaps one notch. Re-trim. Call: "Flaps 25 — *VSI to +50.*" Flaps UP — restabilize.
4	**K5c — Gear DOWN + Flaps DOWN (full)**	Gear down, flaps full. **Expect descent**. Call: "Gear and flaps down — *descending 400 ft/min at V_{YSE} — this is a landing profile, not a go-around profile.*" **Cleanup in priority**: flaps to 25, gear up, flaps up, restabilize.
5	**K5d — Windmilling prop** (gear/flaps UP)	**Unfeather the dead engine** per POH (or simulate by advancing prop control to high RPM and reducing throttle to idle if pre-briefed). Call: "Windmilling prop — *VSI dropped 300 — this is the single biggest item.*" **Re-feather** — restabilize baseline.

Step 8 — Airspeed Bracket around V_{YSE} (K4, S3)

Return to baseline (clean, feathered). Hold for 30 sec at each speed, log VSI, then move to the next. The point is to **see the curve** — especially the asymmetry between slow and fast.

#	Airspeed Target	Expected Observation
1	**V_{YSE} + 10** (~98 KIAS)	ROC degrades gently (perhaps –50 from book). Verbalize: "Above blue — parasite drag costs us, but it's modest."
2	**V_{YSE} + 5** (~93 KIAS)	Near baseline; trivial loss. Verbalize: "5 fast — almost free."
3	**V_{YSE}** (88 KIAS)	**Peak ROC**. Verbalize: "On blue — the top of the curve."
4	**V_{YSE} – 5** (~83 KIAS, near V_{XSE})	**ROC drops noticeably**; rudder pressure lightens. Verbalize: "5 slow hurts more than 5 fast — induced drag is rising and we're heading toward V_{MC}. Recover to blue." **Do NOT continue below V_{XSE}.**

> ***Airspeed floor: The bracket stops at V_{XSE}.*** *We are not demonstrating V_{MC} here — that is Task B. The purpose is purely to show the climb-performance curve and its asymmetry. If the applicant cannot hold V_{YSE} ±5 without descending below V_{XSE}, terminate the bracket and restabilize.*

Step 9 — Cleanup Priority & Return to Cruise (S4)

Examiner specifies altitude and heading for the return to cruise. Applicant verbalizes the cleanup priority and executes it:

Order	Action	Why this order
1	**PROP** — verify dead engine feathered (largest drag item gone)	Removes the single biggest source of asymmetric drag and yaw.
2	**FLAPS** — up in stages, watching speed	Largest controllable parasite drag after the prop.
3	**GEAR** — up, verify retraction	Final parasite drag item; verify 3 lights off.
4	**SECURE** the dead engine (fuel, mags, etc.) per POH	Housekeeping after climb is established — not before.
5	Climb to **assigned altitude ±100 ft**, level off, restore symmetric cruise power	Returns the airplane to normal cruise. Re-light dead engine per POH and pre-brief, or remain OEI for next task.

CRITICAL: HARD ABORTS — CFI restores symmetric power and takes the airplane if ANY of the following occur: (a) altitude descends through **3,000 ft AGL** in any configuration; (b) airspeed reaches **V_{XSE}** (PA-44: 82 KIAS) on the decel side and is not arrested; (c) bank exceeds **20°** in any direction; (d) the applicant cannot recover from K5c (gear+flaps) descent within 500 ft of initiation; (e) any roll trend toward the dead engine that rudder is not arresting. **The CFI's hand stays on the throttles throughout every configuration change.**

PHASE 3 Common Errors, Risk Management & Completion Standards

Common Applicant Errors (K8)

Error	Root Cause / Fix
Treats the demo as airwork, not instruction	Stops verbalizing deltas. **Fix:** every config change is paired with a number (“VSI dropped 250”) and a takeaway (“that's why prop comes off first”) — the lesson IS the verbalization.
Wrong cleanup order (gear before prop, etc.)	Reverts to single-engine habit. **Fix:** drill **PROP, FLAPS, GEAR, DEAD ENGINE** on the ground — highest-drag item first.
Loses altitude in K5c (gear+flaps), does not abort	Fixated on demo, not floor. **Fix:** 3,000 AGL is hard floor — cleanup begins at 3,500 AGL regardless of demo state.
Holds airspeed bracket past V_{XSE}	Confuses Task C with Task B. **Fix:** this is performance, not controllability. V_{XSE} is the floor — never below.
Wings level (or banked into dead engine)	Coordinated-flight habit. **Fix:** 5° bank INTO good engine, ball half toward good — zero sideslip minimizes drag.
Quotes book numbers without reading the VSI	Memorized, not observed. **Fix:** the lesson is the *actual* VSI on *this* airplane today — book is the prediction; VSI is the evidence.
Does not call rudder pressure changes	Eyes inside. **Fix:** every config change moves the drag center — rudder pressure changes — call it (“rudder lightening with flaps”).
Cannot explain WHY cleanup is prop-flaps-gear-engine	Memorized the mnemonic, not the aerodynamics. **Fix:** rank-order drag contributions — that ordering IS the priority.

Risk Management (R1–R6)

Risk	Mitigation
R1 — Altitude selection	≥ 4,000 AGL start, hard 3,000 AGL floor; within power-off glide of a suitable surface; clear of cloud and obstacles.
R2 — Entry & recovery	Baseline first; each case is brief-configure-stabilize-reset; cleanup priority verbalized before any change.
R3 — Loss of control / stall	Airspeed floor V_{XSE} (82 KIAS); 5° bank into good engine; ball toward good engine; no V_{MC} approach — this is not Task B.
R4 — Configuring the airplane	Hand on the lever, verbalize before moving; gear/flap movement against speed limits checked; one item at a time.
R5 — Collision hazards	Two clearing turns before entry; periodic clearing turns between cases; CFI handles radios and outside scan as needed.
R6 — Distraction / SA loss	Sterile cockpit during each case; one case at a time; reset to baseline (and verify altitude, heading, speed) between.

