BOEING 737

NEXT GENERATION

MAU VIRTUAL

Course overview

- Airplane General
- Air Systems
- Warning Systems, Communications, Ice & Rain Protection
- Electrical
- Engines, APU, Fuel System
- Hydraulics, Flight Controls, Landing Gear, Brakes
- Flight Instruments, Displays
- Automatic Flight
- Flight Management, Navigation
- Normal Operations

Topics

AFS Automatic Flight System

- **AFDS Autopilot Flight Director System**
- Mode Control Panel
  - Speed
  - Vertical navigation
  - Lateral navigation
  - Autopilot/Flight Director
- Autopilot engagement/disengagement
- AFS failure
- Flight Director
- AFDS Status Annunciation, Flight Mode Annunciation
- Control Wheel Steering

- **Autothrottle System**

Automatic Flight Operations

- Takeoff and Climb
- Enroute
- Approach and Landing
- Go-around
- Operation in windshear

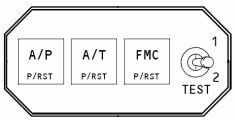
AFS

Overview

The automatic flight system (AFS) consists of the autopilot flight director system (AFDS) and the autothrottle (A/T). The flight management computer (FMC) provides N1 limits and target N1 for the A/T and command airspeeds for the A/T and AFDS.

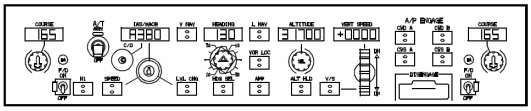
The AFDS and A/T are controlled using the AFDS mode control panel (MCP) and the FMC. Normally, the AFDS and A/T are controlled automatically by the FMC to fly an optimized lateral and vertical flight path through climb, cruise and descent.

Indicators



AFDS

MCP

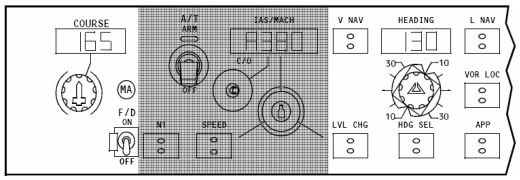


- **Speed**
- **Vertical navigation**
- **Lateral navigation**
- **Autopilot & F/D**

AFDS

MCP Speed

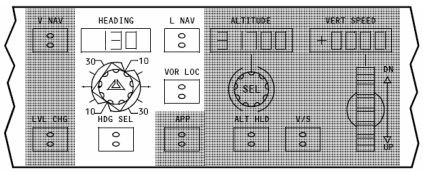
- **Autothrottle ARM switch**
- **Autothrottle indicator light**
- **Changeover switch**
- **MCP speed condition symbols**
- **IAS/MACH display**
- **N1 switch**
- **SPEED switch**
- **IAS/MACH selector**



AFDS

MCP Vertical navigation

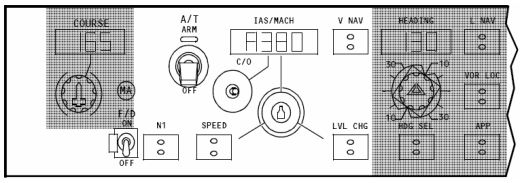
- **VNAV switch**
- **Altitude display**
- **Vertical speed display**
- **Vertical speed thumbwheel**
- **Level Change switch**
- **Approach switch**
- **Altitude selector**
- **Altitude hold switch**
- **Vertical speed switch**



AFDS

MCP Lateral navigation

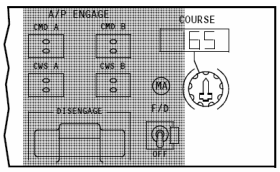
- **Course display**
- **Heading selector**
- **Heading display**
- **LNAV switch**
- **VOR Localizer switch**
- **Course selector**
- **Bank angle selector**
- **Heading select switch**
- **Approach switch**



AFDS

MCP A/P, F/D

- **Command engage switches**
- **CWS engage switches**
- **Autopilot disengage bar**
- **Master F/D indication**
- **Flight director switch**



AFDS

Autopilot engagement/disengagement

Each A/P can be **engaged** by pushing a separate CMD or CWS engage switch. A/P engagement in CMD or CWS is inhibited unless both of the following pilot–controlled conditions are met:

- no force is being applied to the control wheel
- the STAB TRIM AUTOPILOT cutout switch is at NORMAL.

Only one A/P can be engaged at a given time unless the approach (APP) mode is engaged. Approach mode allows both A/Ps to be engaged at the same time. Dual A/P operation provides control through landing flare and touchdown or an automatic go–around.

The A/P automatically **disengages** when any of the following occurs:

- pushing either A/P disengage switch
- pushing either TO/GA switch with a single A/P engaged in CWS or CMD below 2000 feet RA
- pushing either TO/GA switch with a single A/P above 2000 feet RA with flaps down or G/S engaged.
- pushing either TO/GA switch after touchdown with both A/Ps engaged in CMD
- pushing an illuminated A/P ENGAGE switch
- pushing the A/P DISENGAGE bar down
- activating either pilot's control wheel trim switch
- moving the STAB TRIM AUTOPILOT cutout switch to CUTOUT
- either left or right IRS system failure or FAULT light illuminated
- loss of electrical power or a sensor input which prevents proper operation of the engaged A/P and mode
- loss of respective hydraulic system pressure.

