INSTRUMENT READINGS™

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Issue No. 4

OBSTACLE DEPARTURE PROCEDURES

Part 3

In the last issue, I promised to discuss Visual Climb Over Airport (VCOA) departure procedures and to show examples of more complex ODPs than was discussed in that issue.

A VCOA procedure is provided for use when the aircraft cannot make good a specified nonstandard climb gradient to avoid obstacles (usually terrain), and the obstacle environment does not permit a reasonable departure route that avoids obstacles using the standard climb gradient of 200 fpnm. Development of a VCOA is now mandatory when obstacles more than 3 statute miles from the departure end of runway (DER) require a greater than 200 ft/NM climb gradient. But it is not clear that that requirement is always being followed, and there are still departure procedures developed before the VCOA requirement was implemented.

There are two parts of a VCOA: the Initial Climb Area (ICA) and the Visual Climb Area (VCA). Both areas require visual obstacle avoidance, so don't be misled by their names. The ICA is an area beginning at the DER that encompasses the initial part of any instrument departure, in which you cross the DER at or above 35 feet AGL and climb on runway heading to 400 AGL at a gradient of 200 fpnm or better. The ICA extends for 2 nm from DER (200 fpnm X 2 nm = 400 ft. Duh!). Any obstacles in the ICA will be listed.

After reaching 400 AGL on runway heading, you are supposed to turn back to the airport and begin a circling climb to the specified altitude. Climb gradient is not really important during this climb, as you will remain within a containment area, the VCA. Obstacle avoidance during this climb is purely visual. Remember that during an approach circle-to-land maneuver, you are guaranteed obstacle clearance if you remain above the circling MDA and within the maximum allowed distance from the runway. And note that during the turn back from the initial climb and during the circling climb, you will be below approach circling MDA much of the time, and may be beyond the maximum circling approach distance from the runway. You are not guaranteed obstacle clearance in the VCA; you are responsible for visual obstacle avoidance. Keep this in mind if you have a misplaced thought about a night departure.

VCOA criteria are complex, as are most TERPS, and I do not intend to delve into all the details here, so I will present typical information. According to the TERPS criteria, the VCA is centered on the airport reference point (ARP) and has a radius of from two to seven miles, depending on altitude and the category of aircraft expected to use the procedure. The VCA will encompass the ICA. The VCOA climb-to altitude will be sufficient to allow guaranteed obstacle

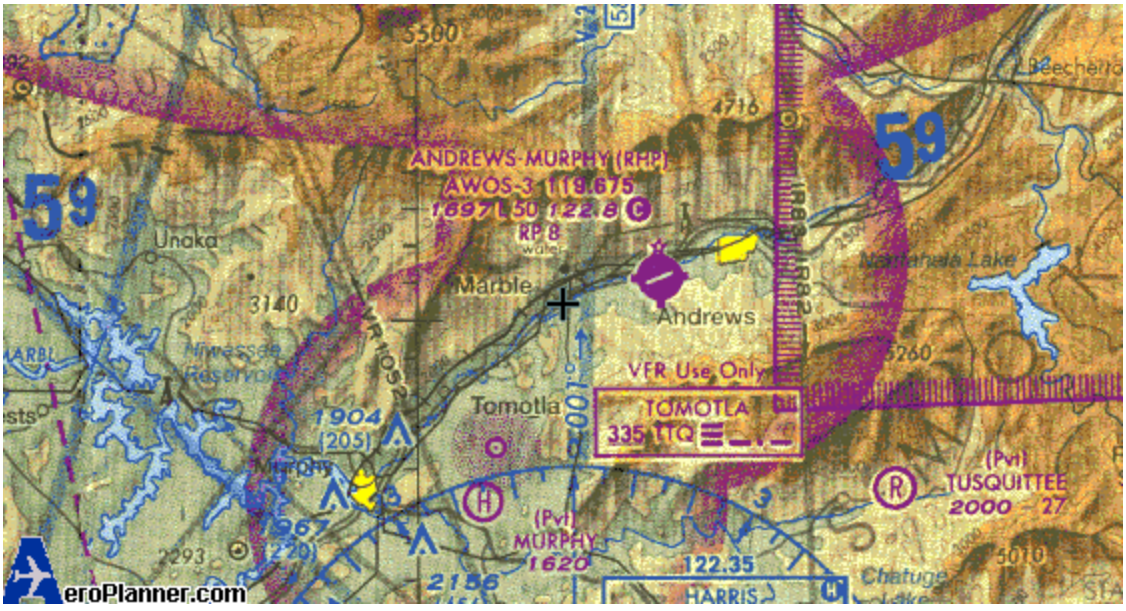
clearance when departing the VCA with a 200 fpnm climb, either a diverse departure in any direction or departure along a specified route, as given in the published procedure. A visibility will be published to allow obstacle avoidance on a see and avoid basis during the climb. A ceiling will be published sufficient to allow visual obstacle avoidance up to the climb-to altitude.

