AIRCRAFT SYSTEMS

SURVEILLANCE

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DSC-34-SURV-30 Weather Radar

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DESCRIPTION

Ident.: DSC-34-SURV-30-10-00014867.0002001 / 22 MAR 17
Applicable to:

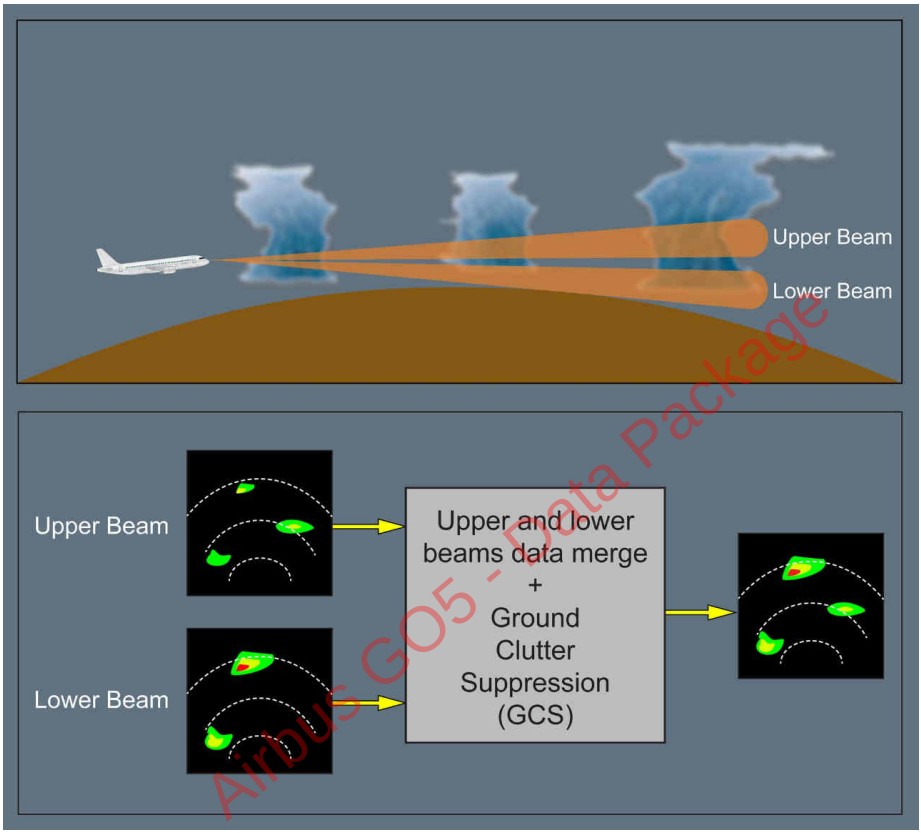
The aircraft is fitted with one or two ◁ Multiscan weather radar systems with a Predictive WindShear (PWS ◁) function and a weather hazard prediction function ◁ .
The flight crew can display weather data on the CAPT and/or F/O NDs in either ARC or ROSE mode.
The flight crew can adjust the brightness of the weather image on the ND thanks the outer knob of the ND Brightness Control knob (*Refer to DSC-31-50 Other EFIS Controls*).

Note: *A low brightness setting of the weather display may reduce the visibility of weather data, and therefore reduce crew awareness of the weather situation.*

The flight crew can use the radar in the following modes:
- Multiscan Automatic mode: MULTISCAN sw set to AUTO (recommended), or
- Manual mode: MULTISCAN sw set to MAN.

When in Multiscan Automatic mode:
- The radar alternatively scans at two antenna tilt settings. The weather radar image that is displayed is the result of the stored and combined information from each beam.
- When the gain selector is set to the Calibrated position (CAL), the radar automatically adjusts the gain based on various parameters (aircraft altitude, geographical area, season, time of the day) to obtain the best weather display.
- To prevent unnecessary clutter display, the “Quiet and Dark cockpit” philosophy removes the weather that:
  - is not on the aircraft flight path
  - is not a threat to the aircraft (post convective cell).
- The Ground Clutter Suppression (GCS) function removes the ground returns from the ND.

