



# Federal Aviation Administration

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## Memorandum

Date: April 2, 2009

To: Manager, Small Airplane Directorate, ACE-100

From: Manager, Wichita Aircraft Certification Office, ACE-115W

Prepared by: Ann Johnson, Airframe Branch, ACE-116W

Subject: Equivalent Level of Safety to 14 CFR §23.1326; Cessna Model 510

ELOS Memo#: ACE-09-04

Regulatory Ref: 14 CFR, part 23, § 23.1326

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This memorandum requests your office to review and provide concurrence with the proposed finding of Equivalent Level of Safety (ELOS) to 14 CFR, part 23, § 23.1326.

### **BACKGROUND:**

As part of the Cessna Model 510 Mustang design philosophy to eliminate unnecessary complexity in the design of the aircraft, a single pitot heat sensor is used to determine if the heater is in an off or inoperative status. An amber "P/S HTR L-R" CAS message is posted and triggers a master caution annunciation if the pitot heat is off or inoperative. The "P/S HTR L-R" CAS message is inhibited only when the aircraft is in emergency power mode.

Cessna requests a finding of equivalent level of safety be made with respect to 14 CFR, part 23, § 23.1326, which requires an amber annunciation when the pitot heating system is not operating, with no consideration of flight phase. Presently, when taxiing or in flight, an amber "P/S HTR L-R" CAS message will be posted if the pitot heat is off or inoperative. After landing, the normal procedure of switching off the pitot heat causes an amber "P/S HTR L-R" CAS message and triggers a nuisance master caution alert. In order to prevent damage to the pitot heater, the Model 510 AFM limits pitot heat on time to 2 minutes while on the ground, which requires pilots to leave pitot heat off while taxiing. Consequently, the pilot acknowledges the master caution but continues to taxi with the amber CAS message.

The Model 510 Citation Mustang would incorporate a white/amber "P/S HTR L-R" CAS message indication when the pitot heater is off or inoperative during specific flight phases. The CAS message would be white while on the ground and transition to amber with a master Caution

annunciation when the throttle is in or above the Cruise detent or when in air. Landing Operational Phase Inhibit (LOPI) would be utilized to prevent nuisance messages during landings.

### **APPLICABLE REGULATION:**

The Model 510 certification basis includes 14 CFR, part 23 effective February 1, 1965, as amended by Amendments 23-1 through 23-54.

FAA Policy Statement PS-ACE100-2002-007 and the associated Advisory Circular AC 23-17A describe the criteria, wherein a design may be considered eligible for an Equivalent Level of Safety (ELOS) to 14 CFR, part 23, § 23.1326(b)(1). In addition to being an eligible configuration, a design that is proposed for an ELOS must also contain the necessary compensating safety features if it is to be issued an ELOS. Aircraft that are not eligible for an ELOS to AC 23-17A, may be eligible for a different ELOS, if their design has compensating factors.

### **REGULATION REQUIRING AN ELOS FINDING:**

In considering the current design, the applicant has requested an ELOS for the requirements of 14 CFR, part 23, § 23.1326, and the FAA has determined that an appropriate level of safety can be provided by the issuance of an ELOS, in accordance with the provisions of 14 CFR, part 21, § 21.21(b)(1).

### **14 CFR, PART 23, § 23.1326 REQUIRES THAT:**

*If a flight instrument pitot heating system is installed to meet the requirements specified in § 23.1323(d), an indication system must be provided to indicate to the flight crew when that pitot heating system is not operating. The indication system must comply with the following requirements:*

- (a) *The indication provided must incorporate an amber light that is in clear view of a flight member.*
- (b) *The indication provided must be designed to alert the flight crew if either of the following conditions exist:*
  - 1. *The pitot heating system is switched “off”*
  - 2. *The pitot heating system is switched “on” and any pitot tube heating element is inoperative.*

### **DESCRIPTION OF COMPENSATING FEATURES**

By utilizing a white/amber “P/S HTR L-R” CAS message indication when the pitot heater is off or inoperative, the Mustang would provide an equivalent level of safety to what is required by 14 CFR, part 23, § 23.1326(a) for the following reason.

- If Pitot heat is off or inoperative when throttles are advanced for takeoff, the “P/S HTR L-R”, CAS message will transition from white to flashing amber as well as trigger a master caution light. This provides an equivalent or greater awareness over

an amber message that will have been previously acknowledged during taxi with the current design.

An equivalent level of safety to what is required by 14 CFR, part 23, § 23.1326 (b)(1)(2), would be provided for the following reasons.

