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Attachment 7 –American Airlines Operations Manuals

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OPERATIONAL FACTORS/HUMAN PERFORMANCE

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E190

Operating Manual

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1.2 Weight Limits

1.2.1 Takeoff Weight. The maximum takeoff weight (weight at brake release or at start of takeoff roll) is limited by the *most* restrictive of the following:

- maximum certificated takeoff weight
- maximum runway limited takeoff weight
- tire speed and brake energy limit weights
- maximum takeoff weight (climb limited)
- obstacle clearance, enroute, and landing weight limitations

1.2.2 Landing Weight. The maximum landing weight is limited by the *most* restrictive of the following, including limitations for inoperative equipment:

- maximum certificated landing weight
- maximum landing weight (runway length plus obstacle)
- maximum landing weight (climb limited)

1.2.3 Certificated Weight Limits.

Maximum Weights (lbs.)	
Taxi & Ramp	114,500
Takeoff (MTOW)	114,150
Landing (MLW)	97,000
Zero Fuel (MZFW)	90,150

• Note •

Perform an “overweight landing” when a condition causes it to be safer to land overweight than to continue flight until at or below maximum certificated landing weight. See QRH, “Overweight Landing” procedure.

1.4 Speed Limits

WARNING

Maximum operating limit speeds (V_{MO}/M_{MO}) shall not be deliberately exceeded in any regime of flight.

1.4.1 Airspeed and Mach Number Limits.

Maximum operating airspeed	V_{MO}
Maximum operating Mach number	.82 (M_{MO})
Maximum airspeed for RAT operation	V_{MO}/M_{MO}
Turbulent airspeed (below 10,000 feet)	250 KIAS
Turbulent airspeed (at or above 10,000 feet)	270 KIAS/.76M
Tire limit ground speed	195 knots
Maximum airspeed for windshield wiper operation	250 KIAS
Maximum airspeed for windshield wiper operation failed in the non-parked position	320 KIAS
Maximum airspeed to open flightdeck window	160 KIAS
Maximum gear extension speed (V_{LO})	265 KIAS
Maximum gear extended speed (V_{LE})	265 KIAS
Maximum gear retraction speed (V_{LO})	235 KIAS

• **Note** •

Reference V_{MCA} and V_{MCL} are figured into V_R and V_2 numbers.

2e.4 Climb Speed and Rate

2e.4.1 Climb Speed Determination. Maintain flaps-up maneuvering speed until clear of obstacles or above minimum crossing altitudes. If there are no altitude or airspeed restrictions, accelerate according to the desired climb speed schedule.

Maneuvering. If considerable maneuvering is required during the departure, the flaps-up maneuvering speed is recommended until the maneuvering phase is complete and the aircraft is enroute toward the destination.

2e.4.2 Speed Schedule. Use the FMS computed climb speed.

• Note •

To prevent the possibility of a fuel leak through the fuel tank vents, do not exceed 290 KIAS when either fuel tank quantity is greater than 11,000 lbs.

When 10,000 feet and above, if ATC, turbulence, or operational considerations require a speed change, use following:

Best Rate	240 KIAS/M 0.60
Long Range	250 KIAS/M 0.70
Turbulence	270 KIAS/M 0.76
Normal	290 KIAS/M 0.74
Alternate	290 KIAS/M 0.70
High Speed	310 KIAS/M 0.77

See also Paragraph [2.7.1 Aircraft Speeds](#).

2e.4.3 Maximum Climbs.

Angle. Maximum angle climb speed is normally used for obstacle clearance or to reach a specified altitude/flight level in a minimum distance. Maximum angle climb speed varies with gross weight and can be referenced by using the pitch limiter indicator (PLI).

- approach:
 - ❖ day VMC visual approach: identify the:
 - ➔ landing runway
 - ➔ back up approach
 - ❖ instrument approach or night VMC visual approach:
 - ➔ airport, approach name, and page number
 - ➔ briefing strip information
 - ➔ weather minima
- landing/taxi:
 - ❖ landing performance assessment
 - ❖ flaps
 - ❖ autobrakes
 - ❖ runway turnoff
 - ❖ planned route (including hot spots/runway crossings)
- standard assessment:

Available Landing Distance & Parameters	
• ≥ 7000 feet or longer¹ • field elevation ≤ 2000 feet • $V_{app} \leq V_{ref} + 15$ or less • no tailwind • with or without autoland • flaps 5 or FULL	• with or without STALL PROT ICE • temp ISA +20 or less • Expected Braking action is DRY (RCC 6) • weight $\leq$ structural limit (97,000 lbs) • no MEL/CDL or non-normal items that affect landing performance

¹**Exception:** KDCA RWY 1/19 (6869 feet) may be included.