Debrief Script (15–20 min, post-flight)

1. Review recorded VSI numbers case by case. Did the applicant predict the relative magnitudes (windmilling prop > gear+flaps > gear > flaps)?
2. Airspeed bracket: asymmetry observed? Why does slow hurt more than fast?
3. Cleanup priority oral: justify **PROP-FLAPS-GEAR-ENGINE** from the drag rank-ordering, not the mnemonic.
4. Tie-back to the pattern: in XII-E approach, what does the applicant know about adding flaps that they didn't this morning? In XII-F go-around, why is **prop first** non-negotiable?
5. Endorse logbook; assign AFH Ch. 13 (drag & performance) + POH OEI climb chart review. Next: Area XIV postflight or examiner’s choice.

Completion: Completion (today): *Applicant completes the **four-case configuration matrix** and **four-point airspeed bracket**, holds heading ±**10°** and speed within tolerance, executes a **correct-order cleanup**, returns to assigned cruise altitude ±**100 ft** and heading ±**10°**, and verbalizes deltas and rationale unprompted. Sign off only after the applicant can **articulate the connection to the single-engine pattern** (Area XII E/F/G) — that is where this knowledge will be evaluated.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	# Config Cases	Aircraft / N#	CFI/MEI Signature & Cert #

Return to Table of Contents »

Area IX, Task C — Engine Failure During Straight-and-Level Flight & Turns (Multiengine)

Flight Lesson • SOLELY BY REFERENCE TO INSTRUMENTS — THE SCAN IS THE NEW DEAD FOOT • MEI Add-On (Instrument Phase)

PTS Reference & Objective

FAA-S-8081-9E, Area IX (Emergency Operations), Task C — **Engine Failure During Straight-and-Level Flight and Turns (Multiengine)**. Per the Area IX NOTE, the evaluator **shall omit Tasks C and D unless the applicant furnishes a multiengine airplane for the practical test, in which case Task C or D is mandatory.** Objective is to determine the applicant exhibits **instructional knowledge** of engine failure during S&L flight and turns, **solely by reference to instruments**, can demonstrate and simultaneously explain the maneuver, and can analyze and correct simulated common errors.

Objective: MEI applicant **demonstrates and simultaneously explains** — under the hood — (a) **identification and verification** of the inoperative engine using primary and supporting flight instruments; (b) **positive aircraft control** by reference to instruments throughout the failure, securing, and subsequent S&L flight; (c) accurate **assessment of performance capability** — climb / maintain / minimum sink — given current weight, DA, and configuration; and (d) **coordinated standard-rate turns** OEI both into and away from the dead engine, to instrument PTS tolerances.

Lesson Sequence & Materials

Time: 0.5 hr pre-flight brief + 1.2–1.5 hr flight (setup, simulated failure under hood, S&L OEI segment, standard-rate turns OEI both directions, recovery) + 0.4 hr debrief. **References:** FAA-H-8083-15B (IFH) Ch. 6 "Helicopter Attitude Instrument Flying" / Ch. 4–5 attitude instrument flying for airplanes; FAA-H-8083-9 (Instrument Procedures Handbook); AFH (FAA-H-8083-3) Ch. 13 "Multiengine Flight"; FAA-P-8740-66 "Flying Light Twins Safely"; **PA-44 POH/AFM** Section 3 Emergency Procedures (Engine Inoperative Procedures, Engine Securing Procedure, OEI Climb).

Sequence: (1) Ground brief: identification by instruments, the control/performance scan adapted to OEI, the performance decision (climb / hold / minimum sink). (2) Climb to ≥ **4,000 ft AGL** in the practice area, two clearing turns, hood on. (3) Establish baseline S&L at cruise, then CFI calls "simulated failure" on the critical engine (throttle to idle smoothly). (4) Applicant **recognizes** via the scan, **identifies** dead engine, **verifies** with the throttle, **controls** the airplane to V_{YSE}, runs the cleanup & feather flow. (5) S&L OEI at V_{YSE} on assigned heading, PTS tolerances. (6) Standard-rate turns OEI: 180° **AWAY** from the dead engine, roll-out, then 180° **INTO** the dead engine. (7) Hood off, restore symmetric power, return to cruise. (8) Debrief.

PTS Task C — Knowledge & Skill Elements

Item	Element
1.a	**Identifying & verifying** the inoperative engine — **by instruments** (HSI/DG drift, AI bank, TC/ball, ASI decay, VSI trend); verify with throttle.
1.b	**Technique for maintaining positive aircraft control** by reference to instruments — control/performance scan adapted to asymmetric flight.
1.c	**Performance assessment** — choose between **maintaining altitude**, achieving **minimum sink rate**, or accepting a driftdown, given current weight, DA, configuration, and terrain.
2.a	**Failure to recognize** an inoperative engine
2.b	**Hazards of improperly** identifying / verifying
2.c	Failure to **properly adjust engine controls and reduce drag**
2.d	Failure to establish & maintain **best OEI airspeed (V_{YSE})**
2.e	Failure to **follow the prescribed checklist**
2.f	Failure to establish & maintain the recommended **flight attitude for best performance**
2.g	Failure to maintain **positive aircraft control** while maneuvering
2.h	**Exceeding the aircraft's operating limitations**
2.i	**Faulty basic instrument flying technique**
3 / 4	**Demonstrate and simultaneously explain**; **analyze and correct** simulated common errors.