Multiscan Principle



When in Manual mode:

- The flight crew can adjust manually the antenna tilt settings, and can adjust gain either automatically or manually using knobs located on the radar control panel
- The GCS function is not available
- When the gain selector is set to CAL, there is no automatic gain adjustment based on altitude, geographical area, season and time of the day.

As a consequence, when the flight crew switches from the Multiscan Automatic mode with CAL gain to the Manual mode with CAL gain, the weather displayed on the ND may be significantly different.

GENERAL

Ident.: DSC-34-SURV-30-20-00020942.0004001 / 17 MAR 17
Applicable to:

The weather radar has a Predictive WindShear system (PWS) that operates when the PWS switch is in the AUTO position , and the aircraft radio height is below 2 300 ft, and

- Weather radar is ON (Radar sw on position 1 or 2), or
- Weather radar is OFF, and
  - At least one engine is running, and
  - Aircraft ground speed is greater than 30 kt, or
  - Aircraft longitudinal acceleration is above a given threshold during at least 0.5 s.

Note: *If two weather radars are installed, when the selected weather radar fails, the flight crew can recover the PWS function by selecting the operative system on the Radar sw of the radar control panel.*

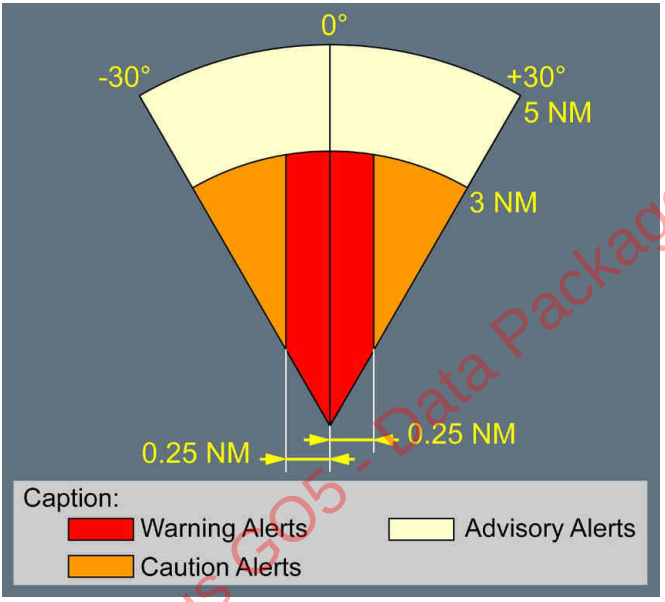
The system scans the airspace for windshear within a range of 5 NM ahead of the aircraft. When the system detects windshear, a windshear symbol appears on the ND (*Refer to DSC-34-SURV-30-30 PWS (if installed) indication on PFD and ND*).
Predictive windshear warnings and cautions are associated to an aural alert and to a red (warning) or amber (caution) "W/S AHEAD" message on the PFD , whereas windshear advisories are only displayed on the ND (*Refer to DSC-34-SURV-30-30 PWS (if installed) indication on PFD and ND*) without message on the PFD.

Alert Level	Aural Warning	PFD	ND (*Refer to DSC-34-SURV-30-30 PWS (if installed) indication on PFD and ND*)
Warning (Approach)	«GO AROUND WINDSHEAR AHEAD»	W/S AHEAD (red)	Windshear icon
Warning (Takeoff)	«WINDSHEAR AHEAD» (twice)	W/S AHEAD (red)	Windshear icon
Caution	«MONITOR RADAR DISPLAY»	W/S AHEAD (amber)	Windshear icon
Advisory	Nil	Nil	Windshear icon

WINDSHEAR ALERTS DURING TAKEOFF ROLL, UP TO 100 KNOTS

Ident.: DSC-34-SURV-30-20-00020944.0001001 / 17 MAR 17
Applicable to:

