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|  | **Autopilot Requirements** |

# Background

Autopilot Functional Requirements

This document describes an example set of requirements that apply to an autopilot controller. The purpose of this example is to demonstrate traceability between requirements, design, code and test cases/procedures for ARP-4754 and DO-178B.

This document provides the artefact for ARP-4754 Section 5.2.2; Functional Requirements.

# Autopilot Requirements

## 2.1 Roll Autopilot

### 2.1.1 Roll Attitude Mode

REQ008

Roll Autopilot shall engage when the pilot selects the autopilot engage switch in the cockpit and disengage when the switch is deselected. When not engaged, the command to the roll actuator shall be zero.

Rationale: The autopilot should only be engaged when the pilot selects it. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22RollReference.slx%22,%22:5%22%5d)

REQ010

Roll hold mode shall be the active mode whenever the autopilot is engaged and no other lateral mode is active.

Rationale: Roll hold mode is the default mode in the roll axis for the autopilot when no other mode is active. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22RollReference.slx%22,%22:13%22%5d)

REQ012

The roll hold reference shall be set to the actual roll attitude of the aircraft, when roll hold mode becomes the active mode, if the actual roll angle is greater than 6 degrees or less than 30 degrees.

Rationale: When engaging the mode at a small bank angle, it is assumed that the pilot wants to maintain level flight. When the mode is engaged above the autopilot roll limit, the autopilot should control to the limit. The turn knob will be considered to be in dent when it is less than 3 degrees. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22RollReference.slx%22,%22:14%22%5d)

REQ013

The roll hold reference shall equal zero if the actual roll angle is less than 6 degrees, in either direction, at the time of roll hold engagement.

Rationale: When engaging the mode at a small bank angle, it is assumed that the pilot wants to maintain level flight. When the mode is engaged above the autopilot roll limit, the autopilot should control to the limit. The turn knob will be considered to be in dent when it is less than 3 degrees. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22RollReference.slx%22,%22:9%22%5d)

REQ014

The roll hold reference shall equal 35 degrees in the same direction as the actual roll angle if the actual roll angle is greater than 35 degrees at the time of roll hold engagement.

Rationale: When engaging the mode at a small bank angle, it is assumed that the pilot wants to maintain level flight. When the mode is engaged above the autopilot roll limit, the autopilot should control to the limit. The turn knob will be considered to be in dent when it is less than 3 degrees. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:7%22%5d)

REQ015

The roll reference shall equal the cockpit turn knob command, up to a 40 degree limit, if the turn knob is commanding 3 degrees or more in either direction.

Rationale: When engaging the mode at a small bank angle, it is assumed that the pilot wants to maintain level flight. When the mode is engaged above the autopilot roll limit, the autopilot should control to the limit. The turn knob will be considered to be in dent when it is less than 3 degrees.

REQ017

Steady state roll attitude shall track roll attitude command within 1 degree in calm air.

Rationale: These tracking, overshoot and bandwidth requirements are necessary for good roll performance in lateral modes. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:8%22%5d)

REQ018

Roll attitude overshoot to a step command shall be less than 10% of the steady state roll attitude in calm air.

Rationale: These tracking, overshoot and bandwidth requirements are necessary for good roll performance in lateral modes. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:6%22%5d)

REQ019

Roll attitude bandwidth shall be greater than 0.5 rad/sec for roll attitude commands of ±3 degrees.

Rationale: These tracking, overshoot and bandwidth requirements are necessary for good roll performance in lateral modes. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:18%22%5d)

REQ021

The maximum roll rate magnitude shall be less than 6.6 degrees/sec in calm air.

Rationale: This roll rate allows good performance while still maintaining passenger comfort. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:13%22%5d) [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:12%22%5d)

REQ023

The maximum roll angle magnitude shall be less than 33 degrees, in calm air.

Rationale: This roll angle allows sufficient turn rate while still maintaining passenger comfort. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:18%22%5d)

REQ025

The maximum aileron command magnitude shall be less than 15 degrees.

Rationale: This is the maximum deflection allowed by the mechanical control system. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22Att_Ctrl.mdl%22,%22:5%22%5d)

### 2.1.2 Heading Hold Mode

REQ028

Heading Hold shall become the active mode when the pilot selects the heading switch in the cockpit and deactivate when the switch is deselected.

Rationale: Heading hold mode will be the active mode when selected by the pilot. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22ModeSwitch.slx%22,%22:4%22%5d)

REQ030

When heading hold mode becomes the active mode the heading hold reference shall be set by the pilot via a cockpit control.

Rationale: The pilot will select the desired heading to track via the cockpit control. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22RollCommand.slx%22,%22:9%22%5d)

REQ032

Steady state heading shall track command within 1 degree in calm air.

Rationale: These tracking and overshoot requirements are necessary for good heading performance. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HeadingMode.slx%22,%22:4%22%5d)

REQ033

Heading overshoot response to a heading step command shall be less than 10% of the change in heading command.

Rationale: These tracking and overshoot requirements are necessary for good heading performance. [](http://localhost:31415/matlab/feval/rmiobjnavigate?arguments=%5b%22HeadingMode.slx%22,%22:5%22%5d)