DO NOT USE FOR FLIGHT

CS Weather Radar User's Manual

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ABOUT THIS MANUAL

VERSION: 08 OCTOBER, 2009

WARNING: THIS MANUAL IS DESIGNED FOR MICROSOFT® FSX USE ONLY. DO NOT USE FOR FLIGHT.

Adobe Acrobat® Reader Required

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CS WEATHER RADAR PRODUCT

SPECIFICATION

The **CS Weather Radar** is available as a separate product at www.captainsim.com as 'one-click' installation .exe file.

File Name: csr001_XX00.exe

Size: ~3 MB

INSTALLATION

1. Right after a purchase you will receive an automated email message from Captain Sim Sales with your Order Number and download links.

Note:

- How to get the product download links if you did not receive our email receipts?
  - Please check-in to Your Profile
  - In Your Profile click: ***Product Name > Extended Download Service*** and download the product.

- Please keep your ORDER NUMBER safe. You will need it for future re-install, updates etc.

2. Download the .exe file to any folder. Please backup the files to avoid the extra charge in future please keep your downloads and Check-in info safe!

3. Double click on the .exe file and follow the prompts.

Note:

- YOUR PC MUST BE CONNECTED TO THE INTERNET FOR THE INSTALLATION.

- ORDER NUMBER IS REQUIRED FOR THE INSTALLATION.

- Links to the Manuals, Weather Radar (WXR) Editor and Uninstall will be available via: START > Programs > Captain Sim > CS Weather Radar >

UNINSTALLATION

Click START > Programs > Captain Sim > CS Weather Radar > Uninstall

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WXR EDITOR

To use the CS Weather Radar you should add it the to FSX aircraft *before flight*.
The WXR Editor is an utility that provides one-click addition and/or removal of the Radar to any FSX aircraft/rotorcraft.

TO ADD CS WEATHER RADAR TO ANY FSX AIRCRAFT/ROTORCRAFT:

1. Go to START > Programs > Captain Sim > CS Weather Radar > and click 'WXR Editor' to run WXR Editor.

2. Select either 'Aircraft' or 'Rotorcraft' option.

3. Using 'Select' list select an aircraft or rotorcraft you wish to add the CS Weather Radar to.

Note:
CS Weather Radar icon on the aircraft/rotorcraft preview means the CS Weather Radar is already added to selected aircraft/rotorcraft.

4. If the aircraft/rotorcraft has more than one panel: Using 'Select Panel' list select the aircraft/rotorcraft panel you wish to add the CS Weather Radar to.

5. Click 'Add WXR' button: Inscription on the button changes to 'Remove WXR'.

Done! CS Weather Radar is added to the aircraft/rotorcraft and available via FSX menu (Views > Instrument panels > CS Weather Radar).

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6. To close the WXR Editor panel click Exit (X symbol on WXR Editor) or Alt+F4.

TO REMOVE CS WEATHER RADAR FROM ANY FSX AIRCRAFT/ROTORCRAFT:

1. Go to START > Programs > Captain Sim > CS Weather Radar > and click 'WXR Editor' to run WXR Editor.

2. Select either 'Aircraft' or 'Rotorcraft' option.

3. Using 'Select' list select an aircraft/rotorcraft you wish the CS Weather Radar to be removed from.

4. If the aircraft/rotorcraft has more than one panel: Using 'Select Panel' list select the aircraft panel you wish the CS Weather Radar to be removed from.

5. Click 'Remove WXR' button: Inscription on the button changes to 'Add WXR'.

Done! CS Weather Radar is removed from the aircraft/rotorcraft.

