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When driving your car and cruising along Interstate Highway 70, you have a road map and a *constant* series of highway identification signs telling you where you are and when to change highways when you want. Flying along V-70, you have an enroute navigation chart—but *no* airway identification signs to see out the window. The only way you even know you are on the right airway is by a panel full of knobs, dials, buttons, CDI needles, HSI, some electronic displays, etc. Maybe that's why pilots are a different "breed of cat." That's why Jeppesen puts so many symbols on our charts.

Let's look at the depiction of those highways in the sky. During most of this discussion, refer to the illustration which is an excerpt from US(LO)7 near the Great Falls, Montana area.

## Airway Designations

Originally, our airborne highways were numbered the same as the ground highways beneath them. As an example, V-2 from Seattle to Boston closely parallels U.S. Highway 2 across the northern United States. Also, the even numbered airways generally run east and west, whereas the north-south airways are labeled with the odd numbers similar to the Interstate highway number-

# The Chart Clinic – Eighth in a Series

ing system. Note that V-21 (odd number) runs north and south near the Great Falls VORTAC.

All airways in the United States are formed by *magnetic* radials from VORs (and a couple NDBs). The design using magnetic was incorporated so the airplane's magnetic heading corresponds with the magnetic radial in a no-wind condition. There are a number of aviation committees working on the possibility of converting *everything* to true instead of magnetic, but the obstacles to a conversion make the transition a very difficult project.

Due to the high magnetic variation values near the North Pole, courses which define airways from a VOR or NDB in the Northern Domestic Airspace of Canada are designated as *true* rather than magnetic. On the enroute charts, the airways in the Canadian Northern Domestic Airspace are designated as true by using the letter "T" which follows the degrees in true from the facility which forms the airway.

## Minimum Altitudes

FAR Part 91.177 states that no person may operate an aircraft under IFR below the applicable minimum altitudes prescribed in Parts 95 and 97. All of the MEAs, MOCAs, MRAs, and MCAs found on the charts are those altitudes prescribed in Part 95. (Part 97 defines the minimum altitudes for instrument approach procedures). This means each Victor airway has a usable envelope with a base at the MEA or MOCA, and the top at 17,999 feet. The MEAs and MOCAs on the charts have a 2,000-foot obstruction clearance criteria applicable in mountainous terrain and a 1,000-foot obstruction clearance for non-mountainous terrain. For a chart depicting the mountainous terrain, refer to Jeppesen Enroute page US-3.

In the enroute chart illustration, refer to the numbers 11000 and 10300T on V-187 (Great Falls 106 radial). The 11000 represents the minimum enroute altitude (MEA), and the 10300T represents the minimum obstruction

clearance altitude (MOCA). Both the MEA and MOCA provide the *same* obstruction clearance. The only difference is that radio navigation signal coverage is provided along the *entire* airway segment at the MEA, but the MOCA provides radio navigation signal coverage only within 22 nautical miles of the VOR. From an application standpoint, what this means is that if you are cleared for an approach while still on an airway, you can descend from the MEA to the MOCA when within 22 nautical miles from the VOR.

West of the Great Falls VORTAC on the 256 radial, note there are two different MEAs. The 9,500-foot altitude is the MEA westbound and the 6,800-foot altitude is the MEA eastbound. The different MEA values are used because of minimum climb gradient values which must be considered westbound from Great Falls. No minimum *descent* gradient values have been established; therefore, when flying eastbound to Great Falls, you may descend (if cleared to do so) to 6,800 feet after crossing Shimy Intersection.

On V-120 (GTF 091 radial), only one minimum altitude is stated. In this case 8,400 feet can be considered *both* the MEA and the MOCA since both altitudes have the same obstruction clearance.

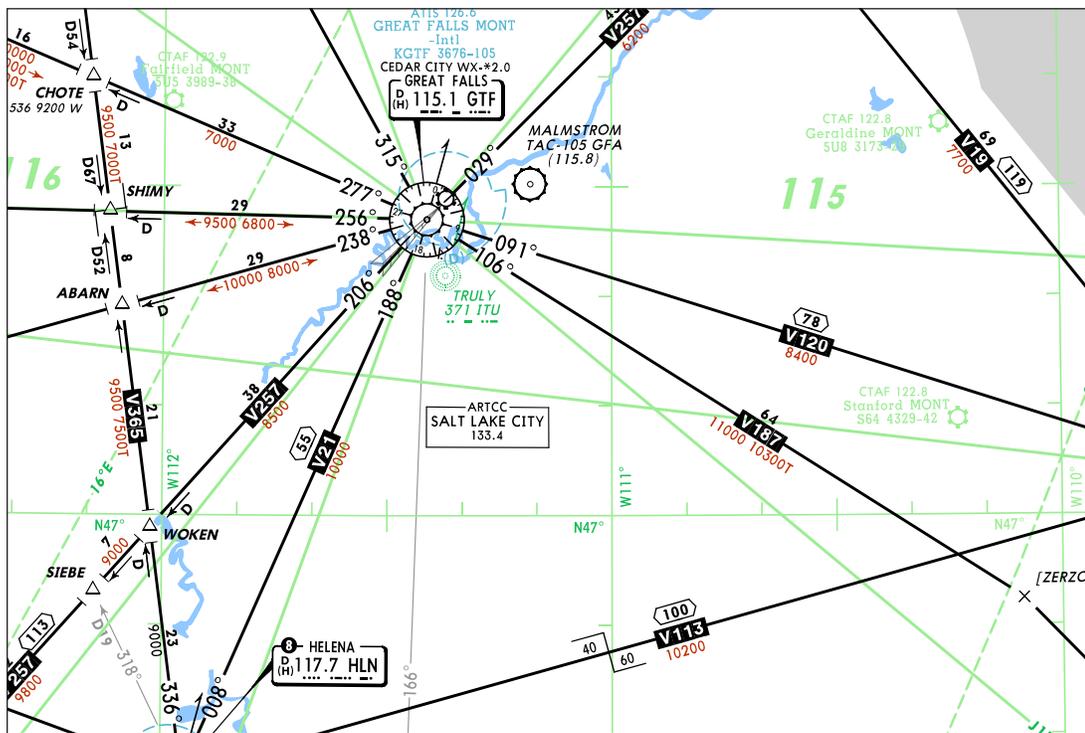
Proceeding westbound from Great Falls on the 277 radial, the MEA changes from 7,000 to 10,000 feet crossing Chote Intersection. When the MEA changes at an intersection, a small "T" bar is at the end of the airway line designation, next to each intersection. There is no MEA change southeast of Great Falls on V-187 (106 radial); therefore, the airway line proceeds to the "X" and stops without the small "T."