Initially. The PM followed by the PF should identify what they consider to be their relevant threats/concerns. *Example:*

Pilot Flying (FO): “I am ready to brief if you are, what are our relevant threats for this arrival?”

Pilot Monitoring (CA): “Well, it is dark and there is construction on runway 28 that is going to change our normal taxi route. We need to make sure to listen carefully and not make any wrong turns.”

Pilot Flying (FO): “I agree. I was just here last week so I can show you what they had us do. The threat that is on my mind is the terrain on the west side of the airport.”

Next. The PF should discuss the plan (consider using FMS and electronic displays). Discuss management strategies (barriers) for previously identified and additional threats when briefing the plan. *Example:*

Pilot Flying (FO): “After landing we will need to roll out all the way to alpha because all the other taxiways are closed due to the construction on runway 28.”

Potential Threats.

Airport	Weather/Terrain	ATC
• Unfamiliar airport • Ramp congestion • Ground conditions/signage • Equipment inside of the line • SID/STAR/approach/airport diagram design	• IMC • Terrain • Turbulence • Icing (ground or airborne) • Convective weather • Visual conditions • Extremes (hot or cold)	• Radio congestion • Non-standard phraseology • Similar call signs • Language/accent • Clearance/reroute/challenging restriction • Slam dunk
Aircraft	Time Pressure	Crew
• MEL/CDL • QRH non-normal • Supplemental normal	• Time pressure/delay • Late crew arrival • Late aircraft arrival • Holding • Missed approach	• Fatigue • Food • Low experience • Complacency • Distraction

Arrival Announcement. The captain will normally notify flight attendants and passengers of ETA and other appropriate information (e.g., turbulence, seatbelt sign, weather, etc.). See FOM > Gen Ops > Communications.

2e.13 Descent

2e.13.1 Planning. Good descent planning is necessary to arrive at the desired altitude and correct speed & configuration. Plan all descents to arrive at traffic pattern altitude at flaps-up maneuvering speed about

- twelve (12) miles out for a straight-in approach or
- eight (8) miles out for an abeam approach.

A good crosscheck is to be at 10,000 feet, thirty (30) miles from the airport at 250 KIAS.

2e.13.2 Schedule. Use the FMS computed descent speed.

When 10,000 feet and above, if ATC, turbulence, or operational considerations require a speed change, use following:

Long Range	250 KIAS/M 0.70
Turbulence	270 KIAS/M 0.76
Normal	290 KIAS/M 0.78
High Speed	310 KIAS/M 0.77

See also paragraph [2.7.1 Aircraft Speeds](#).

2e.13.3 Rate. When a flight reports leaving an altitude, the PF maintains a descent rate consistent with ATC requirements and fuel conservation procedures. Below 2500 ft. on the radio altimeter, do not descend at a rate greater than 2000 ft./min.

2e.13.4 Descent Rate. The distance required for the descent is approximately three (3) miles per 1000 feet (3 to 1).

As a guide, in level flight without speed brakes, it takes approximately ten (10) seconds and one (1) mile to decelerate each ten (10) knots of airspeed.

Factors. From a typical cruise altitude, the top-of-descent (TOD) point should be advanced two (2) miles for each ten (10) knots of tailwind during the descent, and by two (2) miles for each 1000 feet of anti-ice use.

Alternately, use the VTA (Vertical Track Alert) as top of descent point and immediately execute a vertical direct to the crossing restriction waypoint. This method provides an

Chapter 3: Adverse Weather Operations

3.1 Severe Turbulence

Supplemental Guidance. See FOM > Gen Ops > Weather.

3.1.1 General. Flight through severe turbulence should be avoided if at all possible. Use the Flight Plan/Dispatch Release turbulence index information and/or the weather radar's turbulence detection mode to circumvent severe turbulence areas.

Powerplant. Flying in turbulence may cause engine inlet airflow distortion. This distortion combined with angle of attack changes, high altitude engine surge margins, etc. can result in engine surge(s) and/or flameout(s).

Yaw Damper. Use of the yaw damper, even though rudder control may be more active, considerably reduces structural loads on the tail.

3.1.2 Turbulence Airspeed. Turbulence airspeed give the best overall protection from inadvertent stalls and maintains substantial structural margins. The margin between present flight conditions and the onset of buffet is a function of load factor. A load factor margin of 0.5g is considered adequate for penetrating turbulence during cruise flight.

Caution

When encountering moderate to severe turbulence, reduce altitude, if necessary to increase buffet margin.

