

**STAR 003**  
V2 – December 14

**Weather Radar**

Turbulence has produced more serious injuries to passengers and cabin crew than any other class of incident/accident. One method to lessen the risks presented by turbulence, is to improve in-flight turbulence avoidance decision-making. This STAR provides recommendations for effective weather radar use in-flight in order to address this problem.

NB: The following advice is predominantly for use in the cruise. Required Tilt and Range selections in the climb and descent will vary; however, it is still recommended that a practical scanning method involving changing Tilts and Ranges is employed during these phases of flight.

**WEAK RETURNS**

A weaker return does not necessarily mean less turbulence:

- returns can be attenuated by the most adjacent weather
  - returns in the cruise may appear to be insignificant; eg slight returns at FL370 with zero radar tilt can mean that a storm cloud is building well-above flight altitude
- **In both cases continual radar monitoring is essential, and perhaps until proven otherwise, the worst should always be assumed.**

Thunderstorm tops simply don't paint very well, if at all. In fact with a tall storm as much as the top third of the cell can be made up of ice crystals or vapour, both of which are poor radar targets; eg on a 40,000ft tall thunderstorm everything above 27,000ft might not be detectable. Geographic location also plays a part in the percentage of a cell that is just vapour or ice crystals.

- **The important point is don't count on detecting the top part of a storm cell – tilt the radar down!**

**TILT CONTROL**

The lower your height AGL, the higher the tilt has to be set to eliminate Ground Returns – this also applies on the ground when assessing your departure direction during taxi-out.

At low altitudes a movement of tilt upwards of several degrees can provide adequate painting of nearby storms – whereas at high altitudes, a small variation (+/- 0.5°) in the wrong direction could result in "non-detection".

- **Proper tilt management is essential in order to get useful information from your radar.**

**CRUISE PARK POSITION**

A "best-practice" tilt position for the radar during the cruise portion of a flight (park position) is recommended. Tilt the radar down until the ground return arc is displayed just inside the 80nm range - this will provide a better chance of scanning the detectable (lower) parts of storms.

Beware though, if the tilt setting used for long ranges is left unchanged, this could negate the effectiveness of the radar detecting storms at short ranges.

- **Every time the Range selection is changed, consider changing the Tilt.**

**SCAN in IMC**

If Tilt and Range are set to keep track of the bigger (more visible on radar) storms you can easily drive right through the top of a drier storm (less visible on radar).



- **In IMC an effort must be made to methodically and regularly use the weather radar for scanning the sky ahead.**

### **SMALL and ISOLATED CELLS**

Look for any target that appears as more or less round with smooth edges. When returns are within 40nm there's a good chance the tops of it are near or even above your altitude: if it is still painting inside of 20nm it is certainly up at your level.

- **Tilt may need to go as low as  $-3$  to  $-4^\circ$  as Range is reduced occasionally to 40 or even 20 NM.**

### **TIPS**

- If you encounter rain at medium to high altitudes it is there because of convection, therefore regardless of its intensity, expect turbulence: scan down and the active weather will be displayed.
  - When winds aloft are strong and produce "anvils" try checking the upper part of the CB by tilting the radar up – you may display a return. Upwind deviations are preferred, otherwise avoid the anvil.
  - Frequently experiment with the radar when flying VMC where large clouds are visible.
- **If active cells are painting on the radar, and you are manoeuvring to avoid the build-ups – or you are just uncertain about what the radar is telling you - then instigate standard procedures for encountering turbulence including warning the crew, securing the cabin, and adjusting speed – maybe even revise handling techniques if it has been a long time since you last used them!**

### **TECHNOLOGY**

- For radars with Turbulence Mode don't fly through something you wouldn't otherwise penetrate just because there's no turbulence indicated.
- Predictive Wind-shear is a huge safety advance and any alerts from that system must be taken seriously.
- If your radar has a setting to reduce Ground Returns, beware, some weather returns may also be eliminated.
- Some modern cockpit displays are often selected for optimal navigational information which may not be the ideal range for detecting nearby storms.

### **COORDINATE with ATC**

ATC may have accepted your requested deviation as a radar heading.

- **Requests to deviate or regain track must be clear and as precise as possible.**

### **TERRAIN WARNING:**

- **When avoiding weather consider terrain: not just during the climb and descent, but also when in the cruise; the sudden onset of a high rate of descent can bring you uncomfortably close to the ground.**

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