6. To close the WXR Editor panel click Exit (X symbol on WXR Editor) or Alt+F4.

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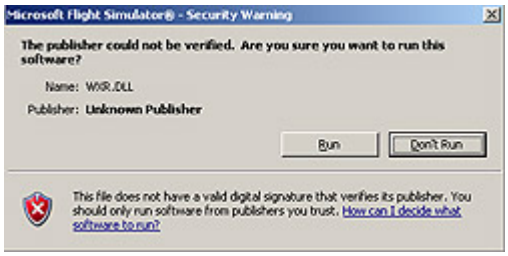
TO USE WEATHER RADAR IN FSX:

1. Run FSX.
2. Select aircraft/rotorcraft you added WXR to.

- You will see the dialogue message:



"The publisher could not be verified. Are you sure you want to run this software?
Name: WXR.dll
Publisher: Unknown Publisher"

Please make sure you click 'Run"

Then on the next pop-up window:

"Would you like to designate this module ([FSX Root Folder\Gauges\WXR.DLL) as "Trusted 'software? Select Yes to automatically load this software whenever you start Flight Simulator. Select No to load this software for this session only'

Please make sure you click 'Yes"

3. Press 'Fly Now'.
4. Go to FSX Main Menu > Views > Instrument Panel > and select 'CS Weather Radar' shortcut.

The Weather Radar panel will be displayed.

For details on Weather Radar operation please see the next sections of the Manual.

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THEORY OF OPERATION

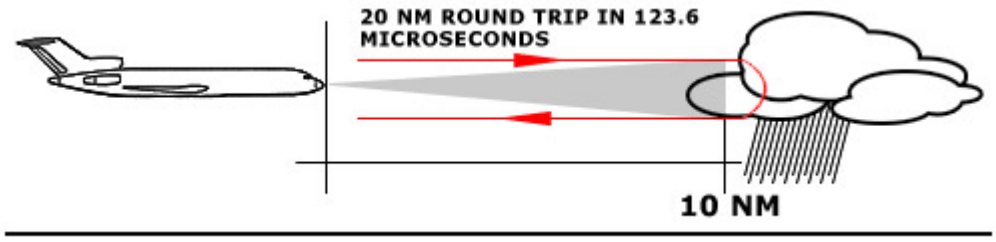
The primary use of this radar is to aid the pilot in avoiding thunderstorms and associated turbulence. Since each operator normally develops specific operational procedures for use of weather avoidance radar, the following information is presented for use at the operator's discretion.

Operational techniques for the radar are similar to earlier generation weather avoidance radars. The proficient operator manages antenna tilt control to achieve best knowledge of storm height, size, and relative direction of movement.

RADAR PRINCIPLES

Radar is fundamentally a distance measuring system using the principle of radio echoing. The term RADAR is an acronym for Radio Detecting and Ranging. It is a method for locating targets by using radio waves. The transmitter generates microwave energy in the form of pulses. These pulses are then transferred to the antenna where they are focused into a beam by the antenna. The radar beam is much like the beam of flashlight. The energy is focused and radiated by the antenna in such a way that it is most intense in the center of the beam with decreasing intensity near the edge. The same antenna is used for both transmitting and receiving. When a pulse intercepts a target, the energy is reflected as an echo, or return signal, back to the antenna. From the antenna, the returned signal is transferred to the receiver and processing circuits located in the receiver transmitter unit. The echoes, or returned signals, are displayed on an indicator.

Radio waves travel at the speed of 300 million meters per second and thus yield nearly instantaneous information when echoing back. Radar ranging is a two-way process that requires 12.36 micro-seconds for the radio wave to travel out and back for each nautical mile of target range. As shown in the distance illustration below, it takes 123.6 micro-seconds for a transmitted pulse of radar energy to travel out and back from an area of precipitation 10 nautical miles away.



WEATHER RADAR PRINCIPLES

Airborne weather avoidance radar, as its name implies, is for avoiding severe weather, not for penetrating it. Whether to fly into an area of radar echoes depends on echo-intensity, spacing between the echoes, aircraft capabilities and pilot experience. Remember that weather radar detects only precipitation drops; it does not detect minute cloud droplets, nor does it detect turbulence. Therefore, the radar provides no assurance of avoiding instrument weather in clouds and fog. The indicator may be clear between intense echoes; this clear area does not necessarily mean it is safe to fly between the storms and maintain visual sighting of them.