3.1.3 Encountering Severe Turbulence. If severe turbulence is encountered, accomplish the following:

1. Autopilot.....Keep On
2. Autothrottles..... Disconnect
3. Thrust..... Maintain Turbulence Airspeed

• **Note** •

Do not allow airspeed to decrease and remain below the turbulent penetration speed, as buffet margin will be reduced and considerable time and fuel will be required to regain cruise speed.

Change thrust only in case of an extreme variation in airspeed. Do not chase airspeed or Mach. A transient speed increase is preferable to a loss of speed that decreases buffet margins and is difficult to recover.

- 250 knots below 10,000 feet
- 270 knots/0.76M at or above 10,000 feet

3.1.4 Manual Flight. Trim the aircraft for Turbulent Airspeed, then do not change the stabilizer position. Control pitch with elevators using the attitude indicator as the primary instrument. Control *attitude* first, then make corrections for airspeed, altitude, and heading.

In extreme up/down drafts, large altitude gains/losses may occur. Do not make sudden or large elevator control inputs, but rather smooth and deliberate inputs to regain the desired attitude. Altitude deviations are probable in severe turbulence and should be allowed to occur providing terrain clearance is adequate.

3.1.5 Flap Extension. Delay flap extension as long as possible. The aircraft can withstand higher gust loads in the clean configuration. Consider diversion to another airfield if severe turbulence persists and/or is a better course of action.

3.2 Moderate to Heavy Rain, Hail, or Sleet

3.2.1 General. Flight through moderate to heavy rain, hail, or sleet should be avoided to the maximum extent possible. Use the weather radar and PIREPs to circumvent these areas.

3.2.2 Reserved.

3.2.3 Inflight Starts. Since water ingestion has been shown to degrade starting characteristics, repeated inflight start attempts may be necessary. In some cases, it may not be possible to start the engine(s) until exiting the areas of moderate to heavy rain, hail, or sleet.

3.2.4 Reserved.

3.2.5 Reserved.

Inoperative Items. Checklists include an inoperative items table only when the condition of the items is needed for planning the rest of the flight and the condition is not indicated by a light, alert, or EICAS alert message. The inoperative items, including the consequences (if any), are read aloud by the pilot monitoring. The pilot flying does not need to repeat this information, but must acknowledge the information was heard and understood.

Consequential Messages. Consequential EICAS alert messages can show as a result of a primary failure condition or as a result of doing a non-normal checklist (such as PACK 1 OFF or PACK 2 OFF as a result of doing the Smoke, Fire or Fumes checklist). Accomplish the checklists for consequential EICAS alert messages *unless* the statement “Do not accomplish the following checklists:” is included. All consequential EICAS alert messages may not show while doing the primary checklist depending on operational circumstances.

Checklist Completion. See section “[__Checklist complete](#)”.

Additional Information. Accomplish/consider items with a hand symbol (☞).

Descent/Before Landing Checklists. After completion of the non-normal checklist, normal procedures (e.g., Descent and Before Landing Normal Checklists) are used to configure the aircraft for each applicable phase of flight. When included in the non-normal procedure, accomplish the QRH’s Descent and Before Landing Checklists.

9.3.5 Managing the Situation.

Performance.

VREF Adjustment . Occasionally, a non-normal checklist instructs the flight crew to use a VREF speed that also includes a speed additive such as VREF FULL + 20 knots. When VREF has been adjusted by a non-normal checklist, this becomes the VREF used for landing. This VREF does not include wind additives. For example, if a non-normal checklist specifies use flaps 3 and VREF FULL + 20 knots for landing, the flight crew would select flaps 3 as the landing flaps and look up the VREF FULL speed on the speed flip card or QRH and add 20 knots to that speed.

Non-Normal Landing Distances. Advisory landing distances for non-normal configurations are located in the iPad Landing Application or Performance Manual, Emergency/Abnormal Chapter.

Cabin Condition. Following any incident affecting the cabin, the flightdeck crew should check on conditions in the cabin by interphone, as soon as possible, after completion of crew duties.

Assess the situation and make any necessary PAs to assist the flight attendants in calming and reassuring the passengers. Advise the arrival station of any assistance needed on landing.

Incidents requiring cabin investigation by interphone may include:

- depressurization
- turbulence
- evasive maneuvers
- smoke
- fire or fumes
- structural failure
- anything else that might have caused injury or alarm in the cabin

Non-Routine Landing Considerations.

• **Note** •

If time permits, accomplish individual item(s) as appropriate.

If desired, reference Potential Threats Table in the QRH.

The Non-Routine Landing Considerations, located in the QRH, is a tool to help manage non-normal situations. It can assist with the following:

- communicating with Air Traffic Control, the Company, flight attendants, and passengers
- identifying potential threats (e.g., degraded approach capabilities, overweight landings)
- developing and communicating a plan

Precautionary Landing. A precautionary landing is defined as a situation when a normal landing is anticipated; however, as a precaution, ARFF equipment may be present. Precautionary landing is an American Airlines term and is not to be used or communicated with ATC or other external agencies.