Windshear Alerts During Takeoff Roll, Up to 100 knots



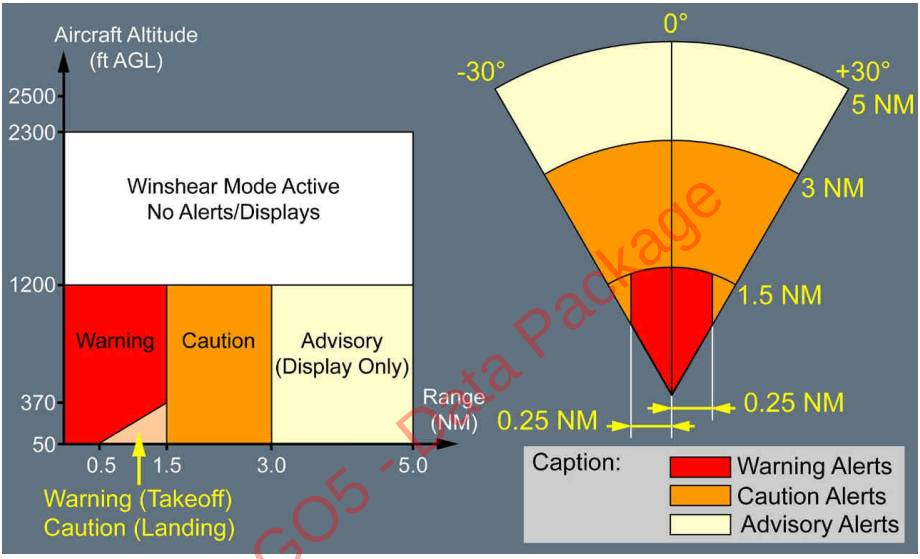
During the takeoff roll, up to 100 kt, both warnings and cautions are available within a range of 3 NM.

Note: *This is also applicable during taxi when weather radar is set to ON.*

WINDSHEAR ALERTS ABOVE 50 FEET

Ident.: DSC-34-SURV-30-20-00006422.0001001 / 12 APR 16
Applicable to:

Windshear Alerts Above 50 feet



During final approach, the visual and aural warning alerts are downgraded to caution alerts between 370 ft AGL and 50 ft AGL, and range between 1.5 NM and 0.5 NM.

WINDSHEAR ALERTS INHIBITION

Ident.: DSC-34-SURV-30-20-00006426.0002001 / 20 JUL 15
Applicable to:

At takeoff, alerts are inhibited above 100 kt and up to 50 ft.
During landing, alerts are inhibited below 50 ft.

The aural alerts of the Predictive WindShear system (PWS):
- Have priority over TCAS , GPWS , and other FWC aural warnings
- Are inhibited by reactive windshear detection and aural messages of stall warnings.

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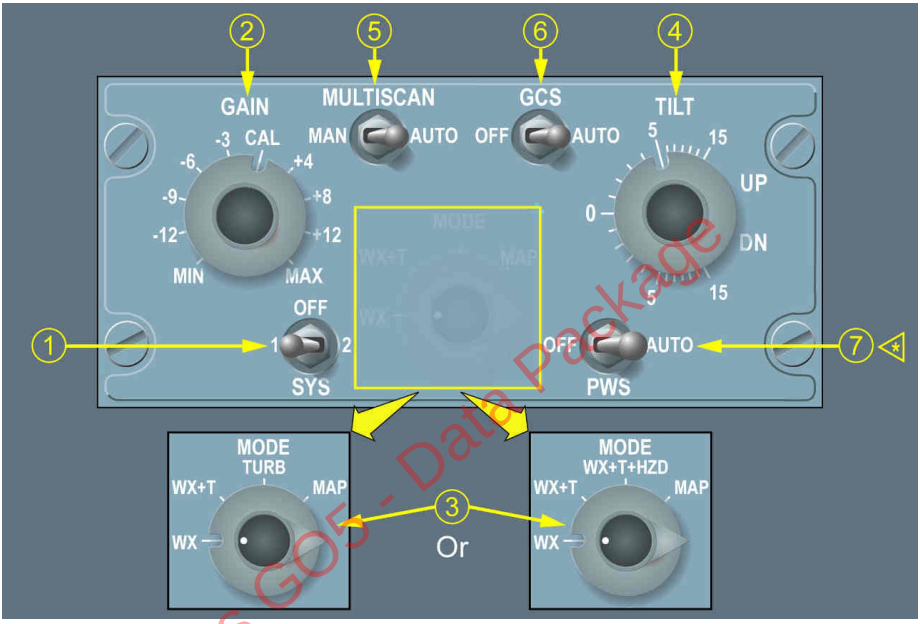
CONTROL PANEL

Ident.: DSC-34-SURV-30-30-00014841.0012001 / 21 MAR 17
Applicable to:



(1) Radar sw

This switch sets one radar to ON or turns both radars to OFF.

