Repl. by 5TA

Federal Aviation Agency

ADVISORY CIRCULAR

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SUBJECT: AUTOMATIC LANDING SYSTEMS

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1. PURPOSE. This circular sets forth an acceptable means of compliance but not the only means for the installation approval of automatic landing systems in transport category aircraft which may be used initially in Category II operations. Approval of these aircraft for use under such conditions will permit the accumulation of data for systems which may be approved for Category IIIa in the future.

2. REFERENCES. Federal Aviation Regulations 21.21, 25.1301, 25.1309, 25.1581 and 121.579; ICAO Annex 10.

3. DISCUSSION.

   a. Applicants are obtaining approval of aircraft equipped with systems for use during Category II operations. Automatic landing capability is included in, or planned for, some of these aircraft. Manufacturers and operators have indicated a desire to utilize that capability under visual landing conditions, when such aircraft are found satisfactory for making automatic landings during normal operations.

   b. The accumulation of service experience in an operational environment and the development of confidence in such systems are considered essential parts of the evolutionary process in aircraft design associated with further reduction in weather minimums for future operations.

   c. Aircraft which demonstrate in service use capability of meeting touchdown limits, as defined in Paragraph 4b, may be expected to comply with touchdown dispersion criteria for operation under Category IIIa conditions, according to best information available to the FAA at this time.

4. AUTOMATIC LANDING SYSTEM CRITERIA.

a. General. ALS evaluation should be based on the use of ILS approach facilities which meet the following performance on a two-sigma basis (95.5% probability of occurrence in a normal distribution):

Localizer (to touchdown)	- Course Alignment Accuracy	±10'
	- Bends	±5ua
	- Airborne Receiver	±5ua
Glide Slope	- Path Alignment and Bends; ICAO Cat. II	
	- Airborne Receiver Centering error	±10ua

Computer analysis of system performance should be based on these ground facility characteristics. Analysis of results of in-flight demonstration should include compensation for beam deviations (such as subtraction of beam deviations beyond 10 feet and treatment of the remainder on a probability basis with other variables) when these are found to be in excess of the permitted tolerances.

The airborne landing system should be demonstrated to achieve the accuracy limits listed below, considering the full range of center of gravity limits and landing weights.

b. Aircraft Touchdown Limits.

(1) Lateral Dispersion.

The aircraft centerline (at main landing gear) should be within 27 feet of the center line of the runway on a two-sigma basis.

(2) Longitudinal Dispersion.

The dispersion of the main gear touchdown point should not exceed 1500 feet total about a nominal point on a two-sigma basis. This nominal touchdown point and the performance limits should be established on the basis of the desired airplane/system characteristics, such that the airplane will touchdown 300 feet or more beyond the threshold and the pilot will be in a position to see at least four bars (on 100' centers) of the 3,000 foot touchdown zone lights at touchdown.

(3) The dispersion limits of (1) and (2) above should consider environmental conditions as follows:

(a) Headwinds up to 25 knots; tailwinds up to 10 knots; crosswinds up to 15 knots; moderate turbulence, wind shear of 8 knots/100 feet from 200 feet to touchdown.

(4) Confirmation of compliance to the above limits may be demonstrated by a combination of:

(a) Computer analysis considering reasonable combinations of wind conditions noted above.

(b) Flight demonstrations, to verify results of the computer analysis, which would be conducted under normal operating conditions.

(5) The computer analysis should show that under the most adverse practical combination of the environmental conditions described in 4.b.(3), the aircraft will land with the outboard landing gear no closer than five feet from the lateral limits of a 150 ft. runway.

c. Automatic landing system malfunction should not:

(1) Cause significant displacement of the aircraft from its approach path, including altitude loss.

(2) Upon system disconnection, involve any out of trim condition not easily controlled by the pilot.

(3) Cause any action of the flight control system that is not readily apparent to the pilot, either by control movement or advisory display.

d. Means should be provided to inform the pilot continuously of the mode of operation of the automatic landing system. Indication of system malfunction should be conspicuous and unmistakable. Positive indication should be provided that the flare mode has or has not engaged at the minimum normal flare engage heights.

5. AIRPLANE FLIGHT MANUAL. Information pertinent to the operation of the automatic landing system and aircraft limitations should be included in the airplane flight manual.

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