• **Note** •

The TEST briefing is not used.

If an evacuation is anticipated see paragraph [Planned Evacuation Landing](#).



E190

Operating Manual

Volume II



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10.2.7 HSI Weather Radar.

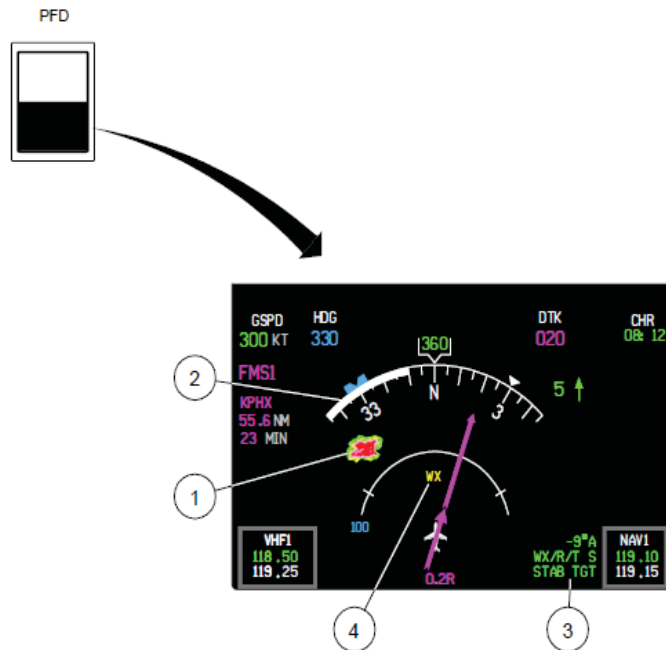


Figure 10.27 HSI Weather Radar Indications

① Weather Radar Returns

Displays targets in color.

Modes:

WX: the color indicates rain intensity in order of increasing intensity: green, yellow, red, and magenta

RCT: attenuation is too high, hiding possible severe weather areas (cyan)

GMAP: color indicates surface information: black, cyan, yellow and magenta

TURB: (WU 880) only): areas of potentially hazardous turbulence (white)

② Antenna Position Indicator

Indicates that antenna scan is active.

③ Weather Radar Annunciations

First line:

CCD inner knob icon: tilt angle is modifiable

Tilt angle readout: displays the tilt angle

ACT annunciation: ACT is an active submode

Fault code data (entire line): fault has been detected

Second line:

Weather Radar Mode Annunciation:

GREEN (WX): normal WX

GREEN (WX/R): normal WX with RCT

GREEN (WX/T): normal WX with TURB

GREEN (WX/R/T): normal WX with RCT and TURB

GREEN (WX/TX): weather transmitting but not selected for display on the PFD or MFD

GREEN (GMAP): GMAP mode

GREEN (FSBY): forced standby

GREEN (TEST): test mode and no faults

AMBER (WX CTRL): invalid WX control bus

AMBER (FAIL): failure is detected

AMBER (OVRNG): MAP range greater than 300 NM

WHITE (WX OFF): WX is OFF

WHITE (WAIT): power up

WHITE (STBY): normal standby

WHITE (S): Slave mode is active

Third line:

Stabilization annunciation: radar stabilization is inhibited

Target and gain mode annunciation.

GREEN (TGT): TGT selected

FLASHING AMBER (TGT): TGT selected and alert condition

AMBER (VAR): variable gain selected

④ Weather Radar Video Annunciation

Indicates weather radar video failure.



Figure 10.32 MFD Weather Radar

① Weather Radar Returns

Displays target in colors.

WX mode: the color indicates rain intensity. In increasing order of intensity: green, yellow, red and magenta.

RCT mode: attenuation is too high, hiding possible severe weather areas (cyan)

GMAP mode: color indicates surface information: black, cyan, yellow and magenta

TURB mode: areas of potentially hazardous turbulence (white)

② Target Alert Checkbox

Enables and disables the radar target feature. Can only be selected in the WX mode and at selected ranges of 200 NM or less.

③ Rain Echo Attenuation Compensation Technique Checkbox

Enables REACT function in all modes, except GMAP.

④ Altitude Compensated Tilt Checkbox

Enables automatic adjustment of the antenna tilt in relation to the altitude and selected range.

⑤ Turbulence Detection Checkbox

Enables the turbulence function only in the WX mode and at selected ranges of 50 NM or less.

⑥ Gain Indication Display

Indicates receiver sensitivity level from 0 to 100.

