

## True Course, Compass Heading – What does it all mean?

Plotting a cross country “the old fashion way”, meant knowing a few things, things that may have slipped into the background in today’s world of “going direct with GPS” and following the magenta line. There may be times when you still have to know the difference between magnetic course and compass heading, maybe on the written exam, or when, “God forbid” you’re going to be flying a plane that doesn’t have a GPS and you forgot your iPad with ForeFlight. Whatever the reason might be, navigating from point A to point B using “Dead Reckoning” is a good skill to know.

It starts with drawing a straight line on an aeronautical map. Theory is, that if you can follow that line things are gone-a-work-out just fine. That line is called your “True Course” and you measure its direction using a Plotter. I’m not going to try and describe how to use a plotter, or an E6B flight computer here, it would take too long and you’d lose interest anyway. Ask someone, read a book, or watch a YouTube video.

To get from A to B you will need to understand a few terms.

“True Course” – (TC), the direction of the line on the map measured from True North.

“Magnetic Course” – (MC), True Course corrected for Magnetic Variation along your intended path.

“Compass Course” – (CC), Magnetic Course corrected for Compass Deviation, (compass error).

“True Heading” – (TH), True Course corrected for wind direction and speed (Wind Correction Angle).

“Magnetic Heading” – (MH), Magnetic Course corrected for WCA.

“Compass Heading” – (CH), Compass Course corrected for WCA.

**The deal is, that if you want to follow the True Course line on the map, you have to fly the plane in the Compass Heading direction.**

Before I show you an easy way to remember how to do the calculations we need to finish defining some terms.

“**Magnetic Variation**” – On the aeronautical map, crossing over your True Course line, or nearby, you’ll find a magenta dotted line with a number on it. The number is the difference between True North and Magnetic North along your intended path of travel. For example, crossing over DFW airport the magnetic variation line says 3°45’E. That means that in that area, magnetic north is “3 degrees+45minutes, East” of true north. The compass in your plane points at Magnetic North, the line you drew on the map is in reference to True North, the variation is the difference between them. Don’t know if you’ll ever actually need to know this but there are 60 minutes in one degree. This makes the variation at DFW 3.75°E.

Using a magnetic compass to navigate, to follow the True Course line on the map, one of the things you’ll have to do is adjust the True Course direction by the amount of the magnetic variation. This is VERY important, so listen up, **if the variation is “East” you subtract the variation from the TC, if “West” you add the variation to the TC.**

Here’s a saying that will help **“East is least, West is Best”**. “East” you subtract (least) the magnetic variation from the TC, West you add (Best). Imprint that in your mind and don’t ever forget. (East is Least, West is Best, East is Least, West is Best, East is Least, West is Best, .....)

**“Compass Deviation”** – The magnetic compass in the plane may (probably does) have a small amount of error. On a strip of paper, sometimes located just below the compass, or a table in the Pilot Operating Handbook is a “Compass Correction Card”. The card shows how much error this compass has for various positions around the Compass Rose.

“Compass Rose” - WHAT THE HECK IS THAT?

If you painted a circle on the ground with degrees marked around the circle you’d have a “Compass Rose (CR)”. Don’t ask me how it got that name, but that’s what it’s called. On the CR, zero would be lined up with magnetic north with the rest of the compass directions shown in a clockwise direction around the full 360 degrees of the circle.

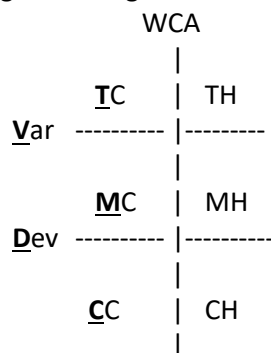
If you lined your airplane up, pointed at the zero (magnetic north) position of the CR, your compass SHOULD say “0” degrees. If it doesn’t, the amount it’s off is the compass deviation for that magnetic direction. (This is the deviation from your magnetic course, more on that later). Write it down, position your plane around the rest of the CR (about every 45°, or so) and when you’re through you’ll have a Compass Correction Card showing the Compass Deviations for this airplane.