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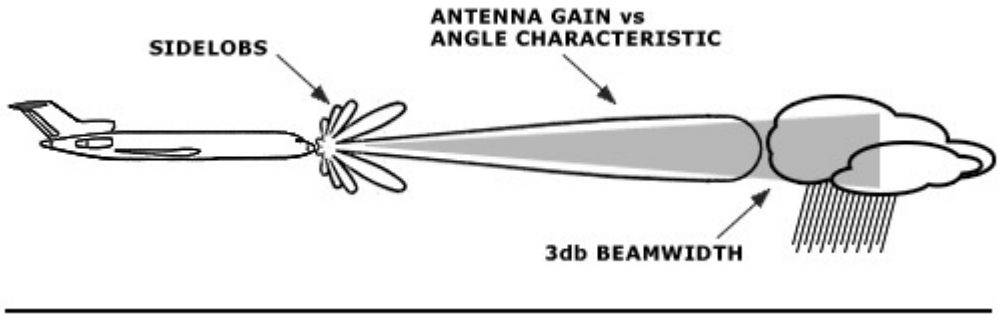
RADAR BEAM ILLUMINATION

Probably the most important aspect of a weather radar is the antenna beam illumination characteristic. To make a proper interpretation of what you are seeing on the display, you must have an understanding of what the radar beam "is seeing". The following figure is a side view of the radar beam characteristic with a storm depicted at a distance that causes the size of the storm to just fill the 3 dB beamwidth. This would be the typical situation for a storm at approximately 40 nautical miles with a 12 inch diameter antenna. It's important to understand and visualize this situation, to enhance your understanding of the rest of this manual.



RADAR REFLECTIVITY

What target will reflect the radar's pulses and thus be displayed on the indicator? Only precipitation will be detected by an X-band weather radar. Therefore weather radar does not detect clouds, thunderstorms or turbulence directly. Instead, it detects precipitation which may be associated with dangerous thunderstorms and turbulence. The best radar reflectors are raindrops and wet snow or hail. The larger the raindrop the better it reflects. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong echo. Drop size is the most important factor in high radar reflectivity.

The radar display has been calibrated to show five levels of target intensity: Black (level 0), Green (level 1), Yellow (level 2), Red (level 3), and Magenta (level 4).

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RADAR OPERATIONAL CONTROLS

1. BRT

Controls brightness of the indicator display (CW rotation for max brightness).

2. Wx

Selects the Wx (weather) mode of operation. "Wx" will appear in the lower left of the display. Wx colors are: Black for no returns, Green for weak returns, Yellow for moderate returns, Red for heavy returns and Magenta for intense returns.

3. WxA

Selects the WxA (weather-alert) mode of operation. "WxA" will appear in the lower left of the display. WxA colors are: Black for no returns, Green for weak returns, Yellow for moderate returns, Red for heavy returns and Magenta for intense returns. When the WxA mode is selected, magenta areas of storms flash between magenta and black at a 1 HZ rate.

4,9. RANGE

Clears the display and advances the indicator to the next range. The upper button increases range, the lower button decreases it. The radar display ranges are: 5, 10, 20, 40, 80, 160, 240, 320. The selected range is displayed in the upper right corner of the display with the range ring distance displayed along the right edge.

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5. STAB

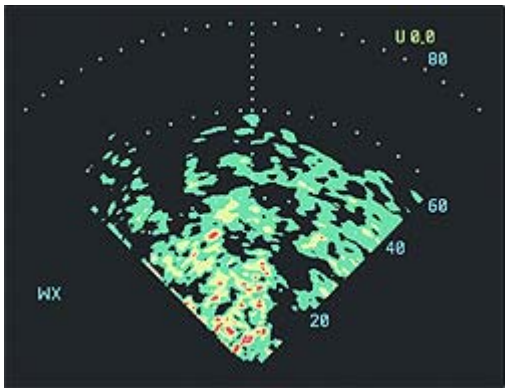
The On position provides normal stabilization. The Off position disables and the stabilization antenna tilt angle is controlled by the tilt control only.

