



# Federal Aviation Administration

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## Memorandum

Date: December 30, 2008

To: Manager, Small Airplane Directorate, ACE-100

From: Manager, Project Support Branch, ACE-112, Small Airplane Directorate

Prepared by: Peter L. Rouse, Regulations and Policy, ACE-111

Subject: Equivalent Level of Safety (ELOS) to § 23.1555(d)(1), Control Markings – Unusable Fuel; Embraer S.A., EMB 505; Finding No. ACE-09-01

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This memorandum requests your office to review and provide concurrence with the proposed finding of equivalent level of safety (ELOS) for the fuel quantity indication system to the requirements of 14 CFR, part 23, § 23.1555(d)(1), Control Markings – Unusable Fuel.

### **BACKGROUND:**

The EMB-505 is a twin engine jet. Embraer has applied for type certification for the EMB-505 in the commuter category. As such, the airplane is proposed to be type certificated in the commuter category of 14 CFR part 23 (and comparable Brazilian requirements RBHA 23) by exemption from 14 CFR § 23.3(d). The EMB-505 is predominantly of metallic construction and is a conventionally configured low-wing monoplane with a T-tail and tricycle landing gear. The two Pratt and Whitney of Canada 3,360 pound thrust PW535E turbofan engines are aft fuselage mounted in typical business jet fashion. The engines are full authority digital engine control (FADEC) equipped.

The airplane's maximum takeoff weight is 17,490 pounds. The V<sub>mo</sub>/M<sub>mo</sub> is 320 KCAS/ M .78, with a maximum operating altitude of 45,000 feet. Requested operations are day/night VFR/IFR and icing operations.

Most modern turbine powered airplanes have a calibrated fuel quantity indicating system that is density compensated and accurately indicates the actual usable fuel quantity in each tank.

The EMB-505 fuel quantity indication system is designed to comply with 14 CFR, part 23, § 23.1337(b)(1). This section requires that the system must be able to indicate to the flight crew the quantity of usable fuel in each tank during flight. The system also must be calibrated to read “zero” during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel, thus providing actual usable fuel indication for each tank.

Many airplanes are frequently operated with less than full fuel tanks. The placards or markings required by 14 CFR, part 23, § 23.1555(d)(1) reflect only the maximum capacity of the tank and would indicate usable fuel only if it were filled to that capacity. Further, this “capacity” is not compensated for fuel density and would indicate usable fuel only if the tank was full with standard density fuel. The placards required by 14 CFR, part 23, § 23.1555(d)(1) are, therefore, redundant relative to the current industry practice and may be misleading.

Embraer S.A. requests the Federal Aviation Administration (FAA) to give them credit for fuel quantity indication system by accepting it as equivalent to the requirements of §§ 23.1337(b)(1) and 23.1555(d)(1).

### **APPLICABLE REGULATIONS:**

14 CFR, part 23, §§ 23.1337(b)(1) and 23.1555(d)(1).

### **REGULATIONS REQUIRING AN ELOS:**

Section 23.1337

Powerplant instruments installation.

- (b) Fuel quantity indicator. There must be a means to indicate to the flightcrew members the quantity of usable fuel in each tank during flight. An indicator calibrated in appropriate units and clearly marked to indicate those units must be used. In addition--
  - (1) Each fuel quantity indicator must be calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply determined under [Sec. 23.959(a);]

Section 23.1555:

Control markings.

- (d) Usable fuel capacity must be marked as follows:
  - (1) For fuel systems having no selector controls, the usable fuel capacity of the system must be indicated at the fuel quantity indicator.

In considering the current design, the applicant has requested an ELOS for the fuel quantity indication system. 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).

### **DESCRIPTION OF COMPENSATING FEATURES:**

The EMB-505 fuel quantity indication system will be calibrated to read “zero” when the quantity of fuel remaining in the tank is equal to the unusable fuel quantity, as determined in accordance with 14 CFR, part 23, § 23.959(a).

The EMB-505 fuel quantity indication system will display the actual usable fuel quantity onboard using both vertical tape and a numeric display.

**EXPLANATION OF COMPENSATING FEATURES:**

The EMB-505 fuel quantity indication system will be calibrated to read “zero” when the quantity of fuel remaining in the tank is equal to the unusable fuel quantity, as determined in accordance with 14 CFR, part 23, § 23.959(a), thereby complying with 14 CFR, part 23, § 23.1337(b)(1).

The EMB-505 fuel quantity indication system will display the actual usable fuel quantity onboard. The EMB-505 fuel quantity indication system not only measures the actual fuel quantity onboard by means of level sensors but also corrects fuel quantity information by inferring fuel density as function of current temperature. Thus, there is no need for a placard displaying the total capacity of usable fuel, as required by 14 CFR, part 23, § 23.1555(d)(1).

**ACE-112 RECOMMENDATION:**

The Project Support Branch, ACE-112, Small Airplane Directorate concurs with the Embraer S.A. that the fuel quantity indication system provides an equivalent level of safety to the requirements of 14 CFR, part 23, § 23.1555(d)(1), Control Markings – Unusable Fuel.

**RECOMMENDATION:**

The Small Airplane Directorate concurs with and grants ELOS ACE-09-01 for the Embraer S.A. Model EMB-505.

Concurred by:

<u>Albert J. Mercado</u>	<u>12/30/08</u>
for Manager, Project Support Branch, ACE-112	Date

<u>Albert J. Mercado</u>	<u>12/30/08</u>
Acting Manager, Standards Office, ACE-110	Date

<u>Diane K. Millam</u>	<u>12/30/08</u>
Acting Manager, Small Airplane Directorate, Aircraft Certification Service, ACE-100	Date

