

Terrain Avoidance Plan

There have been over 380 fatal night VFR accidents since 1993. This AOPA Air Safety Foundation Safety Brief explains how you can use readily available information on VFR and IFR aeronautical charts to avoid obstacles and terrain when flying.

Avoiding terrain and obstacles, especially at night or in low visibility, is easier if altitudes already shown on VFR and IFR charts are used as part of your preflight planning.

VFR Charts

On VFR sectional charts the Maximum Elevation Figure (MEF) gives pilots an obstruction-free altitude. The MEF is determined by rounding the highest elevation (or obstruction height) within the quadrangles of latitude and longitude to the next 100-foot level. These altitudes are then adjusted upward between 100 to 300 feet. On the VFR sectional in figure 1 the MEF is 9,700 feet mean sea level (msl). The highest peak within this quadrangle is (highlighted) 9,396 feet msl. **In some cases the MEF can provide as little as 101 feet of obstacle clearance.**

IFR Charts

IFR low altitude enroute charts offer a few more obstacle free altitudes than do VFR charts.

Within the quadrangles of latitude and longitude shown on the IFR enroute low altitude chart in figure 2, the Off Route Obstruction Clearance Altitude (OROCA) is 3,500 feet.

This altitude guarantees a 1,000-foot obstacle clearance in non-mountainous terrain and a 2,000-foot obstacle clearance in designated mountainous areas. OROCA can be used at night or when visibility is reduced to ensure obstacle clearance.

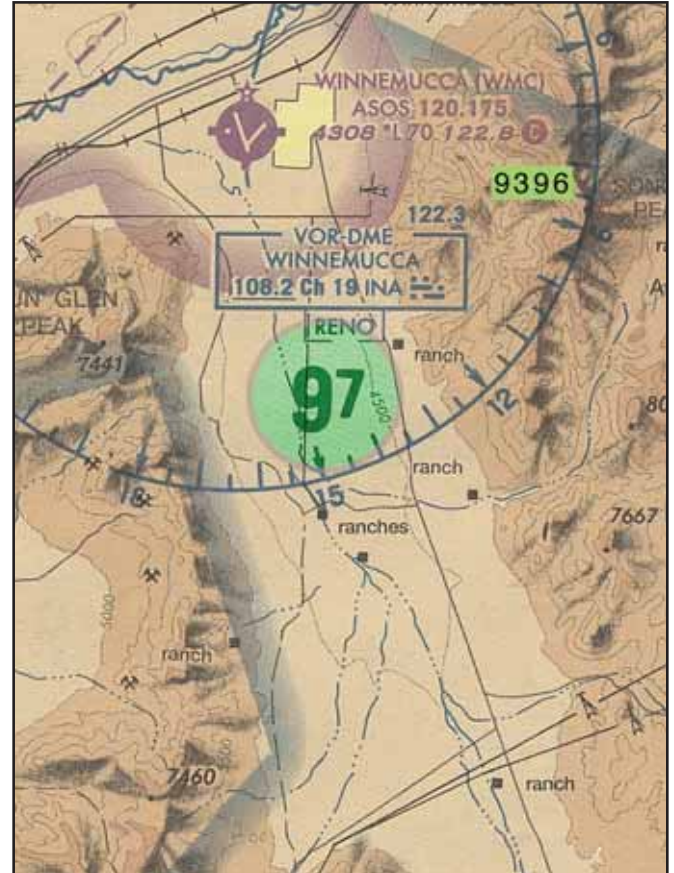


Figure 1: VFR sectional chart showing a MEF of 9,700 feet.

The Minimum Enroute Altitude (MEA) highlighted on this chart is 6,000 feet. This altitude meets obstacle clearance requirements and provides acceptable ground based navigation signal coverage.

The Minimum Obstruction Clearance Altitude (MOCA) highlighted is 3,000 feet. On government charts this altitude is shown with an *. MOCA is the lowest altitude between two fixes that meets obstacle clearance requirements. This altitude only assures an acceptable ground based navigation signal within 22 nautical miles of a VOR. Satellite based navigation systems, like GPS, will still receive navigation signals at these altitudes. OROCA, MEAs, and MOCA are found on IFR enroute low altitude charts. (Figure 2)

If an aircraft is in radar contact and talking to ATC, the aircraft may receive a minimum safe altitude warning, or MSAW, from ATC when flying at an unsafe altitude. Pilots on an IFR flight plan may receive an MSAW if needed. VFR pilots, wanting a little help from ATC, must be receiving flight following in order to take advantage of ATC services. Pilots should understand that MSAWs are not guaranteed. After controllers receive the warning it must be passed along to the pilot. If the aircraft is out of radio range, the pilot may not hear the MSAW. If the low altitude is due to spatial disorientation the pilot may not be aware of, and may be unable to recover from, the altitude loss.

Flight Planning

When planning a flight look at the MEF and OROCA. Be sure the planned cruise altitude is above the MEF or OROCA. If you have to descend during a flight due to weather use these altitudes as your de facto *minimum* cruise altitude. When planning your flight remember that the MEF and OROCA are listed in msl and ceilings are in agl. Ensure that your planned altitude will not only keep you clear of obstacles, but also keep you clear of the clouds.



Figure 2: IFR enroute low altitude chart showing an OROCA of 3,500 feet.

To learn more about avoiding terrain when visibility is limited, visit the resources below:

- *Obstacle Clearance Safety Quiz:*
www.aopa.org/asf/oshquiz.html
- *Beware the Dark Side:*
www.aopa.org/asf/asfarticles/2004/sp0407.html
- Accident analysis: www.asf.org/searches
(click on Night VFR Accidents.)

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