6. GAIN

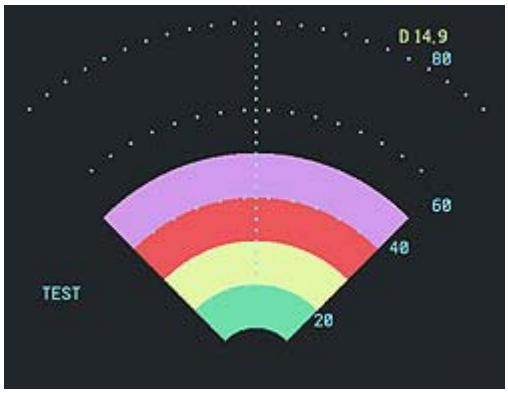
The gain knob adjusts the radar gain from 0 to -20 dB (CCW rotation reduces gain).

7. Radar Mode Selector

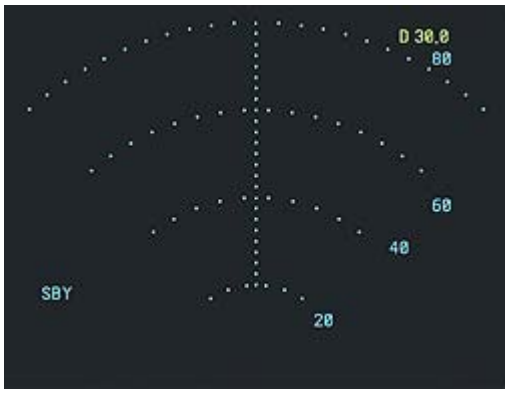
Note:
To select mode click the corresponding inscription shown as outlined red on the Weather Radar panel screenshot above.



ON - Selects the normal condition of operation for weather detection. The system will transmit after a 60 second warm-up time is completed. The radar system initializes to the Wx mode, 80 nm.
Note: The 60 second warm up period can be monitored upon power up of the system. When the knob is switched directly from OFF to ON mode, the display will blank. Just before the warm up period is complete, the screen will turn black for a few seconds, then the radar will begin transmitting and the screen will display radar returns. No radar transmissions occur until the warm up period is complete.



TEST - The multicolored arc display test pattern is displayed in this mode of operation. The test pattern is initialized and sized to fit the 80 nm range and can also be scaled with the range select buttons. No radar transmissions occur while TST is selected. TEST will appear in the lower left of the display.



STBY - Fully energizes the system circuitry but no radar transmissions occur in the SBY mode of operation. The antenna is parked at 0 degrees azimuth and 30 degrees tilt down with the antenna drive motors locked. SBY will appear in the lower left of the display.

OFF - Removes primary power from the radar indicator, but the radar still has power applied. The radar will remain active with no radar transmissions occurring, for up to a maximum time of 30 seconds. This time delay allows time to park the antenna at 0 degrees azimuth and 30 degrees tilt down.

8. ON Light

10. TILT/STAB

Permits manual adjustment of antenna tilt 15° up or down for best indicator presentation.
The tilt angle is displayed (yellow) in the upper right corner of the display: D = Down, U = Up..

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PREFLIGHT PROCEDURES

The system never transmits in the OFF, SBY or TST modes.

Accomplish the following procedures completely and exactly.

1) Place the radar controls in the following positions:
- Function switch to TST
- Tilt to UP 7 (will be shown on the indicator display, upper right corner).

The test pattern will appear.

2) With the function switch in TST or SBY, taxi to a clear area where there are no people, aircraft, vehicles, or metallic buildings within approximately 100 yards.

3) Rotate the function switch to ON. The indicator will automatically display in the Wx mode and 80 nm range. Weather targets will be displayed in green, yellow, red, or magenta. (Note: A 60 second warm up time period is required before the system will transmit).

4) Press the range-down button to display 40 nm as the maximum range.

5) Press the WxA button and observe that magenta areas (if any) flash.

6) Repeat the manual tilt adjustment, this time between the 0 and down 15 degrees positions.

7) Return the function switch to TST or SBY before taxiing!

8) When you are ready for weather detection (after takeoff or just before), place the function switch to ON.

OPERATION IN-FLIGHT - GENERAL

It is the purpose of this section to help you become a proficient radar operator as soon as possible. However, it is realized that proficiency can only improve with usage. It is, therefore, recommended that the operator become familiar with the operation of the system during fair weather instead of while trying to penetrate a storm front.

This section concerns itself with a more detailed discussion of some of these controls and how to make the most efficient use of them.

