



# Sensors and data outputs

## Wind Vane (direction wind is coming from)

- US Digital MA3 Magnetic Encoder
- Data comes in 0-360° and is converted in software to -180 to +180
- Define 0° = in irons, starboard wind is negative readings up to -180° and port wind is positive readings up to +180°
- This is a Relative reading (relative to the boat)

## Compass (direction boat is pointing)

- Data comes in 0 to 360°, expect North is 0° but we will orient sensor so East = 0°
- Adafruit LSM303 Accelerometer and Compass Breakout
- Absolute reading

## GPS (location in latitude and longitude)

- starts as angle in degrees, we convert to radians, then to x, y (meters)
- Adafruit Ultimate GPS Breakout
- Absolute reading

# Actuators and ranges

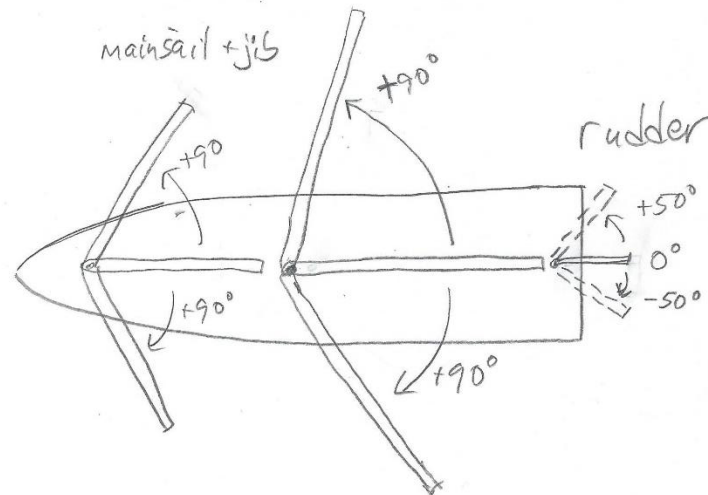


## Rudder Servo Motor

- range =  $-50^\circ$  to  $+50^\circ$ ,  $0^\circ$  center (cannot go full  $\pm 90^\circ$  range)
- measure angle looking down on rudder, CCW is +, CW is -

## Sailwinch Servo Motor

- Uses a line to create a sail angle range =  $0$  to  $90^\circ$
- The actual servo is a winch that rotates  $4 \frac{1}{2}$  revolutions from full-in to full-out
- The servo position for full-in is  $0^\circ$  and for full-out it is  $90^\circ$
- The Main and Jib sheets are both attached to the winch and move together