⑦ Receiver Gain Checkbox

Enables manual variation of the receiver sensitivity.

⑧ Antenna Stabilization Checkbox

Enables/disables automatic antenna stabilization.

A white STAB is displayed within the weather box when automatic antenna stabilization is disabled.

⑨ Sector Scan Checkbox

Enables the sector scan function for both pilots' displays.

⑩ Off Mode

Turns off the weather mode, provided OFF is selected in both weather radar virtual controllers.

In flight only, a single virtual controller selected to OFF operates in SLAVE mode.

⑪ Standby Mode

Selects the radar system into a standby mode, provided STBY is selected in both weather radar virtual controllers.

A green FSBY is displayed within the weather box when forced standby is active, on the ground.

⑫ Ground Mapping Mode

Enables ground mapping mode.

⑬ Radar Mode

In flight, activates the radar mode.

⑭ Forced Standby Override

Enables WX on the ground, when selected on both pilots' virtual control panel.

• Note •

Selection of Antenna Stabilization checkbox (STAB OFF) 4 times in less than 3 seconds enables the forced Standby Override function (FSBY OVRD).

⑮ Weather Radar Annunciations

First line:

CCD inner knob icon: tilt angle is modifiable

Tilt angle readout: displays the tilt angle

ACT annunciation: ACT is active

Fault code data (entire line): fault has been detected

Second line:

Weather Radar Mode Annunciation:

GREEN (WX): normal WX

GREEN (WX/R): normal WX with RCT

GREEN (WX/T): normal WX with TURB

GREEN (WX/R/T): normal WX with RCT and TURB

GREEN (WX/TX): weather transmitting, but not selected for display on the PFD or MFD

GREEN (GMAP): GMAP mode

GREEN (FSBY): forced standby

GREEN (TEST): test mode and no faults

AMBER (WX CTRL): invalid WX control bus

AMBER (FAIL): failure is detected

AMBER (OVRNG): MAP range greater than 300 NM

WHITE (WX OFF): WX is OFF

WHITE (WAIT): power up

WHITE (STAB): STAB OFF function selected

WHITE (STBY): normal standby

WHITE (S): Slave mode is active

Third line:

Stabilization annunciation: radar stabilization is inhibited

Target and gain mode annunciation.

GREEN (TGT): TGT selected

FLASHING AMBER (TGT): TGT selected and alert condition

AMBER (VAR): variable gain selected

⑦ Scratchpad

The working area, located on the bottom line of the display, where the pilot can enter data and/or verify data before line selecting the data into its proper position.

Data is retained on the scratchpad throughout all mode and page changes

The scratchpad also provides advisory and alerting messages to be displayed

10.2.13 Display Controller Panel.

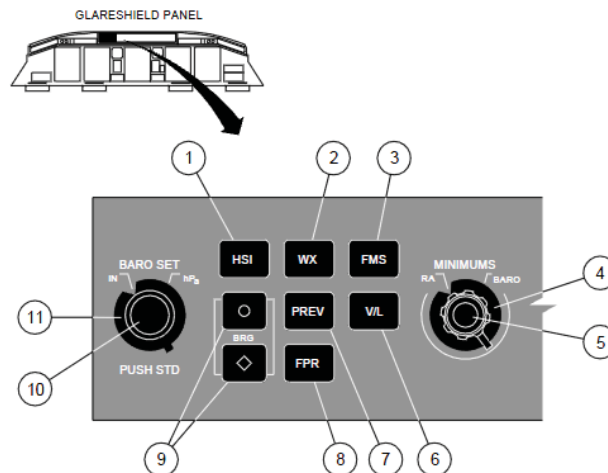


Figure 10.34 Display Controller Panel

① Horizontal Situation Indicator (HSI) Button

Selects between full compass, arc, or map mode for the on side PFD

② Weather Radar (WX) Button

Displays WX radar information on PFD (HSI in arc or map mode only)

③ FMS Selection/FMS Sources

Selects FMS as the primary navigation source for the on side PFD and toggles between FMS 1 and FMS 2

④ RA or BARO Minimums Selector Knob (Outer Knob)

RA: sets radio altimeter minimums

BARO: sets barometric minimums

⑤ **Decision Height (DH) or Minimum Descent (MDA) (Inner Knob)**

Selects decision height (DH), decision altitude or minimum descent altitude based on position of RA/BARO selector knob.

⑥ **VOR/LOC Button (V/L)**

Selects VOR or LOC as the primary navigation source for the on side PFD and toggles between VOR/LOC 1 and VOR/LOC 2.