Note

Your radar is a weather-avoidance device. It should never be used for weather-penetration. It will help you see and plan avoidance maneuvers around significant weather encountered during flight.

TILT MANAGEMENT

Effective antenna tilt management is the single, most important key to more informative weather radar displays. The prime factors must be kept in mind for proper tilt management:
- The center of the radar beam is referenced to the horizon by the aircraft vertical reference system.
- Adjusting the antenna tilt control will cause the center of the radar beam to scan above or below the plane of the attitude reference system.

When flying at high altitudes, the use of proper tilt management ensures observation of weather targets without over scanning. For example, a low altitude storm detected on the long range setting may disappear from the display as it is approached. While it may have dissipated during your approach toward the storm, don't count on it. It may be that you are directing the radiated energy from the antenna above the storm as you get closer. Judicious management of the antenna tilt control will avoid over-scanning a weather target.

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EARLY DETECTION OF ENROUTE WEATHER

To set the antenna tilt to optimize the radar's ability to quickly identify significant weather, follow these steps:
1) Select the Wx (weather) mode of operation. Adjust Brightness control as desired.
2) Select the 50 or 80 nm range.
3) Adjust the antenna tilt to watch the strongest returns seen on the display.

TARGET RESOLUTION

The ability of a weather avoidance radar system to resolve and display two or more closely spaced targets is limited in range by the transmitted pulse width and display range and in azimuth by the antenna beam width.

RANGE RESOLUTION

The transmitter pulse width in the radar is 4 micro-seconds, yielding a receiver range resolution of approximately 1/3 nautical mile.

AZIMUTH RESOLUTION

The ability of the radar to resolve adjacent targets in azimuth is a function of the beam width of the antenna and the range to the target. The diameter of this radiated beam increases as it gets further away from the aircraft.

Targets separated by a distance less than the beam diameter (at the target distance) will merge and appear on the indicator as "one."

PATH PLANNING

Remember to plan a deviation path early. Simply skirting the red or magenta portion of a cell is not enough. Plan an avoidance path for all weather echoes which appear beyond 100 nautical miles since this indicates they are quite intense.

The most intense echoes are severe thunderstorms. Remember that hail may fall several miles from the cloud, and hazardous turbulence may extend as much as 20 nautical miles; therefore, echoes should be separated by at least 40 nautical miles before you fly between them. As echoes diminish in intensity, you can reduce the distance by which you avoid them.

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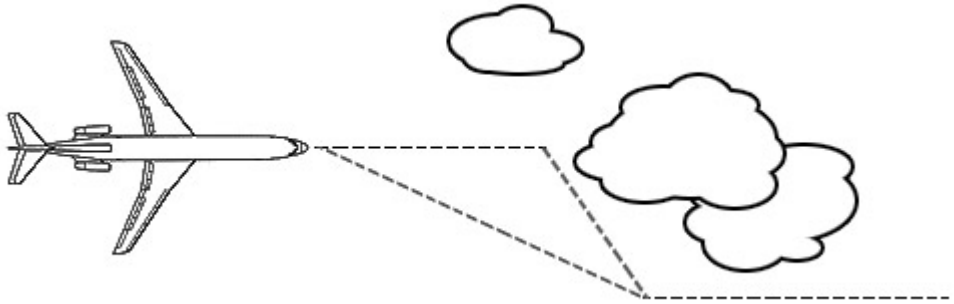
PATH PLANNING CONSIDERATIONS