Note: *If only one radar is installed on the aircraft, either:*

- *a "INOP" or "DEACT" sticker replaces the "2", or*
- *a "ON/OFF" Radar sw replaces the "1/OFF/2" Radar sw.*

Note: *If only one radar is installed on the aircraft, no weather image is displayed on the Navigation Display (ND) when the "1/OFF/2" SYS sw is set to "2".*

(2) GAIN knob

This knob adjusts the sensitivity of the radar.

CAL is the normal position of the knob :

- When in Multiscan Automatic mode and gain set to CAL, the radar automatically adjusts the gain according to various parameters (aircraft altitude, geographical area, season, time of the day) to obtain the best weather display
- When in Manual mode and gain set to CAL, the radar adjusts the gain to a calibrated setting.

(3) Display mode selector

WX : Weather mode :
Colors indicate the intensity of precipitation (black for the lowest intensity, green, amber and red indicate progressively higher intensity).

WX+T : Weather and Turbulence mode :
The ND indicates precipitation and turbulence areas. Turbulence areas are displayed in magenta (within 40 NM).

TURB : Turbulence mode :
The ND only displays turbulence areas in magenta (within 40 NM).

WX+T+HZD: Weather, Turbulence and Hazard mode (recommended position) :
The ND indicates precipitation, turbulence areas in magenta (within 40 NM) and hazard prediction risk areas (*Refer to DSC-34-SURV-30-30 Weather Hazard Prediction Function Indication on ND*).
Hazard prediction function is only available when the MULTISCAN sw is set to AUTO.

Note: When MULTISCAN sw is set to MAN, WX+T+HZD mode is equivalent to WX+T mode.

MAP : Map mode :
The radar operates in ground mapping mode: black indicates water, green indicates the ground, and amber indicates cities and mountains.

(4) TILT knob
This knob adjusts the antenna tilt when MULTISCAN sw is set to MAN.
Zero indicates the horizon reference provided by the IRS.

(5) MULTISCAN sw

AUTO : Activates Multiscan mode
Multiscan controls the tilt automatically and combines two scans done at different tilt angles to optimize weather detection and minimize ground clutter.

MAN : When set to MAN, the crew can manually adjust the tilt by using the TILT knob.

(6) GCS sw
The Ground Clutter Suppression (GCS) switch is spring-loaded to the AUTO position.

AUTO : - If MULTISCAN sw is set to AUTO, the radar is in normal use. Ground clutter is not displayed on the screen
- If MUTLISCAN sw is set to MAN, the GCS sw has no utility. Ground clutter is displayed on the screen.

OFF : Ground clutter is displayed on the screen.

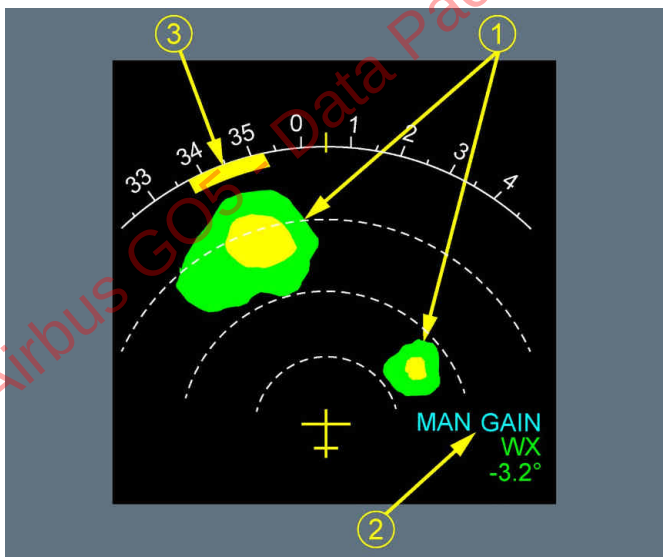
(7) PWS sw

AUTO : Activates the Predictive WindShear function in accordance with activation conditions (*Refer to DSC-34-SURV-30-20 Windshear Alerts Above 50 feet*).