⑦ **Preview Button (PREV)**

- Selects the preview mode when the FMS is the primary navigation source. The course and the lateral/vertical deviation can be previewed.
- Pressing the first time: enables the on-side VOR/LOC preview.
- Pressing a second time: enables the opposite side VOR/LOC preview.
- Pressing a third time: disables the preview mode.
- The previewed navigation source will automatically transition as the primary navigation source when LOC is captured.

⑧ **Flight Path Reference (FPR) Button**

Commands the flight path reference line and the flight path digital readout

⑨ **Bearing Sources (BRG) Buttons**

CIRCLE (o): allows VOR1, ADF1 or FMS1 selection for the onside PFD

DIAMOND (◊): allows VOR2, ADF2 or FMS2 selection for the on-side PFD

⑩ **Barometric Correction Control (Inner Knob)**

Sets barometric altimeter correction

Pushing this control knob sets barometric correction to standard (STD)

⑪ **Barometric Correction Selector Knob (Outer Knob)**

IN: sets barometric correction format to inches of mercury

hPa: sets barometric correction format to hectopascals

Chapter 15: Navigation

15.1 System Description

15.1.1 General. The E190 is equipped with a complete set of navigation radios and systems providing enroute navigation capability.

Navigation may be performed with either the VOR/DME navigation radios, or the Flight Management System (FMS). The FMS uses the VOR/DME, Global Positioning System (GPS) and Inertial Reference System (IRS) for positioning and navigation.

The MCDUs provide the primary radio frequency selection and mode control, in addition to providing the interface with the FMS. Alternatively, frequencies may be selected on the Primary Flight Displays (PFDs) through the Cursor Control Devices (CCDs). The system provides a backup tuning page that may be used when a failure is detected. The backup page is displayed on MCDU 2 and enables tuning for NAV 1.

Additionally, the E190 is equipped with a weather radar system for detection and analysis of weather, or for ground mapping. The captain's and first officer's MFDs display radar data, and provides a virtual controller for the weather radar control. Weather data is may also be displayed on the PFDs.

15.1.2 Inertial Reference System (IRS).

General. The inertial system computes airplane position, ground speed, heading and attitude. The main component of the IRS is the Inertial Reference Unit (IRU), which interfaces with the Modular Avionics Unit (MAU), Global Positioning System (GPS), and Air Data Computer (ADC). The IRU provides output data to the PFD, weather radar, Multifunction Control Display Unit (MCDU), Flight Management System (FMS) and reversionary panel.

The primary source for the captain's PFD is IRS 1 and for the first officer's PFD is IRS 2. In case of mode failure, power loss, or loss of one IRU the affected side can source select the other side with the IRS reversionary panel button.

During power up, automatic alignment is provided. The alignment (up to 17 minutes) must be performed without aircraft movement and the position manually entered via MCDU using the GPS position. In flight alignment is also possible to recover navigation capability using data from the GPS. The alignment time can be checked on the MCDU

TCAS/XPDR Page 2/2:

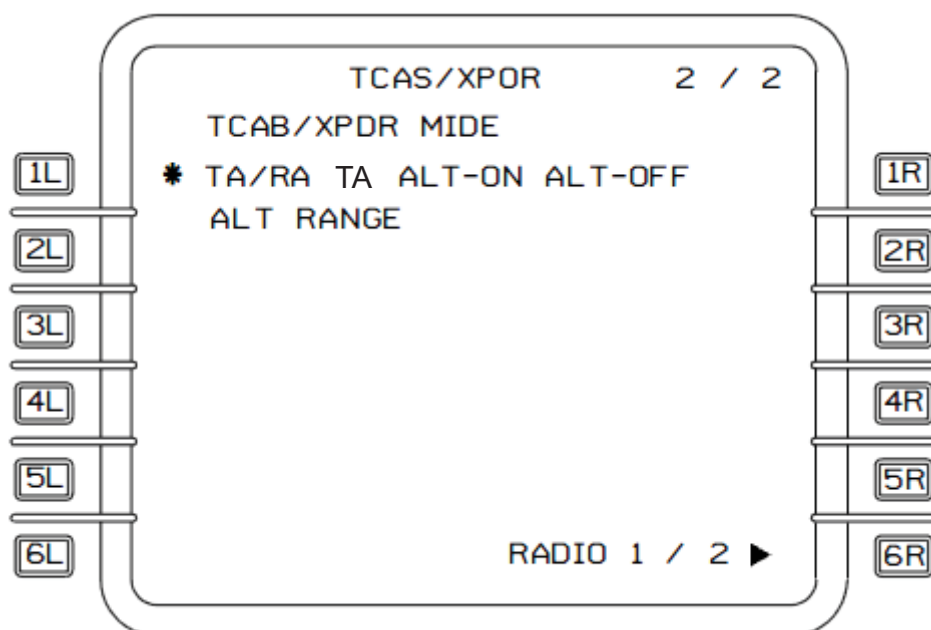
1. Press LSK 1L to cycle the transponder active modes:

TA/RA

TA

ALT-ON

ALT-OFF

**Figure 15.19 TCAS/XPDR Page 2/2****15.1.6 Weather Radar.**

The airplane is equipped with the WU-880 weather radar system. The system is designed primarily for detection and analysis of the weather during flight and for ground mapping. The MFD handles the display of radar data and, in addition, provides virtual controllers for weather radar control. Weather data is displayed on both MFDs and PFDs.