Completion Standards (Today)

Across the demonstration the applicant: **(a)** selects an altitude ≥ **4,000 ft AGL** (1,000 ft margin above 3,000 AGL hard floor) over suitable terrain, clear of cloud and traffic; **(b)** with the hood on, **recognizes** the simulated failure within **5 seconds**, correctly **identifies** the dead engine from instrument cues alone, and **verifies** with the throttle before retarding any other lever; **(c)** establishes and maintains **V_{YSE} ±5 KIAS**, heading **±10°**, altitude **±100 ft** or established driftdown, throughout the cleanup and feather flow; **(d)** performs **standard-rate turns** OEI in both directions to within **±10°** of target heading on rollout; **(e)** articulates Items 1a, 1b, 1c unprompted and ties them to the PA-44 POH numbers.

THE SCAN IS THE NEW DEAD FOOT: Outside the airplane, an applicant identifies the dead engine the way every textbook says — **dead foot, dead engine** — one physical sensation against the rudder pedal. Under the hood, that channel is closed. The information is still there, but it has all moved **into the panel**: the HSI begins to drift toward the dead engine, the AI rolls a degree or two toward the dead engine, the ball deflects toward the GOOD engine, the ASI bleeds back, the VSI starts showing the descent. Recognition now depends on a scan that was already working before the failure occurred. **The pre-failure scan IS the recognition.** An applicant who is fixated on the AI when the engine quits will not see the HSI drift for several seconds — and in IMC, several seconds of unrecognized yaw is the start of a graveyard spiral with one good engine pulling them into it. **The scan is the new dead foot. Build it on the ground, and never let it stop in the airplane.**

PHASE 1 Pre-Flight Ground Briefing — Identification by Instruments, the OEI Scan, the Performance Decision

Step 1 — Recognition: What the Panel Tells You (1.a, 2.a)

When an engine fails on a twin in VMC the pilot feels the yaw and looks at the windshield. Under the hood, every one of those cues arrives on the panel within **1–3 seconds** — but only if the applicant is scanning. The instrument signature of an engine failure, in approximate order of appearance:

When	Instrument	What you see
0–1s	**TC / Ball**	Ball **toward GOOD engine** (airplane yawing toward dead; ball opposite the yaw). **Fastest indicator.**
0–1s	**AI**	Subtle bank toward dead engine as the dead-side wing loses slipstream lift.
1–3s	**HSI / DG**	Heading **drifts toward dead engine** as yaw becomes a heading change.
2–5s	**ASI**	Speed **bleeds back** from extra drag and the windmilling prop.
3–6s	**VSI / ALT**	Slight descent if pitch not corrected. **Slowest of the six — do not wait for it.**

> ***The rule, no horizon required (1.b, 2.i): Identify rule under the hood:*** *ball toward the good engine, heading toward the dead engine. Both arrive together.* ***Verify:*** *retard the suspect throttle — if yaw does not change, throttle the OTHER suspect.* ***Do not feather until you have verified.*** *Control/performance does not go away on one engine: primary pitch shifts to* ***ASI*** *(speed matters more than altitude); in a std-rate turn OEI, primary bank is the* ***TC needle*** *cross-checked against the AI.*

Step 3 — The Performance Decision (1.c)

PTS 1.c demands the applicant accurately assess what the airplane can do **right now**, in **this** weight / DA / configuration, and pick the appropriate goal. **The wrong choice is the most common cause of OEI loss of control:** applicants who try to *climb* at a weight/DA where the airplane can only *maintain*, or *maintain* when only *minimum sink* is available, will pull the nose up, decelerate through V_{YSE}, and arrive at V_{MC} with full asymmetric thrust.

Available	Speed Target	Pitch Target	Teach the applicant to…
POSITIVE ROC (book climb >100 fpm)	V_{YSE} (88 KIAS PA-44)	Whatever holds V_{YSE} with positive VSI	Climb to MSA, then to safe altitude. Standard outcome at low DA, light weight, clean & feathered.
LEVEL ONLY (ROC ~ 0 at V_{YSE})	V_{YSE}	Whatever holds altitude (will not exceed V_{YSE} +/-5)	Accept level flight, navigate to nearest suitable, do not demand climb. Common at high DA / heavy / unfeathered.
DESCENT ONLY (negative ROC even clean+feathered)	V_{YSE} (minimum sink rate, NOT V_{XSE})	Pitch for V_{YSE}, accept the VSI you get	**Driftdown.** Navigate toward terrain that meets a single-engine service ceiling. **NEVER pitch up to 'save altitude'** — that bleeds airspeed into V_{MC}.

> ***PA-44 numbers (verify in POH for the day): PA-44 baseline (gross, SL, std):*** *clean+feathered V_{YSE} = ~**+205 fpm**; unfeathered = ~–**300 fpm**; gear-down feathered = ~–**50 fpm**. Add 2,000 ft DA and 50°F and the clean+feathered number is at or below zero.* ***The climb/level/driftdown choice is a number on a page, not a feeling.***

Step 4 — The Procedure Itself (Order Never Changes; 2.e)

MIXTURES, PROPS, THROTTLES full forward. **GEAR UP, FLAPS UP** (verify clean). **IDENTIFY** the dead engine from the scan (ball toward good, heading drift toward dead). **VERIFY** by retarding the suspect throttle — no yaw change confirms correct identification. **FEATHER** the verified-dead side. **SECURE** per POH after positive control is re-established. **Establish V_{YSE}** and the appropriate climb / level / driftdown profile, with **2–5°** bank into the good engine (zero sideslip). **Identify-before-verify, verify-before-feather** is non-negotiable — feathering without verifying shuts down the good engine, and in IMC that is unrecoverable.

