

Cancelled 6/6/66 See AC 120-20

Federal Aviation Agency

ADVISORY CIRCULAR

AC NO: AC 120-15

AIR CARRIER AND
COMMERCIAL OPERATIONS

EFFECTIVE :

10/2/64

SUBJECT : CRITERIA FOR APPROVAL OF CATEGORY II LANDING WEATHER MINIMA

1. **PURPOSE.** This Advisory Circular is to provide industry and FAA field personnel criteria and guidelines to be used in approving applications for Category II ILS landing minima. While these criteria apply to all transport aircraft, experience may dictate lesser requirements for the smaller and slower type airplanes. Therefore, the applicability of these requirements to such aircraft will be reassessed in due course.
2. **DEFINITIONS.**
 - a. **Category II Operations.** This may be defined as operation down to minima below 200' and 2600 RVR and to as low as 100' and 1200 RVR. (Current visibility measuring equipment in the United States reports RVR in even hundred foot increments in the lower range.)
 - b. **Decision Height.** This is defined as the height above the elevation of the touchdown area at which a missed approach will be initiated if the required visual reference has not been established.
3. **DISCUSSION.** For the past several years the aviation industry and the FAA have been working towards achieving the ultimate goal of all weather landing. The first step in that direction was the authorization to operate turbojet aircraft at 200- $\frac{1}{2}$ mile or 2600 RVR. These minima were approved after approximately 3 $\frac{1}{2}$ years of airline turbojet operations at 300- $\frac{3}{4}$. However, additional requirements pertaining to the ground environment, improved airborne equipment and pilot qualification were the basis of this approval. During the past year the visibility minima were further reduced to 1800 RVR, with a decision height of 200', for all aircraft except four-engine jets at airports equipped with touchdown zone and centerline lights. These system improvements, as a condition for approval of lower minima, assure that the same high level of safety is maintained. This systems concept was also used in the development of criteria for the lower limits of Category II operations. The criteria

which follow prescribe further improvements in ground facilities, airborne equipment, maintenance standards and additional training requirements.

4. AIRPORTS.

a. U. S. Airports. Air carriers may be approved to use ILS minima as low as 1200 RVR at designated U. S. airports which meet Category II criteria with respect to ILS performance and installation, glide slope angle, gradient, and obstruction clearance, and are equipped with at least the following:

- (1) Standard approach light system with sequenced flashers.
- (2) High intensity runway edge lights.
- (3) Touchdown zone and centerline lights threshold to threshold.
- (4) All weather runway marking.
- (5) Runway visual range equipment. Two transmissometers will be required unless unique local conditions permit the use of one sensor.

NOTE: Specific approach procedures will be established and published for such airports.

b. Foreign Airports. U. S. air carriers may receive approval to use 1200 RVR at Category II foreign airports on an equivalency basis.

5. AIRBORNE EQUIPMENT. In addition to the instruments and radio equipment required by the FARs, each airplane must be equipped as follows:

a. Dual ILS localizer and glide slope receivers.

b. Flight control guidance systems.

- (1) An automatic approach coupler (may include split axis) and a flight director system with dual displays, or
- (2) Two independent flight director systems. Single axis flight directors giving steering (roll) command are acceptable provided raw glide slope information is displayed on the same instrument(s).

c. Equipment for accurate identification of the decision height (100').

- (1) One radar altimeter, or

- (2) Dual barometric altimeters - approval for the use of barometric altimetry will be based on the ability of the air carrier to demonstrate the accuracy of its altimeters by a test program acceptable to the FAA. Some of the factors that will be considered are: altimeter repeatability error, and calibration and maintenance techniques.

d. Equipment for go-around attitude guidance.

- (1) Attitude gyro indicators with calibrated pitch attitude markings, or
- (2) Computed go-around attitude guidance display. This is required for turbojet aircraft if identification of the decision height (100') is based on the use of barometric altimeters.

e. An auto throttle control system. An auto throttle control system will be required as indicated.

