Multi-Engine Training And The PTS

GHAFI

John Sollinger/Larry Hendrickson

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Overview

- FAR differences between original and add-on
- Multi-Engine PTS
- Training methods
- Common training scenarios

Original vs. Add-on, Private

- Applicants for private certificate AMEL must have (FAR 61.109(b)):
  - 3 hours X-C training in ME airplane
  - 3 hours night training in ME airplane
    - 100 NM X-C
    - 10 takeoffs and 10 full-stop landings
  - 3 hours instrument training in ME airplane
  - 3 hours of test prep in ME airplane (60 days)
  - no requirement for solo time in ME airplane
- Applicants for AMEL add-on to private certificate train to proficiency with no explicit experience requirements

Original vs. Add-on, Commercial

- Applicants for commercial certificate AMEL must have (FAR 61.1129(b)):
  - 10 hours training in ME airplane
  - 5 hours instrument training in ME airplane
  - 2 hours day X-C (100 nm) training in ME airplane
  - 2 hours night X-C (100 nm) training in ME airplane
  - 3 hours of test prep in ME airplane (60 days)
  - 10 hours solo (or acting as PIC with CFI) in ME airplane
    - one XC at least 300 nm (250 nm straight-line distance)
    - 5 hours night VFR with 10 takeoffs and 10 landings at control tower airport
- Add-on applicant trains to proficiency

Multi-Engine Practical Test Standards

- Flight Instructor Responsibility
  - develop safe and proficient pilots
  - train to acceptable standard in **ALL** knowledge areas, procedures, and maneuvers
  - emphasis on
    - visual scanning
    - runway incursion avoidance
    - positive exchange of flight controls
- Satisfactory Performance
  - perform the approved areas of operation
  - demonstrate mastery of the aircraft
  - demonstrate sound judgment
  - demonstrate satisfactory proficiency and competency (commercial only)

Multi-Engine Practical Test Standards

- Comparison of Private vs. Commercial PTS
  - takeoff and landing tasks
    - slightly tighter tolerances for the commercial applicant
    - commercial +/-5 kts, touchdown within 200’
    - private +10/-5 kts, touchdown within 400’
  - steep turns
    - commercial 50º bank +/-5º, altitude +/-100’, +/-10 kts, rollout +/-10º
    - private 45º bank +/-5º, altitude +/-100’, +/-10 kts, rollout +/-10º
- Tasks are virtually identical with a few minor differences
  - private requires ground reference and basic instrument maneuvers
  - commercial has an area of operation on high altitude operations

Instructing Single-Engine vs. Multi-Engine

- Aircraft is faster
- Aircraft is heavier
- Systems are more complex
- Asymmetric thrust
  - controllability, V_{MC} , red-line
  - performance, V_{YSE}, blue-line
- FAR 61.195f requires 5 hours PIC in make and model to instruct for certificate or rating

Multi-Engine Training

- Introducing the airplane
  - System knowledge and management
    - Fuel
    - Electrical
    - Gear and Flaps
  - Familiarity with cockpit controls and gauges
  - Aircraft performance
    - V-speeds
    - Take-off, climb, cruise, landing charts
    - Weight and balance

Multi-Engine Training

- ME operations prior to SE operations
- Instrument rated pilots must demonstrate instrument proficiency, both ME and SE
- Syllabus (Order of Training)
  - VFR (ME), VFR (SE), IFR (ME), IFR (SE)
  - VFR (ME), IFR (ME), VFR (SE), IFR (SE)
- **Question** - which is better, and what factors are considered?

Multi-Engine Training

- Instructor capabilities (Rules of Engagement)
  - if malfunction occurs during a maneuver, the maneuver is aborted and the malfunction is handled
  - simulated malfunctions during instrument training are prioritized and handled according to the training situation
- Aircraft capabilities
  - “ancient” aircraft with single systems (hydraulic or vacuum pump, or generator)
  - single-engine rate of climb requirements
  - operating limitations and characteristics
    - aircraft designed so that V_{MC} is below stall speed
    - counter-rotating propellers
  - reputation

Training Scenario - Taxi

- Differential Power
  - used for turns if necessary
  - used for taxi during strong crosswind
  - (personal opinion) avoid use during take-off and landing because it is easier to notice when an engine begins to misbehave

Training Scenario - Takeoff

- Takeoff profile
  - hold on runway momentarily while advancing power on engines
  - turbocharger spool-up
  - retract gear and flaps (if applicable) at “safe altitude”
  - climb at full power and V_Y until pattern altitude, then cruise climb airspeed and power
- Engine failure
  - during takeoff roll (stop!!)
  - “area of decision” (after rotation, but before reaching V_{YSE})
  - V_{YSE} and subsequent (fly!!)

Training Scenario - Takeoff

- Factors to consider
  - density altitude
  - terrain and obstacles
  - runway length, slope, surface
  - aircraft loading, age
- Be prepared for the malfunction. Decide course of action prior to applying power for takeoff. (Condition Orange)

Training Scenario - Take-off

- FAA recommends rotation speed at least V_{MC} + 5 kts or manufacturer's recommended airspeed, whichever is higher.

- **Question** - some manufacturers recommend a rotation speed slower than V_{MC} for the short/soft take-off procedures. Is this reasonable?
- **Question** - some manufacturers have revised their POH/AFM. Are the revised procedures safer?

Training Scenario - Stalls and Slow Flight

- ME only
- At altitude to ensure recovery by 3000’ AGL minimum
- Stalls
  - commercial PTS suggests limiting power during entry to power-on stalls to avoid high pitch angle
  - private PTS does not (same difference noted in single-engine PTS)
  - power application at recovery should be gradual
- Slow flight
  - commercial 1.2 V_{s1}
  - private 1.2 V_{s1} or V_{MC} whichever is greater

Training Scenario - Drag Demo

- The aircraft must be configured properly to maximize single engine climb, initially gear and flaps up, inoperative engine zero thrust.
  - loss of climb performance associated with windmilling propeller, extending gear, extending flaps, and combinations
  - different climb penalties with left vs. right engine inoperative
  - effect of bank toward/away from operating engine
  - effect of sideslip

Training Scenarios - Single-Engine Operations

- Simulate Engine Failure with
  - Mixture (above 3000’ AGL only)
  - Throttle (below 3000’ AGL)
  - Fuel shut-off valve (never!)

- Engine Failure Troubleshooting Procedure
  - Maximize available power
  - Minimize drag
  - Maintain V_{YSE}
  - Identify, Verify, Feather
  - Systems Cleanup
  - Take your time and do it right

Training Scenarios - Single-Engine Operations

- Instrument Single Engine Operations
  - stabilized, continuous descent to landing is best (ILS preferred)
  - avoid procedure turns, holds, circling approaches if possible

- Single Engine Go-Around
  - avoid!!! Avoid!!! AVOID!!!
  - use of full flaps should be considered a commit to landing

Training Scenario – V_{MC} Demonstration

- At altitude
- recover at first sign of either imminent stall or loss of directional control
- may be necessary to limit rudder travel
- recover by reducing power on the operating engine
- recover with single engine at V_{YSE}

Training Scenario – Actual Single Engine Operations

- at altitude
- over airport
- good weather
- minimize actual single engine operations
  - simulate with zero-thrust configuration
- may not be able to perform shutdown without risk of engine damage (turbo-charged engines)