



California Wing Turbo Training for CAPS 71-1, 1 Feb 21

Introduction

Whereas CAPS 71-1 (dated 1 Oct 20) requires Wing to “establish syllabi required to transition pilots into any turbocharged aircraft they may have assigned”, the following syllabus shall constitute the official standard for California Wing.

For all CAP Pilots in California Wing requesting privileges to act as PIC in CAP Turbocharged Cessna aircraft (TCA) the following syllabus and standards apply. The syllabus and knowledge items have been tailored to the kind of turbocharged powerplants found in CAWG.

Syllabus

1. For pilots with a minimum of 5 hours flight time in a TCA, applicants must complete Sections 3, 4, 5, and 6.
2. For pilots with no prior TCA experience or less than 5 hours of flight time, applicants must complete Sections 1, 2, 3, 4, 5, and 6.

Section 1: Ground Learning

Applicant should have suitable training on the turbocharging system including theory, components, operation, normal procedures, and emergency procedures.

- a. Turbocharging Theory: BoldMethod Website: <https://www.boldmethod.com/learn-to-fly/aircraft-systems/how-an-aircraft-turbocharger-system-works/>
- b. Turbocharging Theory and Failures: Airplane Flying Handbook (FAA), Chapter 12, pages 9-11: https://www.faa.gov/sites/faa.gov/files/regulations_policies/handbooks_manuals/aviation/airplane_handbook/13_afh_ch12.pdf
- c. The pilot’s operating handbook (POH) for the aircraft to be used in training and evaluation.
- d. Section 3 (operating procedures) of the engine’s operating manual for the aircraft to be flown. In the case of a Cessna T206H: [Lycoming’s engine operating manual](#).
- e. Cessna slides titled “turbocharging” (filename “CAWG Turbo Training Cessna Powerpoint”).

Section 2: Air Learning

The training flight will be done by an instructor pilot. Training will use the outline presented in Section 6, below.

Section 3: Failure Modes Review

The applicant will listen to and view slides associated with failure modes.

- a. Mastery Flight Training Audio seminar, CAWG Turbo Training FFAST PowerPoint file (filename “CAWG Turbo FFASTeam and additional material”).
- b. Mandatory portion: Begin audio at 13 minutes 20 seconds and slide number 6. Continue until conclusion (including “additional slides” that have no audio recording for them).
- c. Optional portion (encouraged): Entire recording
- d. Recognize that this presentation is not specific to the Cessna system and the CAP TCA aircraft do not possess an intercooler.

Section 4: Oral Review

The evaluator will query the pilot to ensure he/she has appropriate knowledge of the operation of the turbocharging system and failure modes. There is no “minimum” time requirement as long as all material is sufficiently covered. However, it is likely that even with an experienced pilot, it will take a minimum of 30 minutes to cover the material.

1. Evaluator and applicant will review, together, CAWG Turbo Training Cessna PowerPoint file that presents photographs of the Cessna turbo components as well as the operating limitations.
2. The evaluator will ask questions, prior to a final flight, that includes the following areas:
 - a. Pilot should be able to describe and/or draw the schematics of the turbocharging system and refer/review Section 7 of the POH (Engine – Turbocharging System).
 - b. Pilot should be able to explain proper engine monitoring systems (such as TIT and limitations).
 - c. Pilot should be able to describe the purpose, function, and operation of the waste gate in the TCA, including the impact of a possible malfunction of the waste gate
 - d. Pilot should be able to describe different failure modes, engine monitoring system impacts, urgency levels, and appropriate emergency checklists for each (failure of waste gate open, failure of waste gate closed, failure of compressor, etc.). Of particular interest are cases such as the appropriate mixture knob response to a turbocharger failure, where negative transfer of knowledge may occur from normally-aspirated aircraft.
 - e. Pilot should be able to explain concept of “momentary overshoot” and how to respond
 - f. Pilot should be able to explain mixture/power management for various flight configurations (such as engine start, taxi, climb out, cruise, descent, landing, taxi, and shut down). This includes review of POH Section 4 details of leaning and TIT procedures.
 - g. Pilots should be able to explain the oxygen system in the TCA (including location of canister, refilling procedures, and gauges), oxygen requirements by altitude, signs of hypoxia, equipment to monitor Oxygen saturation, and emergency procedures regarding oxygen system
 - h. Pilots should be able to explain the “Engine Shut-Down Procedure” in the engine operator’s manual, if there is one.

Section 5: Written Review

1. Applicant should have read and reviewed the POH for the aircraft being flown, with special emphasis on section 2 (limitations), 3 (emergency procedures), and 7 (systems).
2. In addition to the standard required CAP Form 70-5Q-A for whatever aircraft is being flown, the candidate should complete the written California Wing Turbo Questionnaire prior to their evaluation flight. The check pilot will grade the questionnaire and review (and correct) any missed concepts with the applicant. At the discretion of the evaluator, based on the responses to the questionnaire, the evaluator may ask the applicant to repeat the questionnaire or simply mark it corrected to 100%.

Section 6: Evaluation Flight

The evaluation flight may be part of an annual CAPF 70-5 evaluation flight or an abbreviated evaluation specific to turbo operations.

The CAP Turbo Endorsement criteria is specified in CAPS 72-6. The follow is a proposed Plan of Action (POA) to use in evaluating the candidate for the endorsement:

1. Applicant must demonstrate making all power changes slowly and smoothly. Applicant should keep power settings in the green or normal operating area, except for takeoff and landing.
2. Although "actual" turbo failures are difficult to simulate during an evaluation flight, it is required that throughout the flight, the evaluator pose certain questions to illicit abnormal conditions (for example, during cruise flight, indicate to the applicant that the manifold pressure suddenly reads a significantly above red-line measurement – what might be causing that and what steps should be taken).
3. Engine Start and Run Up: Applicant should follow all procedures in the POH, focusing on the differences with a non-turbocharged engine.
4. Takeoff: Takeoff using full, red-line power. Applicant should point out any overshoot. Appropriate fuel / mixture settings should be demonstrated.
5. Climb out: Once established in en-route climb, applicant should demonstrate ability to adjust power and mixture as per the POH. Applicant should be able to evaluate the CHTs and ensure no pistons are hotter than 400 degrees (recommend 380 degrees or less).
6. Cruise: Applicant should demonstrate ability to adjust power and mixture as per the POH and cruise recommendations (such as power setting at 65%). Applicant should be able to demonstrate proper leaning techniques. Applicant should be able to explain why a certain power setting was selected and what the appropriate power/mixture/propeller settings should be. Applicant should be able to demonstrate en-route climbs and descents (similar to altitude changes that would be given by ATC) and use appropriate power and mixture changes including maintaining "green" normal operating areas.
7. Descent and Landing: Applicant should demonstrate ability to adjust power and mixture settings smoothly and properly as necessary for a descent to landing. This includes maintaining engine in green operating ranges, avoidance of shock cooling, and proper leaning for the conditions.
8. Balked Landings: One balked landing (go-around) must be evaluated. Applicant should apply maximum power unless less power is needed for the situation. Applicant should apply power smoothly and avoid shock conditions for the turbo and engine. Applicant should point out any over boost conditions and take appropriate action
9. Engine Cool Down: Applicant should use proper turbo cool-down techniques as per the engine operator's "Engine Shut-Down Procedure", if there is such a procedure. This may include delaying the shut down until optimal TIT is reached or 5 minutes from initial power reduction (i.e., taxi time might be included depending on taxi conditions).