



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

**Subject: CRITERIA FOR OPERATIONAL
APPROVAL OF AUTO FLIGHT
GUIDANCE SYSTEMS**

Date: 3/18/97

AC No: 120-67

Initiated By: AFS-400

Change:

1. PURPOSE. This advisory circular (AC) states an acceptable means, but not the only means, for obtaining operational approval of the initial engagement or use of an Auto Flight Guidance System (AFGS) under Title 14 of the Code of Federal Regulations (14 CFR) part 121, section 121.579(d); part 125, section 125.329(e); and part 135, section 135.93(e) for the takeoff and initial climb phase of flight.

2. APPLICABILITY. The criteria contained in this AC are applicable to operators using commercial turbojet and turboprop aircraft holding Federal Aviation Administration (FAA) operating authority issued under SFAR 38-2 and 14 CFR parts 119, 121, 125, and 135. The FAA may approve the AFGS operation for the operators under these parts, where necessary, by amending the applicant's operations specifications (OPSPECS).

3. BACKGROUND. The purpose of this AC is to take advantage of technological improvements in the operational capabilities of autopilot systems, particularly at lower altitudes. This AC complements a rule change that would allow the use of an autopilot, certificated and operationally approved by the FAA, at altitudes less than 500 feet above ground level in the vertical plane and in accordance with sections 121.189 and 135.367, in the lateral plane.

4. DEFINITIONS.

a. Airplane Flight Manual (AFM). A document (under 14 CFR part 25, section 25.1581) which is used to obtain an FAA type certificate. This document contains the operating procedures and limitations and performance information applicable to a particular airplane type in order to safely operate that aircraft and conform to the type certificate.

b. Autopilot. An aircraft system and associated sensors designed to provide automatic control of the pitch, roll, and, in certain instances, yaw axis of an aircraft.

c. Auto Flight Guidance System (AFGS). Aircraft systems, such as an autopilot, autothrottles, displays, and controls, that are interconnected in such a manner to allow the crew to automatically control the aircraft's lateral and vertical flightpath and speed. A flight management system (FMS) is sometimes associated with an AFGS.

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d. Auto Throttle System (ATS). A system selected by the crew to provide automatic engine thrust control, as required, to achieve and maintain desired aircraft speed or vertical flight profile.

e. Control Wheel Steering (CWS). A selectable feature of some autopilots that directly relates control wheel displacement to a desired aircraft response. The pilot's force or displacement inputs of the control wheel/column or stick are transmitted by the autopilot into appropriate commands to the control surfaces to achieve the desired aircraft pitch, roll, or yaw response.

f. Flight Director (FD). An instrument display system providing visual commands for aircraft control by displaying appropriate command indications on the primary flight display. The flightcrew use these command indications to manually fly the aircraft or monitor the autopilot.

g. Flight Management Systems (FMS). An integrated system used by flightcrews for flight planning, navigation, performance management, aircraft guidance and flight progress monitoring.

h. Minimum Altitude for AFGS Engagement. Unless otherwise specified by the FAA, the minimum height relevant to the airport elevation, and runway elevation over which the crew may either initially engage an AFGS for automatic flight after takeoff or allow the AFGS to remain engaged during approach and landing.

5. DISCUSSION.

a. AFGS capabilities have steadily increased and improved with time. Air carrier crews now routinely use autoflight features that are operational during takeoff and landing/roll-out (e.g., control wheel steering, automatic landing, automatic throttles, and wingload alleviation).

b. Some aircraft now have automatic features identified for operations specifically at low altitudes (e.g., for noise abatement) which when used, contribute to performance, workload, cost, noise, and safety benefits. Such features will be certificated on the aircraft by either type certification or supplemental type certification. Operators may obtain operational approval for in service use by following the guidance in this AC. This should meet the intent of sections 121.579, 125.329, and 135.93 for existing aircraft and describe acceptable methods for demonstration of these systems for new or modified aircraft.

c. In accordance with the regulations, sections 121.579(d), 125.329(e), and 135.93(e), the autopilot system may not be engaged below the minimum engagement certification altitude specified in the AFM or an altitude specified by the Administrator, whichever is higher, and may not be engaged below that altitude without a finding by the Administrator that use of the system will not otherwise affect the safety standards required by those sections of the regulations. Additionally, the Flight Standardization Board (FSB) report for the aircraft may contain further conditions or limitations regarding AFGS engagement after takeoff. Inclusion of a specified altitude for use after takeoff in the AFM or the FSB report does not constitute approval to conduct operations. Authorization to engage the AFGS at the altitude specified in the AFM are made by a revision to the operator's OPSPECS. For aircraft with an AFM that specifies an AFGS engagement altitude for takeoff, principal operations inspectors (POI's) may issue OPSPECS authorizing the engagement of the AFGS after takeoff at or above the altitude specified in the AFM or as specified in the FSB report, whichever is higher. When an FSB report is not available, the FAA does not approve an altitude below that specified in the AFM or 200 feet, whichever is higher. The expectation is that as technology continues to advance, additional operational and safety benefits can be derived from using improved autopilot technology. Such a benefit may eventually include the use of an AFGS from the beginning of the takeoff phase of flight, in which case the rules will have to be amended.