> **CRITICAL: BEFORE GOING UNDER THE HOOD:** Student verbalizes — **(1)** POH numbers (V_{YSE} 88, V_{XSE} 82, V_{MC} 56) and expected ROC clean+feathered at today's DA; **(2)** scan order: TC ball, AI, HSI — ball toward good, heading toward dead; **(3)** IDENTIFY-VERIFY-FEATHER said aloud; CFI simulates the feather; **(4)** hard floor 3,000 AGL — hood off if descending through 3,500 unstabilized.

PHASE 2 In-Airplane Sequence — Hood On, Simulated Failure, S&L OEI, Std-Rate Turns Both Directions

Step 5 — Setup, Baseline, Cold-Scan Check (S3 prep, 1.b)

Climb to ≥ **4,000 ft AGL** — 1,000 ft margin above the 3,000 AGL hard floor. Two **90° clearing turns**. Note nearest suitable surfaces, fuel balance, CHT/oil temps. **Configure baseline:** gear UP, flaps UP, props HIGH RPM, mixtures RICH. Stabilize at **cruise (110–120 KIAS)**, level, on assigned heading. **Hood on. Cold-scan check:** full minute under the hood holding heading ±5° and altitude ±50 ft — if the scan is not stable here it will not produce when the engine quits. Fix it before introducing the failure.

Step 6 — Simulated Failure, IVF Flow (1.a, 1.b, 2.a/b/c/d/e)

CFI smoothly retards **critical-engine throttle (LEFT for PA-44)** to idle — no announcement. Applicant flies the following sequence, **verbalizing each step**:

#	Action	Instructional Standard
1	**RECOGNIZE** via scan	Within **5 sec**: “Ball right, heading drifting left, speed bleeding — engine failure on the left side.” No control input yet — just recognition.
2	**CONTROL** the airplane	**Right rudder**; **pitch for V_{YSE}**; **2–5° bank into good engine**; ball half toward good = zero sideslip.
3	**POWER / CLEAN** — mixtures, props, throttles full; verify gear/flaps up	Both throttles forward; failed-side throttle is the verification tool in step 5.
4	**IDENTIFY** — “My left engine is dead.”	Stated aloud, defended from the scan. Do not name an engine you cannot defend.
5	**VERIFY** — retard LEFT throttle	“No change in yaw — verified left.” If yaw changes, ID was wrong — verify the other side.
6	**FEATHER** (simulated)	CFI sets **zero thrust** (~12–15° MP); applicant does NOT physically feather at training altitude.
7	**SECURE** per POH (announce only)	Mixture ICO, mags off, fuel OFF, pump off, cowl flap closed, alt off — **announced**, not actually shut off.

Step 7 — S&L OEI to Instrument PTS Tolerances (3, 2.f, 2.g)

With the dead engine simulated-feathered and zero thrust set, applicant stabilizes **S&L OEI** on assigned heading. CFI calls a target altitude (typically current altitude held, or “maintain current and let me know what you can do” if performance is marginal). Applicant holds for at least **60 seconds** to demonstrate stable instrument flight in the asymmetric condition.

Parameter	Standard	Common deviation
Altitude	**±100 ft** if performance permits; OR established driftdown at V_{YSE}	Pulls nose up to ‘save’ altitude, decelerates through V_{YSE} — **this is the failure mode that kills.**
Heading	**±10°** of assigned	Insufficient rudder; ball not centered for zero-sideslip.
Airspeed	**V_{YSE} ±5 KIAS**	Speed bleeds in ‘altitude-hold’ attempts; or chases speed by pitching.
Bank / Scan	**2–5° into good**; continuous scan	Wings level (slip toward dead engine); or fixates on AI.

Step 8 — Standard-Rate Turns OEI (3, 1.b, 2.g)

On CFI's command, applicant performs a **180° standard-rate turn AWAY from the dead engine first** (the more stable direction), rolls out on assigned heading, then a **180° standard-rate turn INTO the dead engine**. Both legs in V_{YSE}, hood on.

Turn	Bank / Rate	Watch for	Standard
Away from dead (RIGHT for L-eng-out)	Std rate (**~15°**) on TC needle	Bank reinforced by good-engine thrust; speed tends to **bleed** — ASI scan critical.	Rollout ±**10°**; V_{YSE} **±5**; alt loss <**100 ft**.
Into dead (LEFT for L-eng-out)	Std rate (**~15°**) on TC needle	Good engine pulls outside the turn; significant rudder mid-turn; **do not exceed 15° bank into dead engine** at V_{YSE}.	Rollout ±**10°**; V_{YSE} **±5**; alt loss <**100 ft**.

Both directions are safe at V_{YSE}: OEI turn-direction reality: *(1) the airplane will turn either direction safely if airspeed is maintained — **V_{YSE} is the magic number, not bank direction**; (2) the turn into the dead engine demands more rudder mid-turn because good-engine thrust pulls outside the turn. The scan does not stop because the airplane is in a turn.*

CRITICAL: HARD ABORTS — CFI calls ‘Hood Off, I have the airplane’ and restores symmetric power if ANY of the following occur: (a) altitude descends through **3,000 ft AGL**; (b) airspeed reaches **V_{XSE}** (82 KIAS PA-44) on the decel side and is not arrested within 3 seconds; (c) **bank exceeds 20°** in any direction, or 15° into the dead engine at V_{YSE}; (d) heading drift > 30° from assigned with no corrective input; (e) applicant attempts to **feather without verifying**, or names the wrong engine in identify and is moving toward the wrong lever; (f) any roll trend toward the dead engine that rudder is not arresting. **The CFI's hand stays near the throttles throughout. The verification and feather steps are SIMULATED — CFI sets zero thrust; applicant does NOT physically move the prop control to feather at training altitude unless POH and the operation specifically permit.**