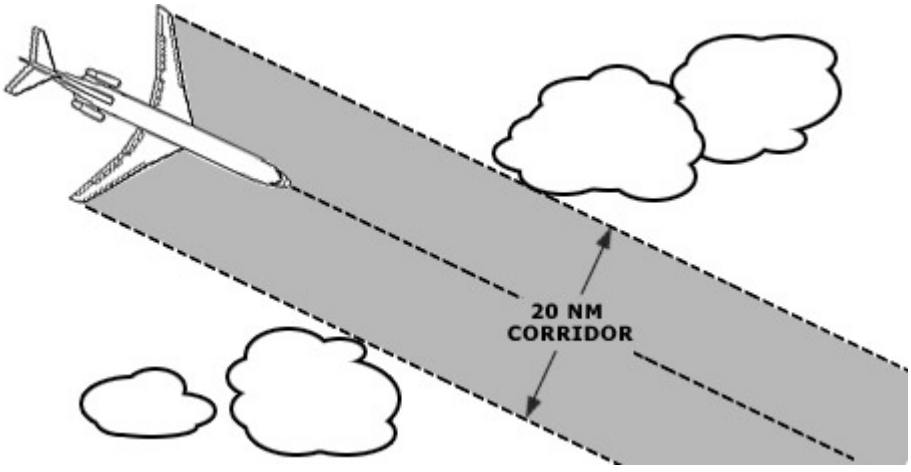
• Avoid cells containing magenta and red areas by at least 20 nautical miles.
• Do not deviate downwind unless absolute necessary. Your chances of encountering severe turbulence and damaging hail are greatly reduced by selecting the upwind side of the storm
• If looking for a corridor, remember corridors between two cells containing magenta and/or red areas should be at least 40 nautical miles wide from the outer fringes of the radar echo. The magenta displays areas of very heavy rainfall and statistically indicates a high probability of hail.

Note:

Do not approach a storm cell containing magenta and red any closer than 20 nautical miles. Echoes should be separated by at least 40 nautical miles before attempting to fly between them.



Cells beyond 75 nautical miles are areas of substantial rainfall, do not wait for red or magenta to appear. Plan and execute evasive action quickly to minimize "doglegging."



When a complete detour is impractical, penetration of weather patterns may be required. Avoid adjacent cells by at least 20 nautical miles.

A "Blind Alley" or "Box Canyon" situation can be very dangerous when viewing the short ranges. Periodically switch to longer-range displays to observe distant conditions. As shown below, the short-range returns show an obvious corridor between two areas of heavy rainfall but the long-range setting shows a larger area of heavy rainfall.

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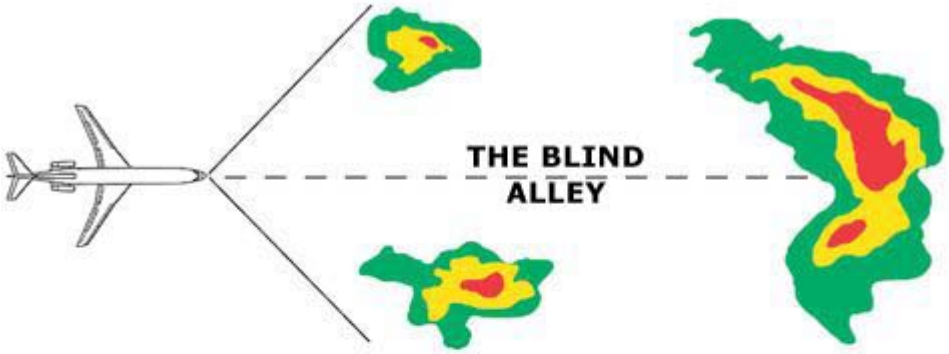

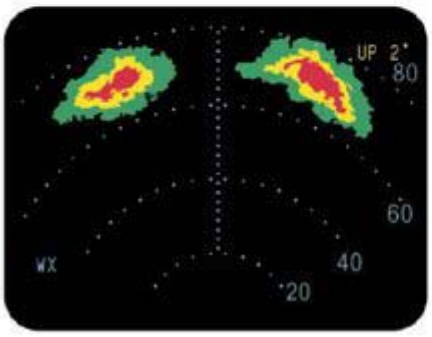

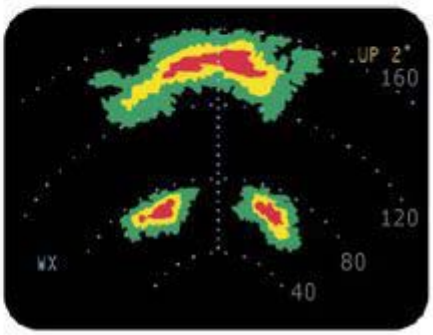

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CUSTOMER SUPPORT

For Customer Support please visit: http://www.captainsim.com/support/

Thank you,
Enjoy your flight!

Captain Sim Team
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