



AEROSPACE RECOMMENDED PRACTICE

ARP5366™

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Autopilot, Flight Director, and Autothrust Systems

RATIONALE

ARP5366 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This document recommends criteria for the design and installation of Autopilot, Flight Director and Autothrust Systems. These three systems are highly interrelated and will be referred to generically as an Integrated Flight Guidance System (IFGS).

2. REFERENCES:

2.1 Documentation:

This annex should be used in conjunction with the ARP4102 Core Document. The following documents may also be applicable:

SAE S-7 ARP4101 Flight Deck Layout and Facilities
SAE S-7 ARP4102/4 Flight Deck Alerting System
SAE S-7 ARP4102/7 Electronic Displays
SAE S-7 ARP4105 Nomenclature and Abbreviations for Use on the Flight Deck
SAE S-7 ARP 4104 Design Objectives for Handling Qualities of Transport Aircraft
Draft Advisory Circular 25.1329 Flight Guidance Systems
ACJ 25.1329 Autopilot

2.2 Definitions:

2.2.1 INTEGRATED FLIGHT GUIDANCE SYSTEM (IFGS): A system which combines the Autopilot and Flight Director, or the Autopilot, Flight Director and Autothrust mode selection features and guidance commands into a single integrated flight control functional architecture.

2.2.2 FLIGHT GUIDANCE CONTROL INTERFACE: The component of the system that allows the flightcrew to engage the Autopilot and/or the Flight Director and/or the Autothrust systems (if installed) and to select and control the various modes of operation.

2.2.3 FLIGHT GUIDANCE MODE DISPLAY FUNCTION: The component of the system that displays the armed and active modes of the Autopilot, Flight Director and/or Autothrust systems.

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3. OPERATIONAL REQUIREMENTS:

3.1 General:

The IFGS should provide the pilot with the means to select modes of operation that control the pitch, roll and yaw axis of the airplane and the thrust level of the engines in a safe and predictable manner while maintaining the airplane within the normal flight envelope. The IFGS should be designed and demonstrated to perform its intended function in all configurations in which it is to be used throughout all appropriate maneuvers and environmental conditions, including turbulence and windshear. A control function such as control wheel steering (as in the DC-10) which allows the pilot to maneuver the airplane manually, but with different stability characteristics than those without the flight guidance system engaged, is not recommended.

3.2 System Requirements:

3.2.1 Engagement Logic:

- 3.2.1.1 It shall be possible for either pilot to individually select their independent flight director function of the IFGS with a single action. Each pilot's display system shall present identical flight director modes and information.
- 3.2.1.2 It shall be possible for each pilot to engage the autopilot function of the IFGS with a single action. Multiple autopilots may be individually engaged.
- 3.2.1.3 It shall not be possible for either pilot to engage the IFGS in a flight regime for which the system is not designed to function. If the IFGS is engaged outside the normal flight envelope, it shall be designed to return the airplane to within the normal flight envelope.
- 3.2.1.4 The autopilot function should engage in the same mode as the integrated flight director function. If an integrated flight director function is off, the autopilot should engage in the basic modes of heading/track hold and current vertical speed/flight path angle. Engagement in a wings level mode or an attitude hold mode is acceptable although it is not recommended for a modern flight guidance system. The engagement modes shall be annunciated.
- 3.2.1.5 It shall be possible for each pilot to arm the autothrust function (if an arming function is used) located on the Flight Guidance Control Interface with a single action.
- 3.2.1.6 It shall be possible for each pilot to activate the autothrust system with a single action.
- 3.2.1.7 The autothrust system shall be designed to prevent inadvertent activation during ground operations.
- 3.2.1.8 If a Takeoff Mode is provided, the flight director should automatically engage in the Takeoff Mode prior to takeoff. A manual means for the pilot to engage the Takeoff Mode shall be provided.

3.2.2 Disengagement Logic:

- 3.2.2.1 If multiple autopilots are individually controlled by dedicated switches, it shall be possible for either pilot to manually disengage individual autopilots.
- 3.2.2.2 It shall be possible to disengage the autopilot function (including all engaged autopilots) by pressing the "Quick Disconnect Button" on the control wheel or control stick.
- 3.2.2.3 It shall be possible to disengage the autopilot function by overriding the autopilot by a manual pilot input to the control wheel or stick. This disconnect feature must function with both pitch inputs, roll and rudder (if applicable) inputs. These disconnect forces must be established to be high enough to preclude nuisance disconnects and low enough to ensure the function is available to all pilots. This feature may not be inhibited during autoland operations.
- 3.2.2.4 It shall be possible to disengage the autopilot function by a manual pilot electric trim input (in either direction) to the elevator or stabilizer.
- 3.2.2.5 Whenever the autopilot function is disengaged (for any intentional or unintentional reason), the disengagement shall be smooth and any airplane response associated with an out of trim condition should be mild.
- 3.2.2.6 Whenever the autopilot function is disengaged, the flight director function shall remain in its existing mode of operation.
- 3.2.2.7 There shall be a means for either pilot to readily disengage their respective flight director function.
- 3.2.2.8 It shall be possible for each pilot to disengage the autothrust system by a single action by pressing a switch located on the throttle controls.
- 3.2.2.9 It shall be possible for each pilot to readily override the autothrust system with one hand to modulate the rate of thrust application. Manual intervention by the pilot to modulate the thrust shall not cause the autothrust system to disengage or to change modes of operation (applicable to moving throttles only).

3.2.3 Flight Guidance System Alerts and Annunciation:

- 3.2.3.1 Engagement of the autopilot and flight director function and each armed and active mode of operation shall be suitably annunciated to each pilot.
- 3.2.3.2 Intentional or unintentional disengagement of the autopilot function using the "Quick Disconnect Button" requires the pilot's immediate attention for either immediate or subsequent pilot action depending on the circumstances. This condition shall result in both an aural alert and a visual alert.