PHASE 3 — Common Errors (PTS Item 2), Risk Management, Debrief & Completion Standards

Common Applicant Errors — PTS Item 2.a–i (4)

PTS Item	Error — Root Cause — Fix
2.a Recognition	Scan was already broken before the failure; or fixation on AI. **Fix:** prove a stable scan in cruise *before* introducing the failure.
2.b ID/verify	Guesses the dead engine, or skips verify and goes to feather. **Fix:** identify defended from the panel aloud; verify always precedes feather.
2.c Drag/controls	Leaves gear/flaps as-is; or pulls operating engine power. **Fix:** mixtures-props-throttles FULL on live side; verify clean; flow before identify.
2.d V_{YSE}	Fixates on altitude over speed. **Fix:** pitch for **speed** in OEI; accept the altitude performance gives you.
2.e Checklist	Works from memory and skips steps; or reads checklist and neglects to fly. **Fix:** flow first, checklist as verification.
2.f Attitude	Wings level or banked into dead engine. **Fix:** 2–5° into good, ball half toward good = zero sideslip.
2.g Positive ctl	Scan collapses in the std-rate turn. **Fix:** ASI primary pitch; TC primary bank; neither falls out of scan.
2.h Op limits	Operating engine at max power too long; or descends through floor. **Fix:** max continuous (not takeoff) sustained; honor the 3,000 AGL floor.
2.i Basic inst	OEI manifestation of pre-existing scan weakness. **Fix:** back to attitude instrument flying basics — this Task is the wrong place to fix a broken scan.

Risk Management

Risk	Mitigation
Altitude selection	≥ **4,000 AGL** start, hard **3,000 AGL** floor; within glide of suitable surface; clear of cloud.
Mis-ID → wrong-engine feather	Verify-before-feather is non-negotiable; CFI sets zero thrust; intervenes if applicant moves for the wrong lever.
V_{MC} loss of control	V_{XSE} (82 KIAS) floor; bank ≤15° into dead engine; **thrust off before bank in** if V_{MC} develops.
Hood disorientation	Cold-scan check before failure introduced; CFI calls 'hood off' on vestibular illusion or scan breakdown.
Task saturation	One element at a time — S&L OEI before turns; turns one direction at a time; CFI handles radios.
Engine handling	Zero thrust rather than physical feather; watch CHT/oil temp; warm before restoration of power.
Collision	Two clearing turns before hood-on; CFI maintains outside scan; flight following / traffic advisories as available.

Debrief Script (15–20 min, post-flight)

1. ID: which instrument was first to tell you? Could you have caught it sooner with a faster scan? **2.** Perf decision (1.c): did today's conditions allow climb, level only, or driftdown? Did the in-flight VSI match the POH prediction? **3.** S&L OEI tolerances: where did the scan slip? **4.** Turns: contrast away-from-dead vs into-dead — rudder, ball, ASI behavior? **5.** Tie-back to Task D (Instrument Approach OEI): every one of these skills applied to an actual approach to minimums. **6.** Endorse logbook; assign FAA-H-8083-9 OEI approach review + AFH Ch. 13 re-read. Next: Area IX Task D.

> ***Completion: Completion (today):*** *simulated failure → IVF flow → stabilized S&L OEI → std-rate turns both directions → recovery, under the hood, holding V_{YSE} ±**5**, heading ±**10°**, altitude ±**100 ft** (or established driftdown), verbalizing Items 1.a/b/c unprompted. Sign off only after the applicant articulates the link to Task D.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	Hood Time (sim inst)	Aircraft / N#	CFI/MEI Signature & Cert #

Area IX, Task D — Instrument Approach: One Engine Inoperative (Multiengine)

Flight Lesson • CULMINATING MEI INSTRUMENT FLIGHT — THE TASK CMEL/MEI CANDIDATES MOST OFTEN FAIL FOR TASK SATURATION • Five-Stack Workload (Aviate-Navigate-Communicate-Configure-Decide)

PTS Reference & Objective

FAA-S-8081-9E, Area IX, Task D — **Instrument Approach—One Engine Inoperative (Multiengine).** Per the Area IX NOTE, evaluator **shall omit Tasks C and D unless the applicant furnishes a multiengine airplane, in which case C or D is mandatory**; most examiners pair an abbreviated Task C with a full Task D — this is the capstone OEI item. **Objective:** MEI **demonstrates and simultaneously explains** — under the hood — a complete OEI instrument approach following a simulated failure outside the final approach environment: (a) maintain alt/airspeed/track per segment; (b) procedure when unable to comply with ATC; (c) MDA / visibility category adjustment; (d) appropriate descent rate on final; (e) continue-straight-in vs. circle vs. miss; (f) land or OEI miss to instrument PTS tolerances throughout.

Lesson Sequence & Materials

Time: 0.75 hr brief + 1.4–1.7 hr flight + 0.5 hr debrief. **References:** FAA-H-8083-9 (IPH) Ch. 4; FAA-H-8083-15B (IFH) Ch. 10–11; AFH Ch. 13 OEI approach; FAA-P-8740-66; current Chart Supplement & **IAP charts** for the destination; **PA-44 POH/AFM** Section 3 Emergency, Section 4 Approach & Landing, Section 5 OEI Climb.

Sequence: (1) Ground: brief IAP, sequencing rule, continue/circle/miss tree for today's wx and weight. (2) IFR training flight to a field with ATC and both an ILS/LPV and a LOC/VOR/RNAV. (3) En route hood-on, CFI calls “simulated failure” **5–8 NM before the IAF**. (4) IVF flow, V_{YSE}, complete the OEI cleanup **before any descent**. (5) Declare/re-brief ATC. (6) Brief plate OEI (category, MDA/vis, ROD, miss). (7) Fly approach. (8) Land or fly OEI miss. (9) Restore symmetric power; re-fly opposite approach type if time/fuel.