**“Wind Correction Angle”** - When you’re up in the air your plane becomes part of the moving air mass. In most cases, the propeller on the plane is taking you in one direction and the wind is moving you in a different direction. In order to make the True Course track across the ground you’ll need to adjust the direction the plane is pointed in order to compensate for the effect the wind. This compensation is called the “Wind Correction Angle” (WCA).

Sooooo, here’s the problem. “How do we follow the True Course track across the ground when we have all the issues of magnetic variation, compass deviation and wind correction”?

Here’s how: Start with the True Course, calculate the magnetic course by applying the magnetic variation, then calculate the compass course by applying the compass deviation, then calculate the compass heading by applying the wind correction angle and you’re done. It’s that simple!

Well, maybe not...., anyway I said I had an easy way of remembering how to do all this, and I do. Draw the following chart diagram.



(Note: the lines are supposed to solid, not dashed as shown)

On the left of the diagram is the “Course” directions, True Course, Magnetic Course and Compass Course. On the right is the “Heading” Directions, True Heading, Magnetic Heading and

Compass Heading. The difference between the Courses and the Headings is the wind correction angle "WCA", (vertical line down the middle of the chart).

As stated earlier, the goal is to determine what COMPASS HEADING we must fly in order to make the TRUE COURSE track across the ground.

When I was first learning to fly an instructor showed me this diagram, told me how to remember what it looks like and how to use it. I've NEVER forgotten what he said, so I'm going to tell you the same thing.

"**T**" is for the "True" direction, True Course and True Heading, (TC & TH).

"**V**" is the Variation (Var) line.

"**M**" is for the "Magnetic" direction, Magnetic Course and Magnetic Heading, (MC & MH).

"**D**" is the compass Deviation (Dev) line.

"**C**" is for the "Compass" direction, Compass Course and Compass Heading, (CC & CH).

**As I promised here's the easy (fun) way to remember it all:**

**TVMDC - "T rue Virgins Make Dull Company"**

Remember that saying and you can construct the chart. Fill in the numbers and you've got the answer.

My guess is that all the young guy's will remember this for the rest of their lives (I did), the gals will just have to grin and move on.

Anytime you cross a line you apply the appropriate correction. If you cross the "Var" line, apply the magnetic variation. Cross the "Dev" line, apply the Compass Deviation. Cross the WCA line, apply the wind correction angle.

Let's work a problem:

The line we drew on the map shows a True Course of 210°

The variation is 9°E (we found the closest magenta dotted line on the map to our TC)

The compass deviation is -2° (Once we knew the magnetic course we looked in the airplane)

The wind correction angle is 20° to the right. (Got that from our E6B flight computer)

Find the Compass Heading.....

Remember, to follow the True Course line you drew on the map, you must fly the Compass Heading. The True Course corrected for magnetic variation, compass deviation and wind correction angle.

Fill in the chart and do the arithmetic-

		20 right	
	210		230
9E	-----		-----
	201		221
-2	-----		-----
	199		219

What the chart tells us is that in order to make a 210° TC track across the ground, (like the line we drew on the map), we would have to fly with 219° showing on the compass, the CH.

So how did we get from 210° TC to 219° CH.

We started with a TC of 210°. Then, “East is least – West is best”, so we subtract the 9°E variation giving a MC of 201°. We then apply the -2° deviation leaving a CC of 199°. Now apply the 20° right WCA. As we move to the right around the Compass Rose (clockwise), the degrees get bigger, so we add the WCA, leaving a CH of 219°.

In this problem we were given the Var, Dev and WCA. In the real world you will have to get the Var from the map, the Dev from the compass correction card in the plane and the WCA from your trusty E6B flight computer, or a fancy electronic app.

Another handy use of the chart is for example; if you know the TC and TH it tells you the WCA. In some examples the chart can also tell you Var and Dev. These are test type questions used to see how well you understand the overall concept.

For example, the question might be “Your TC is 210, your TH is 230, what is the WCA? Look at the chart. WCA is  $230 - 210 = 20$  degrees right. Remember going right around the compass rose the numbers get bigger. TH of 230 is bigger than TC 210, so the WCA is to the right.

So there you have it – **“True Virgins Make Dull Company”** – but we already knew that.