(1) Four-engine Turbojet Airplanes - If Category II minima are predicated on:

- (a) Dual flight director systems - Required
- (b) Split axis coupler and a flight director system - Required
unless the applicant can demonstrate that its low approach system does not significantly increase pilot workload over that required with an automatic approach coupler (all axis).
- (c) Automatic approach coupler (all axis) and a flight director system - Not Required

(2) Two- and Three-Engine Turbojet and Four-Engine Propeller Airplanes - If Category II minima are predicated on:

- (a) Dual flight director systems, or
- (b) Split axis coupler and a flight director - Required
unless the applicant can demonstrate that its low approach system does not significantly increase pilot workload over that required with an automatic approach coupler (all axis).
- (c) Automatic approach coupler (all axis) - Not Required

- f. Glide slope extension. If glide slope extension is employed, it must be capable of keeping aircraft on glide slope with no significant excursions from the programmed flight path during wind shear and wind shift conditions.
 - g. Instrument failure warning system. The failure warning system, along with flight crew procedures and duty assignments, must provide for the immediate detection of essential instrument and equipment failures. The adequacy of the system will be determined by a review of the individual air carrier's aircraft instrument and equipment configuration. (See paragraph 8.d.)
 - h. Rain removal capability. This capability must be available when making approaches to Category II minima during moderate and heavy rain conditions and must provide cockpit visibility which will assure safe visual transition to touchdown and roll out.
6. PILOT TRAINING AND PROFICIENCY PROGRAM. Each air carrier's approved training program shall include at least the following:
- a. Ground Training (Pilot-in-Command and Second-in-Command).
 - (1) Ground Facilities.
 - (a) The operational characteristics, capabilities and limitations as applied to Category II operations of:
 - 1 The instrument landing system, and
 - 2 The visual approach aids; i.e., approach lights, touchdown zone and centerline lighting, etc.
 - (2) The Airborne Low Approach System.
 - (a) The operational characteristics, capabilities and limitations of the airborne low approach system to include as appropriate:
 - 1 The flight director system,
 - 2 The automatic approach coupler (including split axis),
 - 3 The precision altimeter system,
 - 4 The instrumentation and display systems,

5 Automatic throttle control systems,

6 Other system and/or devices peculiar to the particular installation; i.e., computed go-around guidance equipment and failure warning system, etc.

(3) Operations. The following factors shall be covered on both initial and recurrent proficiency checks:

(a) The landing distance requirement,

(b) Resolution of the decision height,

(c) Missed approach technique using as appropriate computed or fixed attitude guidance display,

(d) Runway visual range; its use and limitations,

(e) The availability and/or limitations of visual cues with 1200 RVR using various glide slope angles, and the altitude at which these visual cues are normally discernible.

(f) Problems related to the transition from non-visual to visual flight with 1200 RVR (and subsequent lower values; i.e., 1000 and 800) through the use of the following:

1 Approved simulators with visual capability, and/or

2 The use of films or other training aids.

(g) The effects of vertical and horizontal wind shear, and

(h) Review of operations specifications applicable to Category II operations.

b. Flight Training and Proficiency Program. The following proficiency requirements are in addition to those presently required for Category I (200- $\frac{1}{2}$) unless otherwise specified herein.

(1) Initial Pilot-in-Command Proficiency Requirements. Each pilot-in-command shall satisfactorily demonstrate to either a company check pilot or an FAA inspector the following:

(a) One ILS approach under the hood to 100' using the flight director system.

(b) One ILS approach under the hood to 100' using the auto coupler.

- (c) From at least one of the approaches specified in subparagraphs (a) and (b) above, a landing shall be accomplished.
- (d) From at least one of the approaches specified in subparagraphs (a) and (b) above, a missed approach shall be executed with one of the critical engines in the idle thrust position. Such engine failure may be simulated prior to reaching the outer marker but in any case prior to reaching the middle marker.
- (e) If the carrier proposes to use only the manual airborne low approach system, two ILS approaches under the hood using the flight director system are required. From one of the approaches a landing will be accomplished and from the other a missed approach will be executed in accordance with the provisions of subparagraph (d) above.