PTS Task D — Knowledge & Skill Elements

Item	Element
1.a	Maintain **alt / airspeed / track** per phase of flight or approach segment.
1.b	Procedure if **unable to comply with an ATC clearance** (‘unable / declare’).
1.c	Adjustments to published **MDA & visibility** for aircraft **approach category** (OEI may push category up).
1.d	**Appropriate rate of descent** on the final approach segment OEI.
1.e	Continue **straight-in** vs. **circle** vs. miss — OEI circle heavily discouraged.
2.a	Lack of **plate knowledge.**
2.b	Improper **communications procedures.**
2.c	**Noncompliance with ATC clearances.**
2.d	**Incorrect use of nav equipment.**
2.e	Failure to ID/verify dead engine; failure to **follow emergency checklist.**
2.f	Inappropriate engine-control adjustments and **drag reduction.**
2.g	Improper establishment/maintenance of V_{YSE}.
2.h	Failure to maintain **flight attitude for best performance.**
2.i	Failure to maintain **positive aircraft control.**
2.j	**Faulty basic instrument flying technique.**
2.k	**Descent below MDA or DH** without 91.175(c).
2.l	**Faulty roundout and touchdown.**
3 / 4	**Demonstrate & simultaneously explain**; **analyze & correct** simulated common errors.

THE AIRPLANE FLIES YOU ONLY AS FAST AS YOUR SCAN: An instrument approach OEI has **twelve** listed common errors — the most of any Task in this PTS. By the FAF the applicant is simultaneously (1) flying OEI on instruments, (2) running a published procedure, (3) talking to ATC, (4) configuring down a drag/airspeed schedule, and (5) deciding continue / circle / miss against the worst weather of the day. The failure mode is not knowledge — it is **sequencing**. Applicants try all five at once, drop the scan, and arrive at the FAF high/fast/off-course with a dead engine. **Teach the sequence: the airplane never moves to the next phase until the prior phase is stable on the panel.** Stabilize OEI before talking to ATC. Brief the plate before turning to intercept. **Thoroughness, not speed, is the standard.**

PHASE 1 — Pre-Flight Ground Briefing — Sequencing Rule, MDA/Vis Category, Descent Rate, Land vs Circle vs Miss

Step 1 — The Sequencing Rule (1.a)

Applicants fail this Task because they try the plate, radio, config, and engine flow **at once**. Defense is a **sequencing rule**: the airplane does not advance to the next demand until the prior one is stable on the panel.

#	Demand	Stable means…	…then
1	**AVIATE** OEI	Wings level or std-rate on TC, V_{YSE} ±5, alt ±100 / driftdown.	Touch any other lever or radio.
2	**CONFIGURE** — IVF, clean, secure	IVF complete; failed-side secured; live-engine temps green.	Speak to ATC.
3	**COMMUNICATE** declare/request	ATC has the emergency, knows intentions & equipment limits; current clearance.	Brief / load approach.
4	**NAVIGATE** — brief plate, set nav/miss	Plate aloud (MSA, FAF, MDA/DA, MAP, miss); box set; MISS armed.	Begin descent / intercept.
5	**DECIDE** — continue / circle / miss	Decision made **before FAF** against today's wx/wt.	Cross FAF.

> ***Most common failure: Radio-trap:*** *applicant skips step 2 stability and talks while still chasing V_{YSE}. The 15-sec call → 30° hdg drift, 12 KIAS below V_{YSE}; rest of the approach is recovery.* ***ATC waits, the airplane doesn't.***

Step 2 — MDA / Visibility Category (1.c)

AIM 5-4-7: category by **1.3 V_{SO}** at max gross landing weight, BUT if operated at **any speed** above the category's upper limit, use the **higher category's** minimums. OEI final speed is V_{YSE}+10 = **~98 KIAS** (PA-44), above Cat A's 91 KIAS limit — **use Cat B** MDA/DA/visibility OEI. Many plates show identical Cat A/B, but always verify.

Step 3 — Descent Rate on Final OEI (1.d)

Rule: **(GS / 2) × 10 = fpm** on 3° GS. At 98 KIAS with 10 kt headwind, GS ≈ 88; ROD ≈ **440 fpm**. Coordinate throttle AND drag (gear, partial flaps) without trading airspeed: pull power without drag → balloons; add drag without power → sinks below V_{YSE}.

Segment	Target	Config	Power
Vectors / Initial	Alt ±100, hdg ±10, V_{YSE}+10	Clean, feathered	Cruise climb / max-continuous as needed
Intermediate	Step-downs ±100	Clean, feathered	Whatever holds 98 KIAS level
FAF → MDA/DA	ROD per (GS/2)×10; V_{YSE}+10 → V_{REF}	**Gear at FAF**; flaps 10°	–3 to –5 in MP per 100 fpm desired
VDP → Landing	V_{REF} over threshold	**Full flaps only when landing assured**	Idle on live until flare

Step 4 — Continue / Circle / Miss (1.e, 1.b)

Option	When	OEI consideration
Continue straight-in	Stable, RWY aligned <30°, wx at/above Cat B mins.	**Default OEI choice** — no turn-into-dead bank.
Circle	Landing RWY >30° off final AND circling mins met.	**Heavily discouraged OEI** — low-alt maneuvering in marginal vis is a leading LOC scenario.
Missed approach	At DA/MAP no rwy environment; OR unstable at FAF; OR unsafe to land.	**OEI climb is limiting** — ~+150 fpm clean+feathered. Heading first, then climb. Tell ATC early.