6. OPERATIONAL CONCEPT.

a. The AFGS, as discussed in this AC, consists of an Autopilot (pitch, roll, and yaw) Flight Guidance System, which if used in conjunction with other available components such as FMS, autothrottle, etc., will enhance safety and ease pilot workload. Any or all of the many available automatic operational features are selectable at the pilot's discretion in modern transport aircraft. This allows a clear distinction to be made in contrast to the primary flight control system which may also be largely automatic and electronic, but is not normally deselectable at the flightcrew's discretion, such as the yaw dampers.

b. There are several functions of an AFGS that could be presented for operational approval. These functions could be used singularly or in combination with each other. The following are examples of these functions:

- (1) Setting takeoff thrust.
- (2) Initial climb.
- (3) Noise abatement profiles.
- (4) Engine failure recognition.
- (5) Reduced climb performance profiles.

c. Approval for using any of the above functions may include changing equipment, equipment support, and operational procedures in the aircraft manufacturer's AFM and in the air carrier's operations manual. Approval may require adjustments to the air carrier's OPSPECS.

d. Once the new operation is developed and approved, maintenance and flightcrew training programs must be adjusted and approved. Qualification of maintenance personnel and flightcrews must be accomplished before flight operations with the new procedure can be implemented.

7. AIRPORT AND GROUND FACILITIES. An applicant authorized to use an AFGS may have certain constraints related to airports or ground facilities specified in the operator's OPSPECS where such specific provisions are necessary (e.g., operations based on special procedures at airports with adjacent mountainous terrain, operations requiring runway guidance information, etc.).

8. AIRBORNE EQUIPMENT. AFGS system criteria will be defined in the AFM.

9. PILOT TRAINING AND PROFICIENCY PROGRAM. The operator's training program for flightcrews should provide ground and flight training in the following subjects:

a. Knowledge of airport and ground facilities -- as defined in the airborne equipment certification, AFM, and/or Flight Operations Manual (FOM) to include new minima criteria for weather operations authorized through OPSPECS.

b. The use of the AFGS within the parameters indicated by the AFM and FOM. This should include all normal and abnormal procedures.

c. Training should include checking in the flight tasks (maneuvers and procedures) that have been adjusted in the manuals.

10. OPERATIONS MANUAL AND PROCEDURES. Procedures, instructions, and information to be used by flightcrews should be developed by each air carrier to include, as applicable, the following:

a. Flight Crewmember Duties. Flight crewmember duties during initial engagement or use of the AFGS should be described in the air carrier's operations manual. These duties should contain a description of the responsibilities and tasks for the pilot flying the aircraft and the pilot not flying the aircraft during all stages of operation. The duties of the third flight crewmember, if required, should also be explicitly defined.

b. Training Information. Training requirements and procedures should be provided in the operator's approved training program.

11. MAINTENANCE PROGRAM. Each operator should establish a maintenance and reliability program, acceptable to the Administrator, to ensure that the airborne equipment will continue at a level of performance and reliability established by the manufacturer or the FAA. [part 121, subpart L; part 125, subpart G; and part 135, subpart J] The program should include the following:

a. Maintenance Personnel Training. Each operator should establish an initial and recurrent training program, or arrange for contract maintenance that is acceptable to the Administrator for personnel performing maintenance work on airborne systems and equipment. Personnel training records should be maintained.

b. Test Equipment and Standards. The operator's program for maintenance of line (ramp) test equipment, shop (bench) test equipment, and a listing of all primary and secondary standards utilized during maintenance of test equipment which relates to airborne system operation should be submitted to the Administrator for determination of adequacy. Emphasis should be placed on standards associated with flight directors, automatic flight control systems, maintenance techniques and procedures of associated redundant systems.

c. Maintenance Procedures. Any changes to maintenance procedures, practices, or limitations established in the qualification for airborne system operations are to be submitted to the Administrator for acceptance before such changes are adopted.

12. ENGINEERING MODIFICATIONS. Titles and numbers of all modifications, additions, and changes that were made to qualify aircraft systems performance should be provided to the Administrator. [part 21, subparts D and E]

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