NOTE: The initial pilot-in-command proficiency requirements must be satisfied in each aircraft type for which approval of Category II minimums are sought. During the instrument approaches and missed approaches, all of the associated airborne equipment upon which Category II minimums are predicated shall be used.

- (2) Second-in-Command Flight Training Requirements. The flight training requirements for a second-in-command will depend on his assigned role during Category II approaches. Each second-in-command shall satisfactorily demonstrate, to a company check pilot or an FAA inspector, his ability to perform his assigned functions. If a second-in-command is not expressly prohibited, by his company, from executing Category II approaches, he shall demonstrate his ability to execute one ILS approach under the hood to 100' using either the automatic or manual low approach system, from which a landing or missed approach shall be accomplished.
- (3) Recurrent Pilot-in-Command and Second-in-Command Proficiency Requirements.
 - (a) Pilots-in-Command. During each required proficiency check, the pilot-in-command shall demonstrate, in flight, to a company check pilot or FAA inspector, his proficiency on the items listed in paragraph b.(1) above. If an air carrier has an approved aircraft simulator, configured with the

appropriate low approach system, the alternate check may be accomplished in the simulator. However, in the case of a pilot-in-command who is dual aircraft qualified, the proficiency requirements must be accomplished at least annually in each aircraft type.

(b) Second-in-Command. During each required proficiency check, the second-in-command shall demonstrate, in flight, to a company check pilot or an FAA inspector, his proficiency on the requirements in paragraph b.(2) above. If an air carrier has an approved aircraft simulator, configured with the appropriate low approach system, the alternate check may be accomplished in the simulator.

c. Ground and Flight Training - Aircraft Interchange. When equipment interchange is involved, the pilot-in-command and the second-in-command shall receive sufficient ground and flight training to ensure complete familiarity and competency with the particular airborne low approach system on the interchange aircraft. The amount of training required will depend on the differences in the low approach system and configuration.

7. OPERATIONAL REQUIREMENTS. Each air carrier shall develop procedures and instructions to be used and adhered to by its flight crews to include as applicable at least the following:

- a. Resolution of the decision height. If operation is predicated on the use of barometric altimeters, the decision height will be modified by the bias error determined to exist in the indicated pressure altitude; i.e., bias error 20' + 100' = 120' decision height.
- b. Testing of the radar altimeter by either an internal self-test feature or an acceptable operational procedure.
- c. Use of RVR information.
- d. Approach monitoring.
- e. Decision region. The region between the middle marker and the 100' point where the pilot must decide to either continue his approach or execute a go-around. Instructions to pilots should include the maximum permissible excursions of the raw ILS deviation from which a landing can be made.
- f. Missed approach procedure.

- g. Use of airborne low approach equipment including cross-over system, if provided.
 - h. Instrument failure warning system.
8. EVALUATION PROGRAM. Each air carrier shall establish a program acceptable to the FAA to prove the performance of the airborne equipment to be used in Category II operations. This program will consist of demonstrations of the low approach system and methods of fault detection of the proposed Category II equipment. The evaluation program will not be required for those aircraft types configured with a low approach system which, during type certification, were successfully tested by FAA expressly for Category II operations. In such cases the Airplane Flight Manual will contain a statement to the effect that the airborne low approach system meets Category II performance standards.
- a. Demonstration of the low approach system. Each air carrier shall conduct at least 300 demonstrations of the low approach system to 100' in each aircraft type. Except that if additional aircraft types are configured with the same basic low approach system, the total number of approaches may be reduced by one half. These approaches may be accomplished in line operations or during training flights or any combination thereof. Eighty-five (85) percent of the total demonstrations conducted in line operations must be successful and those conducted on training flights must be 90 percent successful. (See paragraph 8.c. for definition of a successful approach.) The approaches will be accomplished in accordance with the following:
 - (1) A minimum of three ILS facilities shall be used during the demonstrations. At least 10 percent of the total approaches shall be conducted on each facility selected for this program.
 - (2) The low approaches should be accomplished on Category II ILS facilities. However, at the airline's option, demonstration may be made on Category I ILS facilities.
 - (3) No more than 60 percent of the approaches shall be conducted in any single aircraft.
 - (4) A representative number of pilots assigned to an aircraft type shall be used in the conduct of these approaches. No single pilot-in-command shall perform more than 15 percent of these approaches, except when the total number of crews located at a small domicile requires a greater percentage.
 - (5) At least 30 percent of the approaches will be observed by FAA air carrier operations inspectors.