> ***ATC non-compliance: Unable / Declare (1.b):*** *"**Unable** [item], request [alternative]"; if critical,* ***"Mayday / Pan-Pan****, [callsign], engine failure, request vectors [approach]." Teach: 'unable' and 'declaring' are tools, not failures.*

CRITICAL: BEFORE GOING UNDER THE HOOD: Student verbalizes — **(1)** The sequencing rule in order: AVIATE - CONFIGURE - COMMUNICATE - NAVIGATE - DECIDE; **(2)** Today's approach category (B for OEI in the PA-44), the resulting MDA/DA, and Cat B visibility minimum; **(3)** Today's required descent rate at expected GS; **(4)** The continue/circle/miss decision matrix for the published approach including the OEI climb gradient on the miss; **(5)** The phraseology for 'unable' and for declaring an emergency. **If the student cannot say all five without prompting, the lesson is a ground lesson today.**

PHASE 2 In-Airplane Sequence — En Route OEI Setup, Approach Brief OEI, Final to Minimums, Land or Miss

Step 5 — En Route Setup & Simulated Failure (1.a)

IFR clearance (or VFR + flight following with simulated IFR). Hood on by 1,000 AGL. Plan a field with **both ILS/LPV and LOC/VOR/RNAV**. CFI calls "simulated failure" on the critical engine (LEFT PA-44) **5–8 NM before the IAF** in level cruise — enough time to stabilize OEI, re-brief ATC, and brief the plate.

Step 6 — AVIATE + CONFIGURE (Phases 1–2; 2.e/f/g/h/i)

Applicant runs the IVF / OEI flow from Task C — **verbalized aloud** for instructional credit:

#	Action	Standard
1	**RECOGNIZE** from scan	Ball toward good, hdg drift toward dead, ASI decay. Aloud: "Failure left side."
2	**CONTROL**	Right rudder; pitch V_{YSE}; 2–5° into good; ball half toward good.
3	**POWER / CLEAN**	Mix-prop-throttle FULL; verify gear/flaps up.
4	**IDENTIFY & VERIFY**	"Dead left, verified left." CFI sets zero thrust (~12–15 in MP).
5	**SECURE** (announce per POH)	Mixture ICO, mags off, fuel OFF, pump off, cowl closed, alt off — announced.
6	**TRIM & STABILIZE**	**Do not advance until hdg ±5, alt ±100, V_{YSE} ±5.**

Step 7 — COMMUNICATE then NAVIGATE (1.b, 2.a–d)

Call	Example (N123EG to KXYZ Approach)
Declare	"**Mayday**, XYZ App, Seminole 123EG, engine failure OEI, request vectors ILS 29, four souls, two hours fuel."
Unable	"XYZ, 123EG **unable** 4,000 OEI; request 3,000 or as low as practical."
Brief plate aloud	"ILS 29, FAF SUBOR 2,300, GS 3.0°, DA 538/200, Cat B, miss climb right 3,000 BORTU-hold. OEI miss ~150 fpm. Gear at FAF, flaps 10. Full flaps only with runway assured."

Step 8 — Final to Minimums OEI (Phase 5; 1.a/d/e, 2.i/j/k)

Vectored to FAC. **V_{YSE}+10** until 1 NM prior FAF, then slow toward V_{YSE}. **Gear DOWN at the FAF** (signature event — same way every time). **Flaps 10°**. Power for ROD per table. CFI calls config if omitted — hint, not save.

Where	Standard	Common deviation
Vectors / intermediate	Alt ±100, hdg ±10, spd ±10, CDI <full.	Wanders during radio calls.
Course intercept	<3/4-scale CDI; no S-turns.	Overshoots, then bank into dead to recover (LOC window).
FAF to MDA/DH	ROD per calc; V_{YSE}+10 ±5; LOC/GS <3/4 scale; no descent below MDA/DH w/o 91.175(c).	Chases GS with erratic drag; busts MDA (2.k).
MAP/DA	Aloud: "Runway in sight, continuing" or "Going missed." Decision before MAP/DA.	Hesitates; descends below MDA or late high miss.
Landing	V_{REF} over threshold; full flaps only when landing assured; touchdown first 1/3.	Full flaps too early → no go-around OEI.
OEI miss	Live to max-continuous; V_{YSE}; positive ROC verified; gear up first, flaps in steps; heading then climb.	Cleans up gear+flaps together (sinks); or leaves gear down through miss.

> ***Precision vs nonprecision (3, 1.d): Fly one of each if time/fuel:*** *ILS/LPV first (vertical guidance teaches OEI config timing), then LOC/VOR/RNAV-LNAV with dive-and-drive. Different cadence: precision = one continuous descent; nonprecision = power-out / power-in at each step. The MDA-bust (2.k) lives in nonprecision.*

Step 9 — Restore, Climb Out, Return

Landed — clear runway, restore symmetric thrust on ground. On miss — once positive control and obstacles clear, CFI gradually advances the simulated-failed throttle to matched MP, then matched RPM. Climb to safe altitude; hood off to confirm orientation. Re-fly opposite approach type if time/fuel; otherwise return to base.