OFF : The Predictive WindShear function is off.

WEATHER RADAR INDICATION ON ND

Ident.: DSC-34-SURV-30-30-00001255.0014001 / 21 MAR 17
Applicable to:



(1) Weather Radar Picture

- When the radar is operating, and when the ND is not in PLAN mode, the ND displays the weather radar picture.
- The weather echoes appear in different colors, depending on the precipitation rates (black, green, yellow, red or magenta for turbulence).
- The selected ND range will determine how often the image is refreshed.

(2) Weather Radar Indication

- 1st row: Gain Mode
  MAN GAIN appears in cyan when the flight crew selects the manual gain mode.
- 2nd row: Active Detection Mode
  - WX
  - WX+T
  - TURB
  - MAP
  - WX+T+H
  - PWS SCAN (only in green when the PWS function is active)
  - WXR OFF (only in white)

  Note: *Except for PWS SCAN and WXR OFF, the active detection modes are displayed:*

  - *In cyan if the manual mode is selected*
  - *In green if the automatic mode is selected*

- 3rd row: Tilt Angle
  The multiscan function of the weather radar alternatively scans at low and high beam, and automatically sets the tilt of these beams to optimize the weather radar detection. The displayed weather radar picture is the result of the storing and merging of the information from each beam.

  The tilt angle is the angle between the horizon and the radar beam axis. The value of the tilt angle is in degrees, and quarters of a degree. It is displayed:
  - In green, when the MULTISCAN sw is set to AUTO. This value represents the average of the lower and the upper beam tilts.
  - In cyan, next to the "MAN " indication, when the flight crew sets the MULTISCAN sw to MAN.

  When the multiscan function is lost, the tilt value is dashed and the "NO AUTO TILT" message appears in amber on the ND , until the flight crew sets the MULTISCAN sw to MAN.
- 4th row: Failure Messages
  The ND lists the detected failures.
  If the message is in "red", the ND does not display any radar image.
  If the message is in "amber", the image is not affected.

NO WXR (red)	:	Radar display failure.
WXR RT (red)	:	Radar transceiver failure.
WXR ANT (red)	:	Radar antenna failure.
WXR CTL (red)	:	Radar control unit failure.
WXR RNG (red)	:	Range error.
WXR DU (red)	:	Overheating of the display unit
WXR WEAK (amber)	:	Calibration failure.
WXR ATT (amber)	:	Attitude control failure.
WXR STAB (amber)	:	Antenna stabilization failure.
PRED W/S (amber)	:	PWS ⩤ function failure.
NO AUTO TILT (amber)	:	Automatic tilt adjustment failure.
WXR TEST (amber)	:	Radar system test.

(3) Path Attenuation Compensation (PAC) Alert

When the flight crew sets the display mode selector to WX or WX+T, or WX+T+HZD ⩤ and sets the gain to CAL, and when the aircraft is within 80 NM of a storm cell, the PAC alert is available.

The PAC alert displays a yellow arc on the outermost scale of the ND, when an intervening rainfall creates an attenuated area behind a storm cell (also called a radar shadow or attenuation effect).

Note: *The PAC alert is only available when the MULTISCAN sw is in the AUTO position.*

WEATHER HAZARD PREDICTION FUNCTION INDICATION ON ND

Ident.: DSC-34-SURV-30-30-00016149.0001001 / 20 JUL 15
Applicable to:

The Weather, Turbulence and Hazard mode (WX+T+HZD) enables the flight crew to have the following information displayed on the ND:

- The weather returns that appear in different colors, depending on the precipitation rates (black, green, yellow or red)
- The turbulence areas in magenta (within 40 NM)
- The weather hazard predictions computed by the weather radar.

