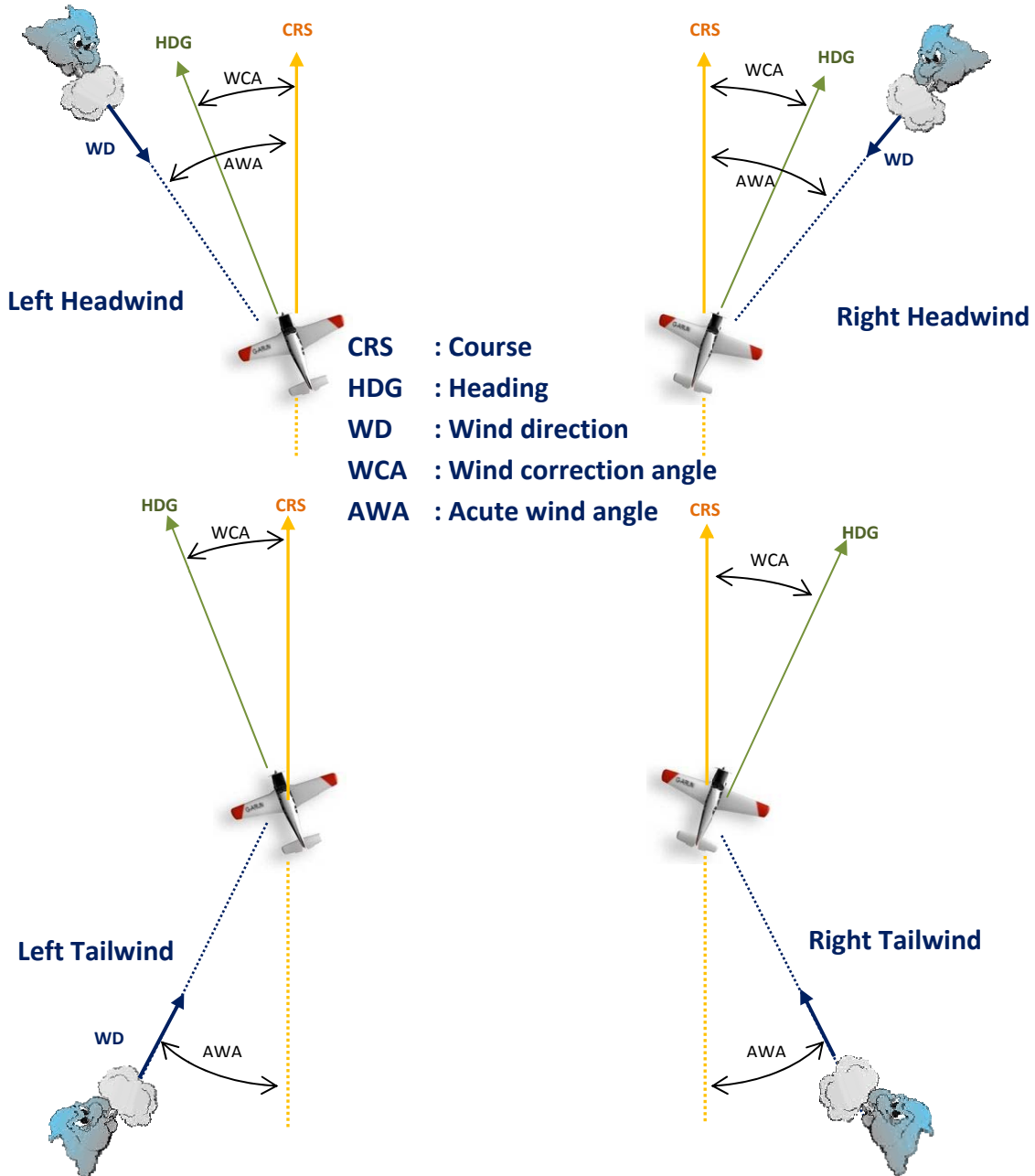


Learning Goals
Wind corrections

Introduction

In order to fly a course, whether it's enroute from A to B, a nice aerodrome traffic pattern or a runway approach with crosswinds, you need to understand the effects of crosswinds.

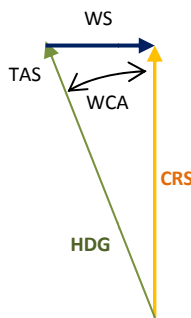


The wind correction angle

The wind correction angle (WCA) is the angle between the course (CRS) and the heading (HDG) that is required for the aircraft to track that course when there is wind. The WCA is basically added (when the wind is to the right) or subtracted (when the wind is to the left) to the course. The result of this addition or subtraction is the heading which the pilot must fly to maintain that course.

HDG = CRS + WCA for winds from the Right
 HDG = CRS - WCA for winds from the Left

If we have a perfect cross wind (AWA=90°) the wind correction angle can be easily described with some math as:



$$\sin(WCA_{max}) = \frac{WS}{TAS}$$

$$WCA_{max} = \text{ASIN} \left(\frac{WS}{TAS} \right)$$

Example:

CRS : 360
 Wind : 270 @ 10 knots
 TAS : 110 knots

$$WCA_{max} = \text{ASIN}(10/110) = 5^\circ - 6^\circ$$

Now for a Cessna this is easy to remember. Our TAS will usually be around 110 knots and for each 10 knots of crosswind we need a heading correction of 5 -6 degrees!.