CRITICAL: HARD ABORTS — CFI calls 'Hood Off, I have the airplane' and restores symmetric power if ANY of the following occur: (a) altitude descends through the hard floor — **3,000 AGL** outside the FAF, or **MDA/DH + 100** on the final approach segment if unstabilized; (b) airspeed reaches **V_{XSE}** (82 KIAS PA-44) and is not arrested within 3 seconds; (c) **bank exceeds 20°** in any direction, or 15° into the dead engine at V_{YSE}; (d) CDI / GS deflection beyond 3/4 scale with no corrective action; (e) applicant attempts to **feather without verifying**, or configures gear/flaps without first stabilizing AVIATE; (f) applicant attempts to **descend below MDA/DH** without 91.175(c) requirements; (g) **full flaps deployed before landing is assured** (commits the airplane to a landing it may not make OEI); (h) ATC clearance not complied with AND no 'unable' transmitted (PTS 2.c) — CFI prompts once, then takes the airplane on the second occurrence. **Verification & feather are simulated; CFI sets zero thrust. Applicant does NOT physically move the prop control to feather at training altitude unless POH and the operation specifically permit.**

PHASE 3 — Common Errors (PTS 2.a-l, 12 items), Risk Management, Debrief & Completion Standards

Common Applicant Errors — PTS Item 2.a–l (4)

PTS	Error — Root Cause — Fix
2.a Chart knowledge	Doesn't know FAF altitude / MDA / MAP / miss procedure. **Fix:** brief the plate **aloud** before the IAF; examiner-style brief: A/W/A/R/E (alts, weather mins, approach segs, runway, emergency miss).
2.b Comms	Stammers, runs together, forgets call elements. **Fix:** scripted phraseology (declare / unable / brief); fly the airplane first — ATC waits, the airplane does not.
2.c ATC non-compliance	Accepts clearance the OEI airplane cannot meet. **Fix:** “unable” is a tool. Teach the applicant to use it.
2.d Nav equip	Wrong source on CDI; wrong frequency tuned; ILS not identified; missed approach not armed. **Fix:** tune-identify-monitor-arm at the same point on every approach (10 NM out is a good trigger).
2.e ID/verify/checklist	Compresses IVF, skips checklist under stress. **Fix:** flow first, checklist as verification; never compress.
2.f Drag/controls	Leaves gear down throughout (kills climb perf on miss); or retracts gear before positive ROC on miss. **Fix:** predictable: gear at FAF down; gear UP on miss only after positive ROC verified.
2.g V_{YSE}	Flies too fast / too slow on final — especially behind the airplane at FAF. **Fix:** V_{YSE} +10 to FAF, V_{YSE} to MDA/DA, V_{REF} over threshold — three speeds, three points.
2.h Attitude/perf	Wings level (slip toward dead) or banked into dead engine through turns. **Fix:** 2–5° into good, ball half toward good = zero sideslip.
2.i Positive ctl	Scan collapses on the FAC intercept turn or on the GS intercept. **Fix:** the scan does not stop because the airplane is in a turn or descent.
2.j Basic inst	OEI manifestation of pre-existing weak scan — amplified by the approach workload. **Fix:** back to attitude instrument flying; this is the wrong place to fix a broken scan.
2.k Below MDA/DH	Descends ‘chasing the runway’ without 91.175(c) elements in sight. **Fix:** MDA is hard in instructional context; verbalize the runway environment by element.
2.l Roundout/touchdown	Full flaps too early eliminates go-around; or floats / drops it in OEI because never carries enough airspeed into the flare. **Fix:** full flaps only when landing assured; V_{REF} over threshold every time.

Risk Management

Risk	Mitigation
Task saturation	**Sequencing rule** enforced on EVERY approach: aviate → configure → communicate → navigate → decide. CFI calls out skipped steps.
Altitude floor	**3,000 AGL** outside the FAF as hard floor; on the approach the floor is **MDA/DH + 100** if unstabilized. Hood off + power restored at floor.
Mis-ID → wrong-engine feather	Verify-before-feather non-negotiable. CFI sets zero thrust; intervenes if applicant moves toward the wrong lever.
V_{MC} loss of control on intercept turn	Vectors planned to limit intercept <30°; bank ≤15° into dead engine at V_{YSE}; if tighter, ask for re-vector.
Full-flap commit to a landing not assured	Full flaps ONLY at ‘runway made’. Half flaps until then. CFI takes airplane if full flaps deployed early on a marginal approach.
OEI missed climb gradient	Brief expected OEI climb (~150 fpm clean+feathered PA-44 at gross/SL); compare to published gradient; pick approach with achievable miss.
ATC overload	Declare early; request priority handling; CFI handles non-essential radio if applicant is on the scan.
Weather / equipment	VMC for training (hood simulates IMC); equipment to fly the planned approach legally; second nav source for cross-check on partial-panel scenarios.

Debrief Script (20–25 min, post-flight)

1. Sequencing: at which approach segment did the rule slip first? (Answer is usually ‘the radio call before stable.’) **2.** Plate brief: missing elements? — replay the A/W/A/R/E template aloud. **3.** Category & minimums (1.c): correct minimums used? Did the applicant verbalize the category jump? **4.** Descent rate (1.d): actual ROD vs computed; how did you split power/drag to hold the profile? **5.** Decision (1.e): defend the continue/circle/miss call — what would have changed it? **6.** OEI miss (if flown): climb perf, gear/flap retraction timing, heading vs altitude priority. **7.** Endorse logbook; record .X simulated instrument time. **This concludes the MEI flight training syllabus.** Assign FAA-S-8081-9E rehearsal of all PTS Tasks ahead of the MEI practical; schedule mock checkride.

Completion: Completion (today): *simulated failure en route → stabilized OEI → ATC declaration & brief → full OEI instrument approach to minimums (at least one; ideally one precision + one nonprecision) → landing OR published OEI miss, under the hood, holding instrument PTS tolerances throughout, verbalizing Items 1.a–e unprompted, and applicant* ***self-identifies*** *at least two of the twelve common errors during debrief without prompting. Sign off only when the sequencing rule is reflexive.*

Applicant Name & Cert #	Lesson Date	Tach Start / Stop	Hood Time (sim inst)	Aircraft / N#	CFI/MEI Signature & Cert #