From the last issue of *Instrument Readings*, your homework assignment was to study the Takeoff Minima and ODP at Andrews-Murphy Airport, NC (KRHP). Let's examine that procedure to illustrate the VCOA concept. Airport elevation for KRHP is 1697 ft. For an idea of the terrain, see the Atlanta sectional at 3512N/08352W, or see the sectional extract below. You can also view a topographical map at www.topozone.com using the airport lat/long. The approach MDA is 4020 MSL, or 2323 AGL.

ANDREWS, NC
ANDREWS-MURPHY
TAKE-OFF MINIMUMS: **Rwys 8, 26,** max. 180 KIAS 3400-2, max. 210 KIAS 3400-2½, max. 250 KIAS 3400-3.
DEPARTURE PROCEDURE: **Rwys 8, 26,** procedure NA at night. Remain within 3 NM of Andrews-Murphy Airport while climbing in visual conditions to cross airport westbound at or above 4900. Then climb to 7000 via heading 251° and HARRIS (HRS) VORTAC R-356 to HRS VORTAC before proceeding on course.

First note that the takeoff visibility is dependent on speed. This is because of the greater turning radius required for higher-speed aircraft during the see-and-avoid obstacle avoidance maneuvers. The required ceiling is 3400 AGL, or 5097 MSL. Also note that the departure procedure is not authorized at night, presumably because of the requirement for visual obstacle avoidance.

The ODP says to remain within 3 nm of the airport. That is hard to do accurately on a purely visual basis, so I suggest staying as close as you can while climbing with a reasonable bank angle, and watching for wind drift. Remember turns around a point? A GPS set to the airport reference point can be useful in making sure you don't get too far away.



Step-by-step. On takeoff, cross the DER at or above 35 ft AGL and climb runway heading to 400 AGL, at a gradient of 200 fpnm or greater. Turn back toward the airport and begin a circling climb, staying within 3 nm of the airport reference point. No guidance is given as to which way to make the initial turn or which way to turn in the climb. Before departure, or upon arrival at the airport, you might make a visual assessment of the obstacle environment to see if you would

rather turn one way or another to maximize clearance from some obstruction. During the initial climb and at least the early stages of the circling climb, I suggest that you use your best climb gradient to get as high as you can in the shortest distance. Altitude is your friend. Continue the circling climb, visually avoiding obstacles, up to the specified climb-to altitude of 4900 MSL. (Note on the sectional how close 3 nm takes you to terrain on the north.) You are instructed to depart the VCA by crossing the airport westbound. Plan your last circle to allow this airport crossing. Then turn to heading 251 degrees and continue the climb at 200 fpnm or greater to 7000 MSL, intercepting the HRS R-356 radial inbound to the VORTAC, from which you can turn and climb to the course and altitude specified in your clearance. Correlating this to the sectional, you can see that the procedure takes you to the southwest down the valley, then south to the VORTAC, always up, up, up. The sectional shows MEFs of 5900 MSL, and the IFR low-altitude enroute chart shows OROCA of 8900. Along V267, which is HRS R-001, the MEA is 7800. Clearly you are in high terrain in this area and vigilance in maintaining climb rate and altitudes and courses is in order. You should definitely trim for the climb. You should also make sure that your airplane can maintain 200 fpnm at your planned climb speed at these altitudes.

This is a fairly long ODP that takes you far from the airport. Referring back to Issue #2 of *Instrument Readings*, make sure your clearance is consistent with flying the ODP. Your filed flight plan should have HRS as the initial route waypoint.

Another consideration in departing KHRP is that there is only one IAP, a GPS approach. If you do not have approach-certified GPS with current database, you cannot return to the field if needed.

VCOAs necessarily require a fairly high ceiling, and you may expect normal VFR traffic at the airport. This requires caution during the initial turnback maneuver and during the initial circling climb. You probably should just fly the standard traffic pattern once and begin climbing on the upwind leg over the runway, making appropriate self-announcements on the CTAF. Or if there is a control tower, coordinate with the tower. You have to coordinate your clearance with them anyway.

MEEKER, CO
MEEKER
TAKE-OFF MINIMUMS: **Rwy 3**, 2000-2.
Rwy 21, 1000-1¼.
DEPARTURE PROCEDURE: Climb visually within 3 miles southeast of airport to depart to 7400. Climb on EKR R-113 to 9000, then climbing left turn direct EKR VORTAC. Depart EKR VORTAC at or above 10500.