AFDS

AFS failures

– **Power interruption or loss** may cause disengagement of the AFDS and/or A/T. Re–engagement is possible after power is restored.

– Dual channel A/P operation is possible only when **two generators** are powering the busses.

– Two independent radio altimeters provide radio altitude to the respective FCCs. With a **radio altimeter inoperative**, do not use the associated FCC for approach or landing, and do not use the associated autopilot for approach.

AFDS

Flight Director

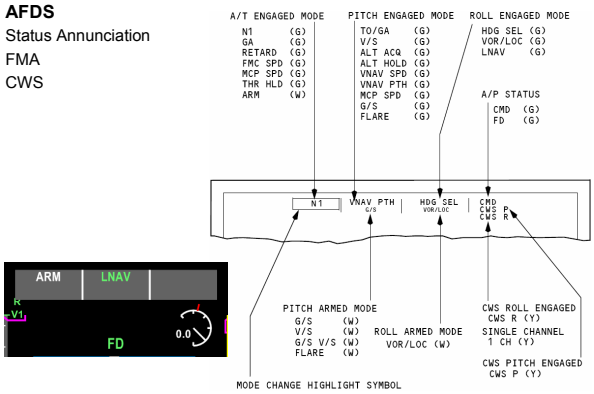
Turning a F/D switch ON displays command bars on the respective pilot's attitude indicator if command pitch and roll modes are engaged. If command pitch and roll modes are not engaged, the F/D command bars do not appear. The F/Ds can be operated with or without the A/P and A/T. F/D command modes can be used with an A/P engaged in CWS.

F/D commands operate in the same command modes as the A/P except:

- the takeoff mode is a F/D only mode
- dual F/D guidance is available for single engine operation
- the F/D has no landing flare capability. F/D command bars retract from view at approximately 50 feet RA on an ILS approach.

AFDS

Status Annunciation
FMA
CWS



Autothrottle

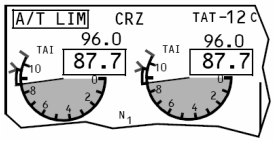
The A/T system provides automatic thrust control from the start of takeoff through climb, cruise, descent, approach and go–around or landing. In normal operation, the FMC provides the A/T system with N1 limit values.

The A/T moves the thrust levers with a separate servo motor on each thrust lever. Manually positioning the thrust levers does not cause A/T disengagement unless 10 degrees of thrust lever separation is exceeded during a dual channel approach after FLARE armed is annunciated. Following manual positioning, the A/T may reposition the thrust levers to comply with computed thrust requirements except while in the THR HLD and ARM modes.

The A/T system operates properly with the EECs ON or in ALTN. In either case, the A/T uses the FMC N1 limits.

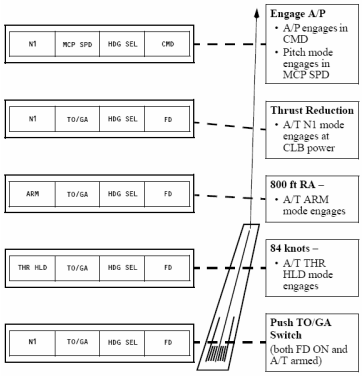
Thrust mode display annunciations

- **TO** – takeoff
- **R-TO** – reduced takeoff
- **R-CLB** – reduced climb
- **CLB** – climb
- **CRZ** – cruise
- **G/A** – go–around
- **CON** – continuous
- **—** – FMC not computing thrust limit



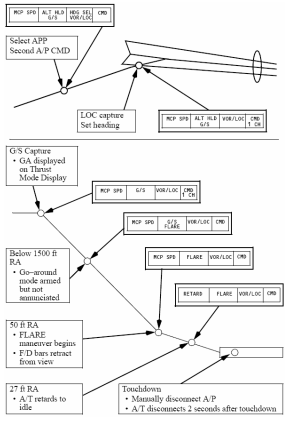
Automatic Flight Operations

Takeoff



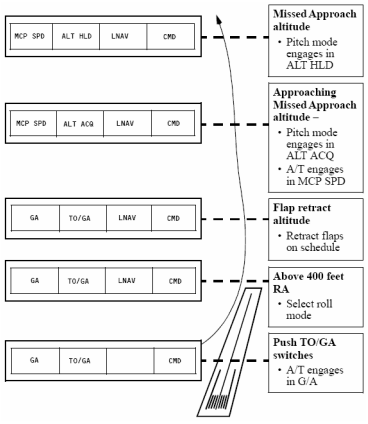
Automatic Flight Operations

Approach and Landing



Automatic Flight Operations

Go-around



Köszönöm a figyelmet!

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