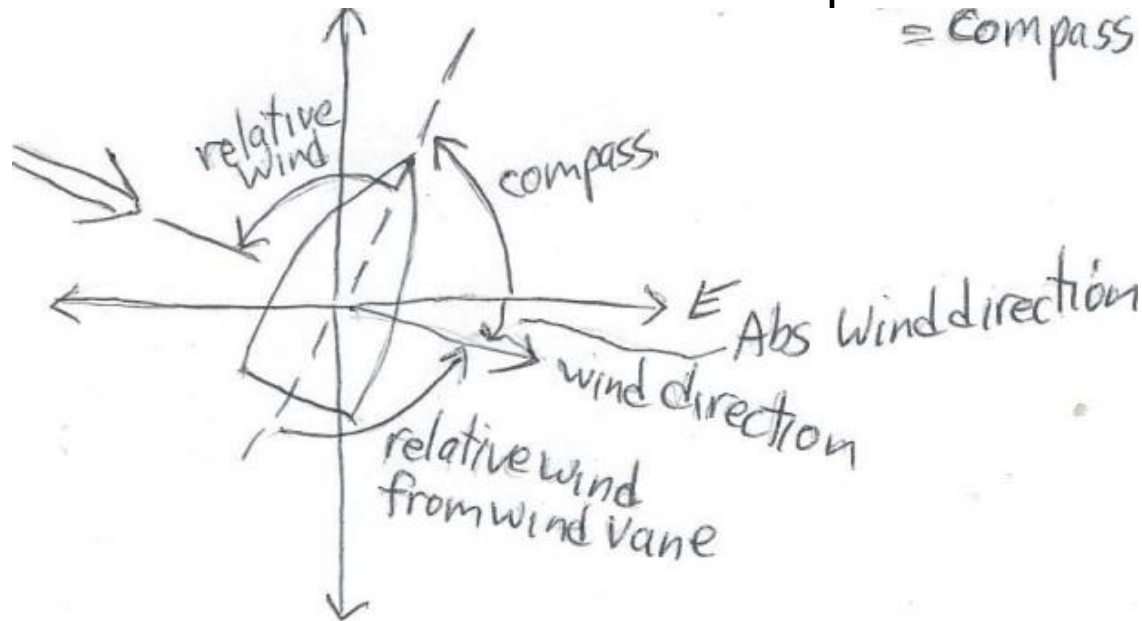


# Values to Calculate

**Absolute** Wind Direction (real direction wind is coming from)

- Set East = 0° range = -180° to +180°
- Data needed: Relative Wind Direction

**Absolute** Wind Direction = **Absolute** Compass + **Relative** Wind Vane



# Values to Calculate

## Sail to a Desired Compass Point

Calculate Desired Wind Angle (angle for Windvane)

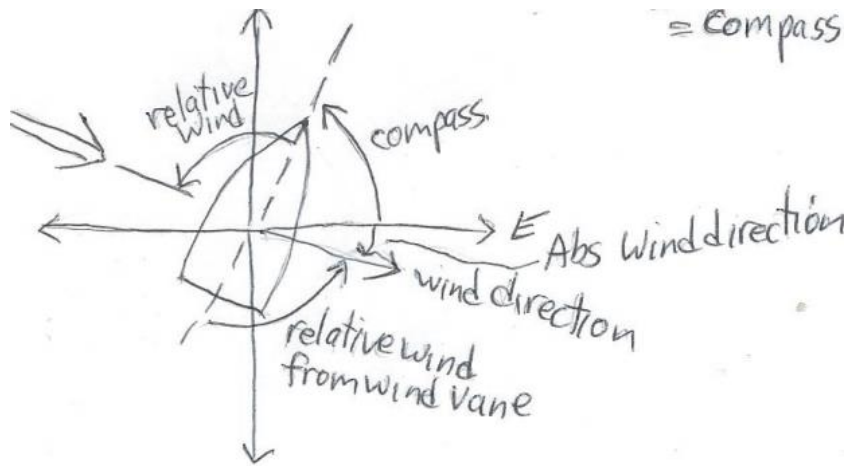
- Set East = 0° range = -180° to +180°
- Data needed: Relative Wind Direction, Absolute Compass

**Desired Wind Angle = Absolute Wind Direction – Desired Compass**

**Substitute in: Absolute Wind Direction = Absolute Compass + Relative Wind Vane**

## Desired Wind Angle

**= Absolute Compass + Relative Wind Vane – Desired Compass**





# Values to Calculate

**Absolute** Angle-to-Waypoint (direction from boat to destination)

- range is  $-180^\circ$  to  $+180^\circ$  or 0 to  $360^\circ$
- Starting point is  $(x_1, y_1)$ , destination waypoint is  $(x_2, y_2)$
- Data needed: GPS location of boat and destination, or just difference

**Absolute** Angle-to-Waypoint =  $\arctan (y_2 - y_1 / x_2 - x_1)$

# Values to Calculate

**Relative** Angle-to-Waypoint (angle boat must turn through to be heading at destination)

- range is  $-180^\circ$  to  $+180^\circ$  or 0 to  $360^\circ$
- Data needed:
  - GPS location of boat and destination (or just difference)
  - Compass heading

**Relative** Angle-to-Waypoint = **Absolute** Angle-to-Waypoint – **Absolute** Compass