Here is another VCOA, Meeker, CO. This one is used as an example in the *Instrument Procedures Handbook*. The wording is garbled ("to depart to 7400"?), but ignoring the "to depart" words, we see the instructions to "climb visually within 3 miles southeast of airport to 7400". Remember that the VCA is centered on the airport reference point per TERPS. So what does "within 3 miles southeast of airport" mean? Your guess is as good as mine, but guessing can get you killed. I could guess that it means to stay within 3 miles of the airport on the southeast side, and that it doesn't really matter in the other directions. Looking at the sectional, that doesn't look right. The terrain to the west looks higher and closer, and is relatively benign to the southeast. It looks like they want you to circle southeast of the airport, like the VCA is shifted to the southeast. But what they want us to remain within 3 nm of is not clear. I think I would try to tap into local knowledge before flying this one. Notice that it does not say that the procedure is not authorized at night., but you have heard of the Darwin Award?

Here is one that is a little different, Eagle, CO (KEGE), elevation 6535. Note that you can depart either runway with a low ceiling if you can make good a climb rate of 480 fpnm, or you can fly a standard 200 fpnm gradient if the ceiling is 5100 or 5400 AGL. In either case you will follow the departure procedure. In the latter case, you will be visually avoiding a lot of obstacles, and you are assured that the standard climb gradient will not clear the obstacles. If there is the occasional little hill, you might avoid it with lateral maneuvering (if two mile visibility allows you to see enough to formulate a course of action). But the terrain in that area is extremely mountainous, and what you will actually be encountering is mountain ridges that you cannot outclimb at 200 fpnm. If you can see enough to turn away from the mountain in time, you can climb on the reverse of the course that got you there, then turn around and try again. This kind of meandering around in 2 mile visibility amongst mountains is not conducive to longevity. What you are doing here is flying along in a small bubble of visibility, attempting to avoid obstacles on a progressive basis, not knowing what lies ahead outside your little bubble. The word "obstacle" seems inadequate to describe a mountain.

EAGLE, CO
EAGLE COUNTY REGIONAL

TAKE-OFF MINIMUMS: **Rwy 7,** 5100-3, or 700-2 with a min. climb of 480' per NM to 11800. **Rwy 25,** 5400-3 or 1300-2 with a min. climb of 750' per NM to 10500.

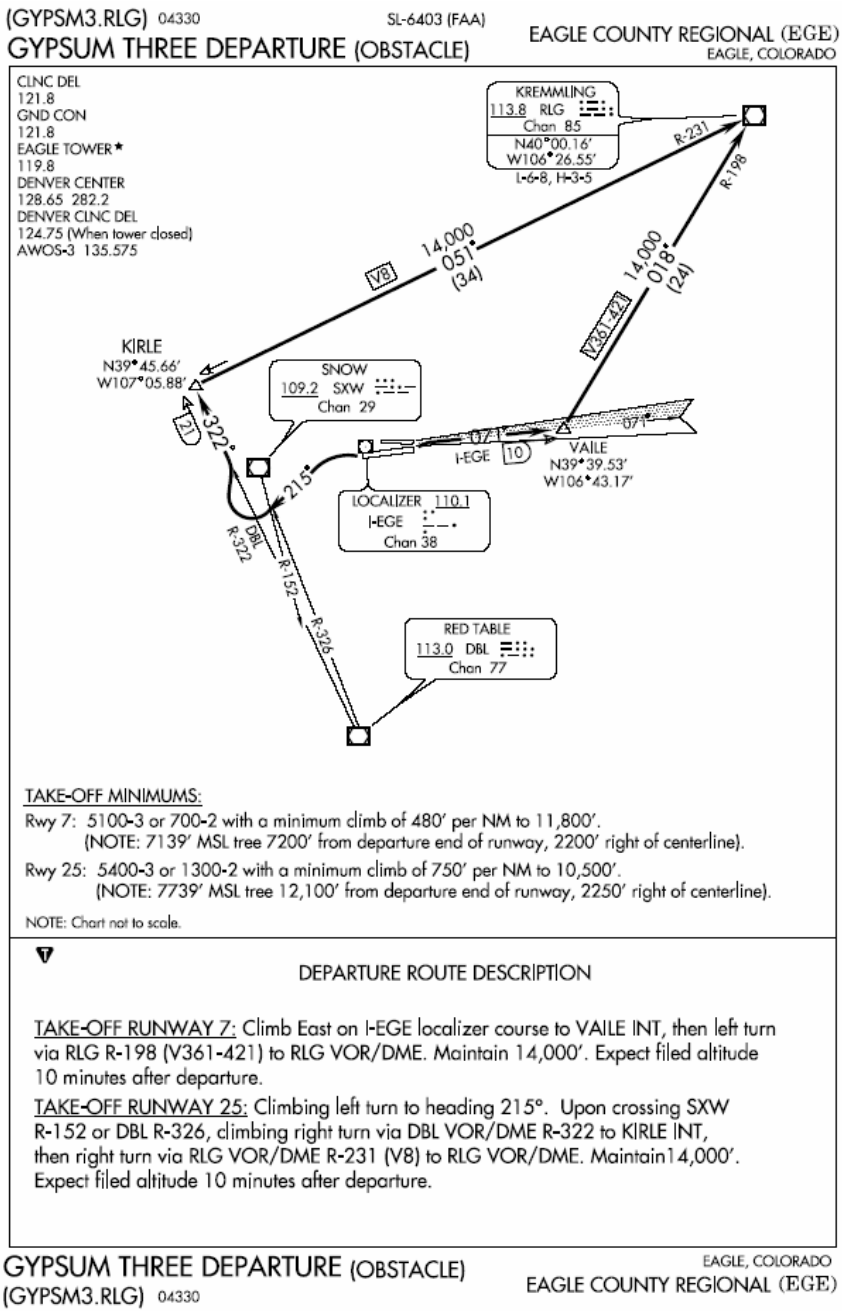
DEPARTURE PROCEDURE: **Rwys 7, 25,** use GYPSUM DEPARTURE.