1. Per the AFM, pitot heat is checked for proper operation during the preflight walk around.
2. Per the AFM, pitot heat will be turned on before takeoff roll.
3. By providing an amber “P/S HTR L-R” CAS message with master caution annunciation while in the air, or when the throttle is advanced to the cruise detent with weight on wheels, the crew is protected from inadvertently operating the aircraft in an environment where ice formation on the pitot probes may occur with the pitot heat off or inoperative. Providing an amber “P/S HTR L-R” CAS message during climb, cruise, descent, and approach complies directly with 14 CFR, part 23, § 23.1326 during these flight phases.
4. FAA Advisory Circular AC 23-17B, section 23.1326 outlines two negative issues related to the 14 CFR, part 23, § 23.1326 (b)(1) rule:
  - a. It violates the “dark cockpit” philosophy where caution and warning lights only represent failure conditions.
  - b. Adherence to a “dark cockpit” philosophy will cause pitot heat operation in all environmental conditions, which will shorten the life of the system.
  - c. Implementation of a white “P/S HTR L-R” CAS message when taxiing with Pitot heat off as required by the AFM will provide pilot awareness while adhering to the “dark cockpit” philosophy. Transitioning the CAS message to amber if the pitot heat remains off at takeoff roll will provide adherence to the 14 CFR, part 23, § 23.1326 (b)(1) rule.

Implementation of a white “P/S HTR L-R” CAS message when taxiing with pitot heat off as required by the AFM will provide pilot awareness, while adhering to the “dark cockpit” philosophy. Transitioning the CAS message to amber, if the pitot heat remains off at takeoff roll will provide adherence to the 14 CFR, part 23, § 23.1326 (b)(1) rule.

## **EXPLANATION OF COMPENSATING FEATURES**

The intent of 14 CFR, part 23, § 23.1326 is to prevent operating the aircraft in an environment where ice formation on the pitot probes may occur with the pitot heat off or inoperative. Providing a white/amber “P/S HTR L-R” CAS message indication when the pitot heater is off or inoperative during specific flight phases will provide an equivalent level of safety to an amber “P/S HTR L-R” CAS message alone. Presently, due to the 2 minute limitation for activation of pitot heat while on the ground, acknowledgement of the present amber “P/S HTR L-R” CAS message will have been made prior to takeoff roll. Changing to a white/amber “P/S HTR L-R”

CAS message will provide enhanced pilot awareness due to the master caution annunciation and flashing amber “P/S HTR L-R” CAS message that will be provided, if the Pitot heat remains off or inoperative when the throttles are advanced during takeoff. Additionally, utilizing LOPI inhibits will prevent what Cessna believes is a nuisance distraction during that critical flight phase.

## RECOMMENDATION

The FAA has determined that the compensating features provide an equivalent level of safety with the requirements of 14 CFR, part 23, § 23.1326, during ground operation prior to takeoff, and after landing. This position is based on the following considerations:

### 1. Pitot Heat Use During Ground Operation

The Cessna Model 510 Approved Flight Manual Section II – Operating Limitations prohibits use of the pitot-static heat for more than two minutes to preclude damage to the pitot tubes and stall warning vane. Pitot heat is only selected on during ground operation during:

- a. Pre-flight inspection.
- b. Takeoff.
- c. Landing.

Immediately after landing pitot heat is then selected off. Since pitot heat is not selected on during ground operation prior to takeoff and after landing, there is no benefit in annunciating that the pitot heat is off with an amber message. There is also no benefit in annunciating a condition where pitot heat is selected, but not functioning during ground operation prior to takeoff and after landing since pitot heat is not utilized at these times due to the AFM limitation.

### 2. Airspeed Criticality During Ground Operation

During ground operation prior to takeoff and after landing airspeed indication from the pitot-static system is not relied on for any safety function.

### 3. Improvement in Crew Awareness

The proposed means to annunciate failure of pitot heat has two benefits to safety by improving crew awareness.

- a. Currently, for all ground operation with pitot heat selected off, an amber “P/S HTR L-R” CAS message is posted. This may condition the pilots to ignore the amber message. By changing the “P/S HTR L-R” CAS message color to white for ground operation prior to takeoff and after landing, the unsafe condition is only annunciated, when it is relevant and is more likely to be noticed and acted on.
- b. Currently, the amber “P/S HTR L-R” CAS message posts prior to takeoff, so that the master caution is activated and extinguished prior to selecting pitot heat on for takeoff. Once the CAS message color is changed to white, if pitot heat is inoperative during takeoff the master caution will be

- c. activated in addition to the amber CAS message giving additional crew awareness.

#### 4. Precedence in Policy

Policy memorandum PS-ACE100-2002-007 states:

“Aircraft that are not eligible for an ELOS in AC 23-17A may be eligible for a different ELOS, if their design has compensating features other than placards, or Aircraft Flight Manual (AFM) limitations. For instance, a design with retractable landing gear could hardwire pitot heat to power through a weight-on-wheels switch. There would be no need for an ON/OFF switch, so there would be no need for a caution annunciation of switch position.”

This is relevant because the proposed design for the Model 510 would annunciate pitot heat off or a pitot heat failure more robustly than the policy example. The policy example would not provide pitot heat during the takeoff roll, and would not annunciate a pitot heat failure until the aircraft is in the air. The proposed Model 510 configuration, in contrast, would provide pitot heat during the takeoff roll and would annunciate with an amber CAS message and the master caution, if pitot heat is not selected on or has failed.

John Colomy

for Kim Smith, Manager, Small Airplane Directorate  
Aircraft Certification Service

4/2/09

Date

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| ELOS Originated by<br>Wichita ACO: | Jason Brys,<br>Acting Manager) | Routing Symbol<br>ACE-115W |
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