When operating in ground mapping, prominent landmarks are displayed which allows identification of coastlines, hilly or mountainous regions, cities or large structures.

The weather radar system consists of an integrated receiver transmitter antenna (RTA) unit and two virtual weather radar controllers. The RTA unit is mounted in the nose of the airplane. The virtual controllers consist of the CCDs and the weather mode information displayed on the MFDs.

Selection of weather data display is accomplished via the CCD actuating a soft key in the MFD to select the MAP menu and display the virtual controller on the MFD.

• Note •

For a description of the weather radar MFD controls and indications see [10.2.11 MFD Weather Radar](#)

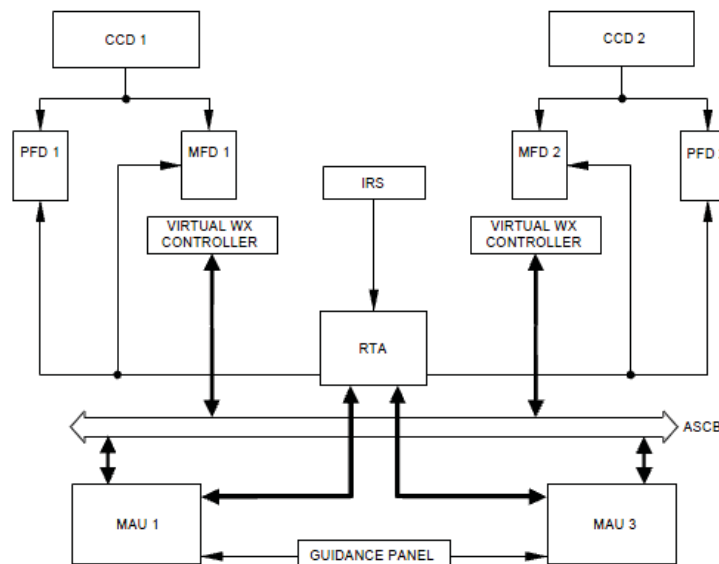


Figure 15.20 Weather Radar Schematic

WX Radar Modes. The WX radar incorporates five modes as follows:

Radar Weather Detection Mode (WX). The WX mode is used to detect areas of severe weather. This will allow the pilots to avoid areas of dangerous weather conditions and possible turbulence. If WX is selected before the initial Receiver Transmitter Antenna (RTA) warm-up, (approximately 90seconds), WAIT is displayed in the mode field, and the transmitter and antenna scan are inhibited.

Ground Mapping Mode (GMAP). This mode is used to alert the flight crew about hazards caused by ground targets. This is especially useful in areas of rapidly changing terrain, such as hilly mountainous areas. The selection of preset gain will generally provide the desired mapping display, however the gain can also be manually operated. One pilot may operate in GMAP while the other is using the WX mode.

• **Note** •

The ground mapping mode is not intended to replace EGPWS.

Standby (STBY)/Forced Standby (FSBY) Mode. The weather radar remains in a ready state, with the antenna scan motionless and stowed in a tilt-up position. Additionally, the transmitter is inhibited and the display memory is erased. The Receiver Transmitter Antenna (RTA) is in the forced standby mode on the ground, and FSBY is displayed in the mode field of the MFD display. Overriding forced standby requires both pilots to select FSBY OVRD on the menu item on the respective weather controllers or one pilot selects the antenna stabilization checkbox (STAB Off) 4 times within 3 seconds to enable the WX mode on the ground. The following table shows the RTA modes for each WX radar configuration:

Left Controller	Right Controller	Left Side	Right Side	RTA Mode
OFF	OFF	OFF	OFF	OFF
OFF	Standby	Slave Standby	Standby	Standby
Standby	OFF	Standby	Slave Standby	Standby
OFF	ON	Slave ON	ON	ON
ON	OFF	ON	Slave ON	ON
Standby	ON	Standby	ON	ON
ON	Standby	ON	Standby	ON
ON	ON	ON	ON	ON
Standby	Standby	Standby	Standby	Standby

Off Mode. Turns the radar off, provided OFF is selected on both virtual controllers. The system is no longer radiating power and the antenna is stowed.