For the weather hazard predictions:

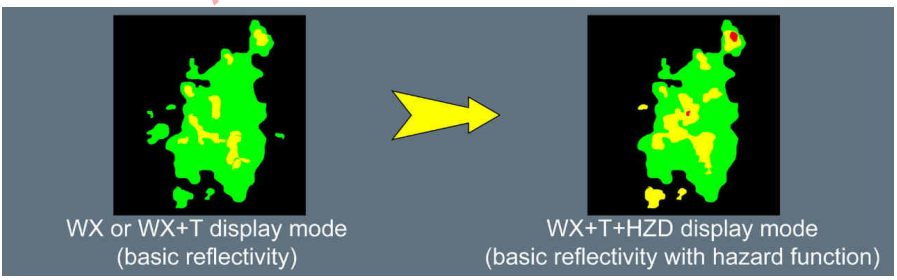
- The weather radar computes an automatic threat assessment of the lightning, hail and convective activity in a storm cell and in the area near the storm cell (Core Threat Assessment and Associated Threat Assessment)
- The weather radar is also able to alert the flight crew of storm cells that may rapidly build below the aircraft flight path (Predictive Overflight).

Note: *The hazard predictions are only available when the Multiscan mode is in AUTO.*

CORE THREAT ASSESSMENT

The Core Threat Assessment function operates until 320 NM. In case the weather radar determines that lightning, hail or turbulence may occur in a given cell. Native reflectivity color of the weather is increased in order to better reflect the threat associated with a cell core.
The adjustment can go up to a color level (green cells may become yellow, yellow cells may become red).

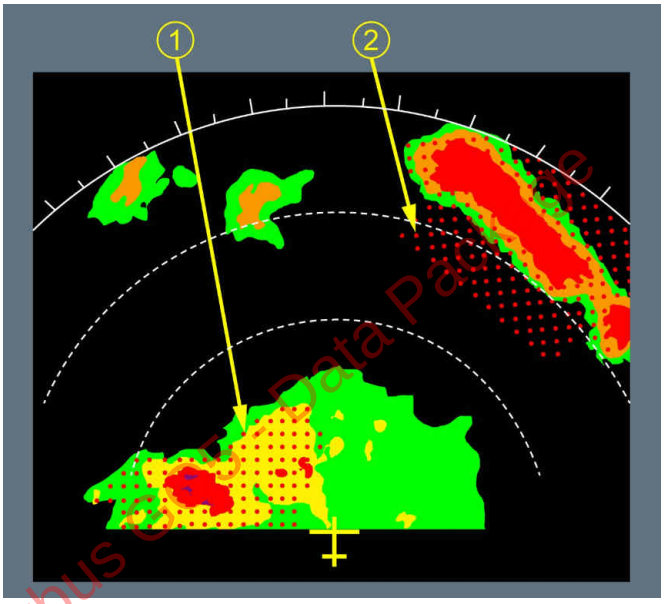
Core Threat Assessment



ASSOCIATED THREAT ASSESSMENT

Associated threat assessment enables to indicate an area of possible hail, lightning, and convection on the ND. This permits to identify potential threats even if there is no reflective activity in the area.

Associated Threat Assessment



Associated threats are represented by red dots on the ND and can be within the cell boundary or outside. Two types of indications can be displayed:

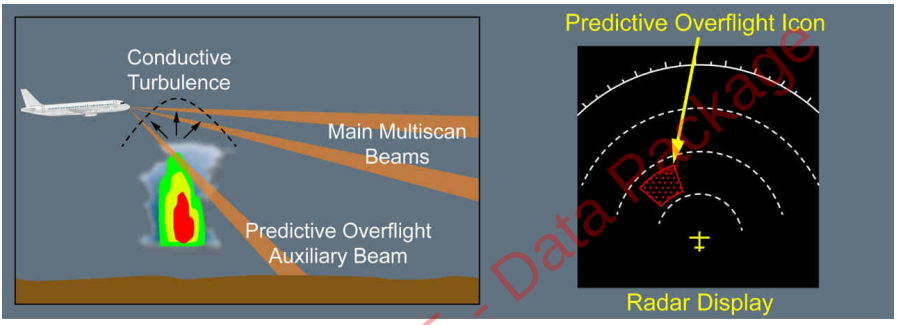
(1) The first type of indication is represented by red dots in the area of potential lightning and icing found in precipitation around the freezing level. This information is available only when the aircraft is below the freezing level or up to 6 000 ft above the freezing level.

