



## **Preliminary investigation of Methods to Ameliorate Wind Direction Maneuver Perturbance**

### **Theory**

Wind direction maneuver perturbation is a change in wind direction during and immediately after a large change in heading. The wind direction departs from the correct value during the maneuver and returns to the correct value when the maneuver ends. Wind direction averaging smears this perturbation out by 10 to 30 seconds following the maneuver.

There are several possible causes of this effect:

1. Incorrect mast height setting (Option 8). When heel changes rapidly, athwartship wind is induced in the masthead sensor. The system uses roll rate and mast height to correct for this effect. If the mast height or heel sign is wrong, the correction will also be wrong.
2. Boatspeed sensor installation. Boatspeed is incorrect during the maneuver because of keel flow during tacking causing a boatspeed spike.
3. Anemometer cup delay. Cup anemometers respond slowly to windspeed change. This delay causes an incorrect value to be used in wind direction calculations during the response period.

Correcting the first one is simple. The second is expensive and may not be the cause. The third can only be corrected by switching to a sonic masthead. So, how do we fix the problem on a boat in the middle of the season?

Some systems and software (notably Bravo) 'freeze' the wind direction during a tack. This goes against our design philosophy of not hiding things. Rather, the Ockam T1 processor can now add an adjustable amount of turn rate into the wind direction solution, set by Option 28. This appears beginning with the CPU.RTB dated 11/1/06 rev 20.03.

The math is:

Wind direction' = (Wind direction) + Option28 \* (Turn rate in %/sec)

so

$$Option28 = \frac{WindDirectionChange}{TurnRate}$$

The value of Option28 depends on how bad the disturbance is.

Example:

When we tack to port, the wind direction increases, peaking at 10° and it takes 10 seconds to tack thru 90°.

1. Turn rate is 90°/10sec, or about 9° per second and turning right is positive (heading is increasing).
2. Wind direction is increasing by 10° when tacking to port (turning right). Therefore we want to subtract the turn rate correction to bring wind direction back to what it was before the tack.
3.  $Option28 = \frac{10}{9}$  or approximately 1.1. Because turn and wind are both positive, we want a negative correction. If wind and turn were opposite, we would want a positive correction.

This gives a starting point to set Option 28. Experience will then dictate whether to increase or decrease it.

### **Brass tacks**

1. First, check the obvious:
  - Are the sign of heel and wind angle the same? They should be.
  - Is the mast height (option 8) set correctly? Check Status1 (tag ' ') for the value of O8:xx.
  - Is the rev of T1 software compatible? Check Status1 for O28:x.x. If it isn't there, the CPU rev is too old.
2. Determine how much perturbation is being experienced. If you can afford the time and being branded as a 'geek', set wind direction average (A14) to 0 to eliminate masking the error signal. Remember to return it to normal afterward.
3. Set up to adjust Option28 – OS4 driver, HyperTerminal or Expedition(?).
4. Go sailing and mess with the value of O28.
5. REPORT YOUR FINDINGS!!

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