b. Data collection during evaluation program. Each air carrier shall develop a form to be used by the flight crews to record data listed below. This form will be completed whenever an approach is attempted utilizing the airborne low approach system regardless of whether it is initiated, abandoned or concluded successfully. The completed forms will be made available to the assigned FAA principal air carrier operations inspector for his evaluation.

- (1) If unable to initiate approach due to some airborne equipment deficiency, state deficiency.
- (2) If approach is abandoned, give reasons and altitude above runway at which approach was discontinued.
- (3) Speed control at the 100' point.
- (4) Was airplane in trim at the 100' point for continuation to flare and landing?
- (5) Compatibility of flight director with auto coupler.
- (6) Diagram of cockpit raw ILS display and diagram of runway extended to middle marker. Instructions to flight crew to indicate position of airplane at middle marker, 100' point and estimated touchdown point.
- (7) Quality of overall system performance.

NOTE: Unsuccessful approaches attributed to ATC instructions may be excluded from the statistical data; for example, flights vectored too close in for adequate localizer and glide slope capture and ATC requests to abandon approach. Also, unsuccessful approaches may be excluded from consideration when they are due to faulty ground station signals and where a pattern of such faulty performance can be established.

c. Definition of successful approach. A successful approach is defined as one in which at the 100' point, upon disengagement of auto coupler (if coupler is used):

- (1) The airplane is in trim so as to allow for continuation of normal approach and landing.
- (2) The indicated airspeed and heading are satisfactory for a normal flare and landing. (Speed must be \pm 5 knots of programmed airspeed but may not be less than computed threshold speed.)

- (3) The airplane is positioned so that the cockpit is within, and tracking so as to remain within, the lateral confines of the runway extended.
- (4) Deviation from glide slope does not exceed \pm 75 microamps as displayed on the ILS indicator.
- (5) No unusual roughness or excessive attitude changes occur after leaving middle marker.

d. System fault detection. The air carrier shall submit a description of the proposed Category II system which outlines the methods of detecting and protecting against the consequences of single failures. Where warning flags are used they must be easily discernible under all lighting conditions. The following will be treated in the description:

- (1) Attitude (vertical gyro)
- (2) Heading
- (3) Auto throttle system
- (4) Altitude
- (5) ILS instrument
- (6) Flight director system
- (7) Any other equipment essential to the system

9. MAINTENANCE PROGRAM. Each air carrier shall establish a maintenance program which will assure that the airborne electronic equipment will continue at the level of performance and reliability demonstrated during the evaluation program. This program shall be acceptable to the FAA, and will consist of the following minimum requirements:

a. Reliability Reporting. For a period of one year after an air carrier has been advised that its low approach system meets Category II requirements, and reduced minima are authorized, the carrier shall provide a monthly summary to the FAA of the following information:

- (1) The total number of approaches where the equipment constituting the airborne portion of the Category II system was utilized to make satisfactory actual or simulated approaches to Category II minima (by aircraft type).
- (2) The total number of unsatisfactory approaches and the reasons therefor (broken down into appropriate categories - airborne equipment faults, ground facility difficulties, aborts of approaches because of ATC instructions) by airport and aircraft registration number.