(2) The second type of indication is represented by red dots in a rectangular shape on top of a storm cell displayed on the ND. The doted rectangle above a storm cell indicates a potential of icing, hail and/or lightning. This information is available at all altitudes. The rectangle may extend beyond the storm cell to indicate potential threats that can not be seen by the basic reflectivity function of the weather radar.

PREDICTIVE OVERFLIGHT FUNCTION

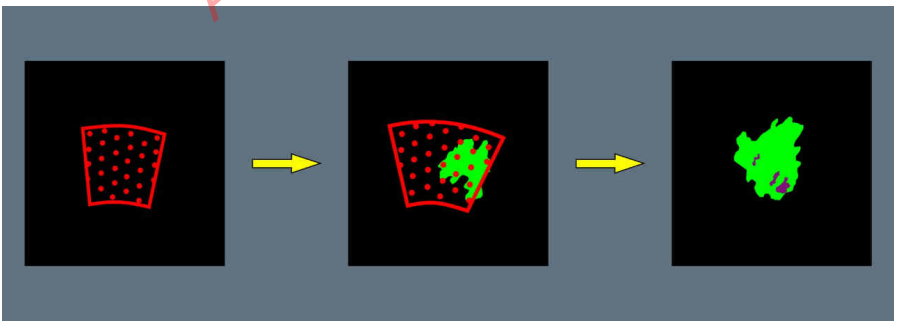
The predictive overflight function is active above 25 000 ft and operates up to 40 NM. Its aim is to indicate risk constituted by cells growing rapidly underneath main radar beams. For this purpose, an auxiliary beam with very low tilt searches for growing cells. When a conflict between a fast growing cell and the aircraft flight path is detected, a Predictive Overflight icon is displayed.
The Predictive Overflight icon is represented by an area of red dots with red boundaries.
As it is based on actual convection measurement, the flight crew should avoid predictive overflight areas.

Predictive Overflight Function



First, the icon is displayed “alone” over black when the concerned cell can not be displayed (the cell is much lower than aircraft flight level). Then, when cell reach aircraft flight level, the icon and the reflectivity are displayed together. Finally, the icon is removed 1 min after cell ceases to be considered as a threat by the weather radar or when the relevant depiction (i.e. at least red core) for the cell is displayed on ND.

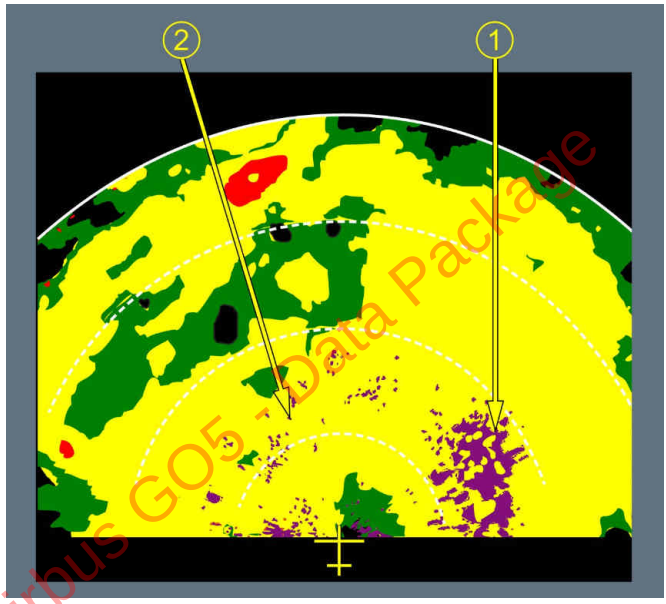
Predictive Overflight Icon Evolution



Note: *Avoidance of the detected weather always has priority over avoidance of the predicted hazards. The flight crew must apply standard storm avoidance recommendations in priority, and hazard areas should be avoided as much as possible.*

SEVERE AND MODERATE TURBULENCE DISPLAY

Example of Severe and Moderate Turbulence Display



The weather hazard prediction function provides two levels of turbulence:

(1) Basic plain magenta:
It indicates potential severe turbulences (available in WX+T or WX+T+HZD display mode).

(2) Speckle magenta:
It indicates potential moderate turbulences that could decrease passenger comfort (available only in WX+T+HZD display mode).

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