## Mileages/Changeover Points

The numbers adjacent to the airway designators, and enclosed in the six-sided box, represent the total distance between navigation facilities. When an airway between nav aids is broken by intersections, the various leg lengths are shown by numbers not enclosed in a box. The segment distances are included between any combination of nav aids, intersections, and mileage breaks. As an example, the number 78 in the six-sided box above the designator for V-120 indicates the total distance on that airway between nav aids. On the next airway to the south (V-187), the distance of 64 is only from the VOR to the "X."

The FAA has defined points between navigation facilities along airways which are called changeover points (COPs). The COPs indicate you should change over your navigation equipment to the facility ahead from the nav aid behind you.

The COPs assure continuous reception of navigational signals at the MEA and also assure that you will not receive azimuth signals from two different navigation facilities on the same frequency. *Every airway has a changeover point.*



Even though V-120 (GTF 091 radial) does not have a COP symbol, the changeover from navaid to navaid is technically at the midpoint, or 39 nautical miles. When flying eastbound from Great Falls on V-187 (GTF 106 radial), the changeover point is at the bend in the airway. In most cases when a mileage break (designated by the letter "X") is found on an airway, it can be considered as the COP, even if a turn is not obvious.

When the changeover point is not at the midpoint or a mileage break, a COP symbol is placed on the airway. When flying eastbound on V-113 from Helena, you should change over to the next navaid when 40 nautical miles from Helena. There also is a COP at the Shimy Intersection (HLN 336 radial) when flying on V-356. There are no mileages indicated on the COP at Shimy, since the DME mileages are included on the airway. When the COP is not at an intersection, the distances to each navaid are included with the COP symbol.

## Intersections

Intersections on airways, also known as reporting points, are used for ATC purposes, locations for altitude changes, and as transition points to depart the enroute structure for an approach. If the intersection is a non-compulsory reporting point, it will be depicted as an open triangle. Compulsory reporting point intersections appear as a solid triangle. The "X" symbol east of GTF is not an intersection, but a bend in the airway which is also called a mileage break. Because these fixes are in Jeppesen's database, the database identifier [ZERZO] is included in brackets for the use with airborne databases. The FAA is in the process of naming all these fixes with unique five-letter names. These fixes are called computer navigation fixes (CNFs), and are not to be used in communication with ATC.

To determine which facilities form an intersection, a couple of different symbols are used. The Abarn Intersection (GTF 238 radial) is formed by the radials from Great Falls and Helena. This is indicated by the small arrows adjacent to the airway line next to the intersection *from* the forming facility. Note that there is a small letter "D" under the arrow near Abarn Intersection which points from the Great Falls VORTAC. This means that Abarn Intersection can be identified using DME from GTF. Even though the Helena VORTAC has DME capability, the Abarn Intersection *cannot* be identified using the DME from Helena since the letter "D" is not located adjacent to the forming arrow. It is apparent that everything from the Helena VORTAC is OK, but the lack of a DME formation from HLN at Abarn may be an FAA oversight.

Southwest of Great Falls on the 206 radial is the Siebe Intersection, which can be identified *only* by using the radials from Great Falls and Helena. (Siebe can be formed by the DME from Helena but that surely isn't practical when flying the airway.)

The depiction of the DME distance is portrayed differently depending on whether the intersection is the first fix from a navaid or if it is beyond the first fix. When an intersection is the first reporting point from a VORTAC, the leg distance can be used as the DME distance; therefore, the letter "D" stands alone without the DME distance designation. Since the Shimy Intersection is not the first intersection away from Helena, but can be identified



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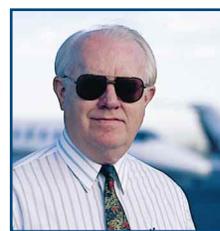
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ified by a DME distance, the leg segment distance can't be used without adding it to the previous leg distance. To avoid mathematics, the distance of 52 is specified next to "D" by the Shimy Intersection.

In the next article on airway chart usage we'll look at the FAA's new announcement on using GPS as a substitute for DMEs and NDBs and continue the discussion of the enroute charts.



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