NOTE: **Rwy 7,** 7139' MSL tree 7200' from departure end of runway, 2200' right of centerline. **Rwy 25,** 7739' MSL tree 12100' from departure end of runway, 2250' right of centerline.

If you can make the 480 fpnm climb gradient from 6535 MSL to 11,800 MSL, you can take off into the soup with a 700 AGL ceiling and 3 miles visibility. At 75 kts, you have to climb 600 fpm, and at 120 kts you have to make 960 fpm. I sure hope you have a turbocharged engine, and if you have two turbocharged engines, I sure hope both of them keep working. Note to multiengine pilots: always plan your departures on the basis of One Engine Inoperative. Or have a good Plan B. TERPS is quite clear that it makes no allowance for inoperative equipment or degraded performance.

Note the 7139 MSL tree 7200 ft from DER. That tree is 604 ft above and 1.18 nm downrange from DER. The climb gradient necessary to go over it with the required obstacle clearance is 671 fpnm. That is quite demanding, so the procedure designer raised the ceiling to 700 ft to be above the obstacle and requires that you visually avoid it. Remaining obstacles along the departure path will be cleared by virtue of the 480 fpnm climb gradient.

The next important thing about the Eagle departure is that no textual description is provided. The departure procedure is sufficiently complex that a graphical depiction of it is warranted, and this one is called the GYPSUM THREE DEPARTURE (OBSTACLE). The DP can be distinguished from a Standard Instrument Departure (SID) by the word OBSTACLE in the title. Although a SID includes obstacle avoidance, it is primarily driven by ATC considerations. A graphical ODP is primarily concerned with obstacle avoidance, although it may be influenced somewhat by ATC and noise considerations.



To prevent unnecessary cross-referencing of the takeoff minima in TPP Section C and the graphical ODP in the IAP section, the takeoff minima are duplicated on the ODP chart.

If you examine the terrain on the sectional or one of the IAPs for Eagle, you will note that the Rwy 25 departure routes you around a mountain.

Go back and look at the ceiling required for a 200 fpnm departure, choosing rwy 7 for example; it is 5100 ft AGL, or 11,635 MSL. This is very close to the 11,800 MSL altitude below which a higher than standard climb gradient is required for obstacle clearance. That ceiling supposedly allows all the obstacles that cannot be climbed over with a standard gradient to be seen and avoided. I have already pointed out the difficulties of avoiding obstacles, which we know cannot be climbed over, on a progressive basis while flying along amongst the mountains inside a little visibility bubble. This is exactly the kind of situation that VCOAs were created for. The date on the version of the ODP chart as of this writing is late 2004, so it has been generated or revised well after the time when VCOAs came into being. No VCOA is

provided, even though it seems to fall within the mandatory VCOA criteria. This illustrates the caution that must be applied when departing under ODPs.

There are those who believe that, if you can't make the climb gradient, you shouldn't depart that airport and runway, unless you have unlimited visibility and local knowledge. That is, unless a VCOA is provided. Some advocate a somewhat less restrictive approach: if you can't make the climb gradient, improvise a VCOA by climbing in visual conditions over the airport to the specified ceiling altitude, then crossing the DER at that altitude and following the ODP from that point, maintaining the minimum 200 fpnm climb gradient. As long as there aren't any close-in obstacles, this looks safe to me. But it always helps to have local knowledge. If you do this, be sure to coordinate with ATC so your clearance accommodates your intentions.

There will be one more installment in this series of articles on Obstacle Departure Procedures, then I will move on to other topics.

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