



Federal Aviation Administration

Memorandum

Date: March 18, 2011

From: Manager, Fort Worth ACO, ASW-150 /s/ M. Monica Merritt

To: Manager, Small Airplane Directorate, ACE-100

Prepared by: Patrick Massie, Aerospace Engineer, ASW-150

Subject: Equivalent Level of Safety (ELOS) for Air Tractor's AT-1002/AT-1002A
Agricultural Use and Forest and Wildlife Conservation Airplanes:
14 CFR, part 23, § 23.1326(b)(1) Pitot Heat Indication Systems

ELOS Memo#: ACE-11-03

Regulatory Ref: Through Amendment 23-49: §§ 23.1326(b)(1), 23.1323(b), 21.21(b)(1)

This memorandum informs the certificate management aircraft certification office of an evaluation made by the accountable directorate on the establishment of an ELOS finding for the Air Tractor Models AT-1002 and AT-1002A.

Background

Air Tractor, Inc. (ATI) has applied for a new type certificate for the models AT-1002 and AT-1002A. The AT-1002 is similar to the AT-1002A except the cockpit has seating for two crew members' side-by-side. The AT-1002 and AT-1002A will be certificated in the restricted category for the special purposes of surveying, patrolling, agricultural use, and forest and wildlife conservation with a proposed maximum gross weight of 20,000 pounds and maximum altitude of 20,000 feet.

Unlike the previous Air Tractor models, Air Tractor has applied for night and instrument flight rules (IFR) operation; however, their application does not include flight into known icing conditions. Air Tractor is requesting an ELOS, because its current design does not show compliance to § 23.1326(b)(1), Amendment 23-49.

As stated above, the purpose of the AT-1002 and AT-1002A includes agricultural use, forest and wildlife conservation. The operating environment for these purposes normally involves visual,

low-level operations in warm weather and in special use airspace. Air Tractor's purpose for adding night and IFR capability is to increase the level of safety by allowing operators to safely reposition airplanes under IFR, when adverse weather conditions prevail. The issue paper and ELOS has only addressed the AT-1002 and AT-1002A models with currently proposed fuel quantities, since its purpose and operational environment will normally involve short durations of visual, low-level operations in warm weather and in special use airspace.

Applicable Regulation(s)

14 CFR, part 23, §§ 23.1326(b)(1), 23.1323(b)

Regulation requiring an ELOS finding

14 CFR, part 23, § 23.1326(b)(1)

Description of compensating design features or alternative Methods of Compliance (MoC) which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency):

An ELOS finding may be found for 14 CFR, part 23, § 23.1326(b)(1) requirement to indicate to the flight crew, when the pitot heating system is switched "off". The ELOS requires the applicant to include in the flight manual information on how to perform checks to verify the "ON", and failure state of the pitot heating elements annunciate in accordance with the intent of the regulations. Air Tractor will install a placard and have flight manual instructions on when to operate the pitot heat to include activating pitot heat system before flying into visible moisture with an outside air temperature of 40 degrees F, or less.

Explanation of how design features or alternative MoC provide an ELOS to the level of safety intended by the regulation:

The requirements of § 23.1326(b)(1) are as follows:

"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 crew member.
- (b) The indication provided must be designed to alert the flight crew, if either of the following conditions exists:
 - (1) The pitot heating system is switched "off."
 - (2) The pitot heating system is switched "on" and any pitot tube heating element is inoperative."

Due to advancements in technology, many 14 CFR part 23 airplane installations now utilize equipment whose data sources are critical to the accurate and dependable operation of that equipment. The heated pitot tube is one such data source. The pitot heat indicating system will advise the pilots of any inoperative heating element in the pitot tube and those subsequent inaccuracies may result.

14 CFR part 23 airplanes certificated for flight under instrument flight rules or for flight in icing conditions are required by current § 23.1323(d), to have a heated pitot system or an equivalent means of preventing an airspeed indicating system malfunction due to ice accumulation. When a pitot heat system is used to show compliance to § 23.1323(d), the heated pitot tube must be equipped with a pitot tube heat indicating system. This requirement will provide greater assurance that the pilots will not be dangerously misled by faulty flight instrument indications caused by pitot tube icing.

When the pitot tube heat indicating system requirements were added to 14 CFR part 25, the FAA noted the occurrence of at least one accident and several incidents in which an airspeed indicating error occurred that might have been avoided, if a pitot tube heat indicating system had been installed. 14 CFR part 23 airplanes operate at lower airspeeds and over shorter distances than do 14 CFR part 25 airplanes, so their exposure to moisture and temperature conditions where icing may occur is higher than it is for transport category airplanes. Because of this environmental exposure, the potential for an inoperative heated pitot tube becoming a hazard to 14 CFR part 23 airplanes is greater.

Per § 23.1326, pitot heating requires a caution annunciation whenever the pitot heat is off, or on and there is a failed heating circuit. The first can have a positive safety effect, if it causes pilots to activate the pitot heat in all environmental conditions. The second annunciation cause is fully justified in that it represents a failure condition. This eliminates the loss of the pitot static system because of the pilot error of failing to operate pitot heat when conditions warrant it.

A caution annunciation when the pitot heat is off has two negative issues as follows:

- (1) It violates the “dark cockpit” where caution and warning lights only represent failure conditions; and
- (2) Adherence to a “dark cockpit” will cause pitot heat operation in all environmental conditions, which will shorten the life of the system.

An aircraft design that does not include a caution annunciation, when the pitot heat is “off” may be eligible for an ELOS finding that preserves a “dark cockpit”, provided a placard and/or flight manual prescribes how to operate the pitot heat in a safe manner. The placard and/or AFM will address pitot heat operation, failures and system checks.

Policy memorandum PS-ACE100-2002-007, did not intend to exclude certain restricted category airplanes in which their main purpose will be for agricultural use, forest and wildlife conservation.

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project issue paper S-1. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The accountable directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet under the Certification Basis section (TC's & ATC's), or in the Limitations and Conditions Section of the STC. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings has been made for the following regulation(s):

14 CFR, part 23, § 23.1326(b)(1) Pitot heat indication systems (documented in ELOS Memo LLXXX-X-Z-Z).

Earl Lawrence
 Manager, Small Airplane Directorate,
 Aircraft Certification Service

4/5/2011
 Date

ELOS Originated by: Fort Worth ACO	M. Monica Merritt, Manager, Fort Worth ACO	Routing Symbol: ASW-150
---------------------------------------	---	----------------------------