- b. Maintenance Personnel Training. The initial and recurrent training program for personnel performing maintenance work on Category II airborne systems and equipment shall be acceptable to the FAA. Training records for such personnel shall be kept current and made available to FAA for inspection.
 - c. Test Equipment and Standards. The air carrier program for maintenance of test equipment and primary and secondary standards which relate to Category II operations shall be acceptable to the FAA. Emphasis will be placed on standards associated with ILS receivers, flight directors, autopilot/couplers and altimeter systems.
 - d. Maintenance Procedures. Any changes to maintenance procedures, practices or limitations which were established in qualification for Category II operations will be submitted to the FAA for acceptance before any such changes are adopted.
 - e. Engineering Modifications. Titles and numbers of all modifications, additions and changes which were made to qualify aircraft systems for Category II performance will be provided to FAA.
10. APPROVAL OF LOWER MINIMA. Upon satisfactory completion of the evaluation program, the air carrier will be advised in writing that its low approach system meets Category II performance requirements. Authorization will then be granted to operate those aircraft, which are equipped with the Category II low approach system, at weather minima of 1600 RVR with a decision height of 150'. This authorization will be dependent on the ability of the air carrier to comply with the maintenance requirements and the pilot training program as well as other aspects of these criteria. When a minimum of six months has elapsed, the air carrier will be authorized to operate at 1200 RVR with a decision height of 100'. The six-month period at the higher minima will be required only for an air carrier's initial approval of Category II minima. When an air carrier has met the provisions of these criteria, operations specifications with appropriate authorization and limitations will be issued. The following are examples of the operations specifications:

OPERATION SPECIFICATIONS

Airborne Equipment Required for Category II Weather Minima

 Type Aircraft

ABC Airlines is authorized to utilize weather minima down to 1600 RVR with 150' decision height (1200 RVR with 100' decision height) provided all components of the primary or alternate low approach system are operative. A list of the airborne equipment upon which this authorization is predicated follows:

EXAMPLEPrimary Low Approach System (Automatic)

All instruments and radio equipment required by FARs for instrument flight and in addition:

- 2 - Independent localizer and glide slope receivers
- 1 - Automatic pilot/approach coupler
- 1 - Flight director system with dual displays
- 1 - Radar altimeter

Alternate Low Approach System (Manual)

All instruments and radio equipment required by FARs for instrument flight and in addition:

- 2 - Independent localizer and glide slope receivers
- 2 - Independent flight director systems, each having its own display
- 1 - Auto throttle system
- 1 - Radar altimeter

OPERATION SPECIFICATIONS

Straight-in ILS landing minima of 1600 RVR with a decision height of 150' (or 1200 RVR with a decision height of 100'), as applicable, are authorized for those pilots who have 300 hours as pilot-in-command on turbojet transports (if applicable), and who have completed the approved training program applicable to these minima and have been certified by an FAA inspector or company check pilot as being qualified to operate at these minima.

An approach shall not be started when the RVR is below 2000 for four-engine turbojet aircraft or 1800 for all other aircraft unless:

1. All of the airborne equipment of the primary or alternate (manual) low approach system (whichever is appropriate) is in normal operation.
2. The following elements of the ground navigation system are in normal operation:
 - a. All components of the ILS
 - b. Runway visual range
 - c. High intensity runway lights
 - d. Approach light system and sequenced flashers
 - e. Touchdown zone and centerline lights
3. The crosswind component on the landing runway is 10 knots or less.
4. Fifteen percent or 1000', whichever is greater, additional runway over the present CAR landing field length is available (for turbojet aircraft).
5. The RVR at the approach end of the runway is 1200 or higher and the RVR at the roll-out end is at least 600.^{1/}

An approach shall be abandoned when:

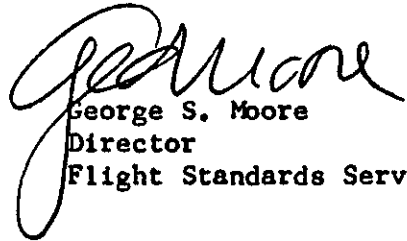
1. Any required component of the ground and airborne low approach system becomes inoperative.

^{1/} This requirement or a similar one may appear on the operation specifications, for 1200 RVR, as a result of further evaluation of dual or multiple RVR information.

10/2/64

2. Upon reaching the decision height adequate visual reference has not been established.
3. Landing cannot be accomplished within the touchdown zone.

If operation is predicated on the use of barometric altimeters, the decision height will be modified by the bias error determined to exist in the indicated pressure altitude. In no case shall the decision height be less than the auto coupler hard-over altitude loss (as established in the AFM) plus 50 feet.



George S. Moore
Director
Flight Standards Service