Slave Mode. One controller is in the OFF position while the other controller is in the operating mode. The operating controller is in control of both sweeps.

WX Radar Functions. The WX radar incorporates ten functions as follows:

Turbulence Detection (Turb) (WU-880 ONLY). The radar processes return signals to determine if a turbulence signature is present. Areas of moderate, severe, or extreme turbulence are displayed in soft white. TURB may only be engaged in the WX mode ranges of 50 NM or less.

• Note •

There is a possibility that the turbulence function annunciation in the MFD and PFD will remain displayed for ranges above 50 NM even though the function is deactivated. Range selections of 200 NM or greater always clear the turbulence function annunciation.

Antenna Stabilization. The antenna is stabilized in pitch and roll using attitude information from the IRU. Momentarily selecting the **STAB Off** checkbox disables the antenna stabilization and causes an amber **STAB** to be displayed on the MFD.

Receiver Gain (Gain). The **GAIN** control varies the RTA receiver gain. There are two modes: variable and calibrated. The normal preset is the calibrated mode and is used for weather avoidance. The system will be forced into calibrated gain when **RCT** or **TGT** is selected. The variable mode is useful for additional weather analysis and for ground mapping. In **WX** mode, variable gain can increase receiver sensitivity above the calibrated level to show weak targets or it can be reduced below the calibrated level to eliminate weak returns.

Range. The range is set with the rotary knob on the **CCD** to the desired value (10, 25, 50, 100, 200, 300 NM). **OVRG** is displayed on the MFD when the range is selected above 300 NM.

Target Alert (TGT). The **TGT** function monitors for weather beyond the selected range and 7.5° on each side of the aircraft heading. If weather is detected within the monitored heading, outside the selected range and up to a range of 200 NM, the **TGT** annunciation changes from a green-armed condition to an amber alert condition on the MFD. This annunciation advises the flight crew that potentially hazardous weather lies directly in front and outside of the selected range. When this warning is received, the flight crew should select greater ranges to view the questionable target. Note that **TGT** is inactive when hazards are within the selected range.

Selecting the **TGT** function forces the system to a preset gain and turns off the variable gain mode. Selection of ranges of 200 NM or greater automatically turns off the **TGT** function and allows the variable gain mode. **TGT** can only be selected in the **WX** mode.

• Note •

The TGT annunciation on the MFD may still be displayed when the range is increased to 200 NM or greater, even though the function is deactivated. In such cases, systems logic follows the TGT function annunciation and the gain is automatically preset. Selection of the 1000 NM range always clears the TGT annunciation.

Sector Scan (SECT). The normal radar sweep is ± 60 degrees from the aircraft nose, at a rate of 12 sweeps per minute. Selecting the SECT push button reduces the angle of sweep to ± 30 degrees and increases the sweep rate to 24 sweeps per minute.

Tilt. The inner tuning knob on the CCD provides tilt control giving the pilot manual control of the antenna tilt angle. The CCD inner knob is a dedicated tilt knob if VAR Gain is not active. Tilt can be varied between 15 degrees up (clockwise rotation) and 15 degrees down (counterclockwise rotation).

Altitude Compensated Tilt (ACT). Automatically adjusts the antenna tilt according to the altitude and selected range. The TILT knob can be used for fixed offset corrections of up to 2.0 degrees.

Rain Echo Attenuation Compensation Technique (REACT). Automatically adjust sensitivity to compensate for attenuation losses as the radar pulse passes through weather targets on its way to illuminate other targets. The REACT compensation can be activated in all modes except the GMAP mode.

WARNING

The cyan field indicates areas where further compensation is not possible. This is a warning indicating that attenuation is hiding possible severe weather and should be considered very dangerous.

Test Function. The test function is selected on MCDU avionics test page. The test is used to select a special test pattern to allow verification of system operation. If fault codes are detected they will be displayed where tilt angle is displayed.

WARNING

Output power is radiated in the test mode when the WX radar is not in FSBY.

Terrain Mapping Selection. Terrain mapping is provided by EGPWS and is displayed on the navigation map of the MFD display when selected. There are two selection modes:

- Display selection through the MFD's MAP menu function
- EGPWS Auto pop- up during a terrain/obstacle caution/ warning

When an auto pop-up occurs, the MFD range is automatically changed to 10 NM. Terrain mapping is removable from the display via the MFD menu function. EGPWS modes and status are displayed adjacent to the navigation display. Weather radar data is disabled while terrain data is displayed. EGPWS range is controlled with the overall range control in the CCD. The range selections are 5, 10, 25, 50, 100, 200, 300 and 500.

The TERRAIN digital display shows the highest and lowest terrain/obstacle elevations.