In reality we will not have a perfect crosswind so what to do now?

The WS has to be corrected with a Correction factor in order to get the crosswind component :

$$WCA = \text{ASIN} \left(\frac{WS * \sin(AWA)}{TAS} \right)$$



Now this is getting complicated.

For reason of estimation it's easier to use a correction factor CF which is very close to the real value of sin(AWA).

$$WCA = ASIN \left(\frac{WS * \text{Correction factor}}{TAS} \right)$$

AWA	SIN(AWA)	Correction factor (CF_{AWA})	
0	0	0	0
15	0.258	1/4	0.25
20	0.342	1/3	0.33
30	0.500	1/2	0.5
40	0.642	2/3	0.67
50	0.766	3/4	0.75
60	0.866	9/10	0.9
70	0.939	1	1
80	0.985	1	1
90	1	1	1

example:

CRS : 360

Wind : 230 @ 10 knots

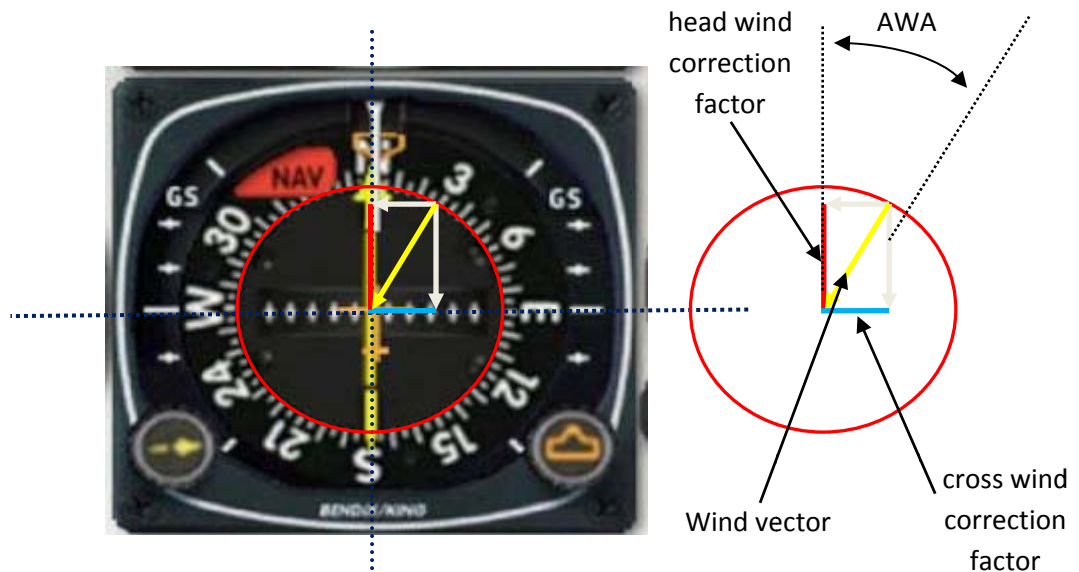
TAS : 110 knots

WCA = asin * (10*0.5 / 110) = 2.6 degrees



How to estimate the WCA in practice

Use any compass related instrument to visualize the wind. In our example we will use an HSI.



Imagine you are flying heading 360 / North.
winds are 030 / 10 knots
TAS = 110 knots

1. draw a line from 030 down to the X-axis. The blue line from the center to the intersection point represents the cross-wind (X-wind) correction factor which is 0,5 (half the length of a the red circle)
Note: $\sin(30^\circ) = 0,5$
2. draw a line from 030 left to the Y-axis. The Red line from the center to the intersection point represents the Head-wind (H-wind) correction factor which is approx. 0,9
Note: $\cos(30^\circ) = 0,87$

The wind is 10 knots so:

X-wind = $0,5 * 10 = 5$ knots

H-wind = $0,9 * 10 = 9$ knots

$$WCA = \frac{60}{TAS} \times Xwind$$

$WCA = 60/110 * 5$

WCA = 2.7° and in practice use 3°

Note :

Remember that when you are using this imaginary technique during a crosswind landing, your TAS reduces from normal maneuvering speed to approach and landing speed.

(from 110 to 80 to 60). In practice this means that if the winds remain constant, your WCA changes from 3° to 6° !!!!



Difficult...well...I admit..it's not that easy to do it perfect but with our estimation technique we will get pretty close.

Let me show you why:

	TAS	WCA
Cessna	110	A bit more than 1/2 * Crosswind
Beechcraft	180	A bit more than 1/3 * Crosswind

Crosswind = Correction factor * Wind

Correction factor

AWA	Correction factor (CF_{AWA})	
0	0	0
15	1/4	0.25
20	1/3	0.33
30	1/2	0.5
40	2/3	0.67
50	3/4	0.75
60	9/10	0.9
70	1	1
80	1	1
90	1	1

So...we fly a Cessna 172 and want to fly a course of 360 when we have winds from 330 @ 20 knots?

our WCA will be a bit more than $1/2 * 20 * 1/2 =$ a bit more than 5° so make it 6°

Our heading should be : 354°

Generally speaking we could say:

for a Cessna: use 5-6 degrees of wind correction for every 10 knots of perfect crosswind
for a Beechcraft : use 3-4 degrees of wind correction for every 10 knots of perfect crosswind

for an Airbus or Boeing.....well....just read the wind correction from your display.

