RACE OFFICIALS NATIONAL CONFERENCE
Saturday 7th and Sunday 8th February 2015

ON BOARD ELECTRONIC DECISION MAKING
GREG WELLS
Who am I and why is this important?

• **Greg Wells**
  – 10 years in marine electronics - Sales not Engineering! (Tacktick and Raymarine).
  – Been racing Dinghies, Sports Boats, Flying Fifteens and occasional big boats for 40 years.
  – Moderate success
  – Race Officer for Youth trials, Feva worlds, Chi Harbour Fed week.

• **Why is this subject important**
  – Boats with modern electronics usually have better data/information than the Race Officer
  – The data on a sailing boat is different to a committee boat
  – Knowing the difference will help set better courses and start lines.
  – Electronics are becoming commonplace even on dinghies
    • Compasses, GPS, Watches, Trackers etc.
  – Like it or not it is the future

• “I believe electronics can help to improve the sailors experience and therefore retain them in our wonderful sport.”
On Board Electronics - Basics

• **Raw data transducers**
  – Compass Heading
  – Boat Speed (STW)
  – Apparent Wind Speed (AWS)
  – Apparent Wind Angle (AWA)
  – Depth

• **GPS data**
  – GPS Lat and Long
  – Waypoints
  – Course over Ground (COG)
  – Speed over Ground (SOG)
  – Time & date
  – Timer

• **Calculated or derived data**
  – True Wind angle (TWA)
  – True wind Speed (TWS)
  – True Wind Direction (TWD)
  – Velocity made good to Windward (VMG)
  – Wind Shift
  – Beaufort Scale
  – DTW, BTW, XTE, TTG, VMG-WP/VMC
  – Drift and Set.
  – Opposite tack angle

**Angle vs Direction**
Angle = relative to the bow of a boat
Direction = relative to an external point, such as north
How many types of wind are there?

- Apparent wind, made up from the effects of:
  - Tide wind (opposite to current flow and direction)
  - Motion wind (created by boat movement)
  - Ground wind (as recorded by an anchored committee boat)
  - Is measured by the mast head unit on a sailing boat.
How many types of wind are there?

- **True Wind (TWS, TWD, TWA)**
  - This is our **Sailing wind** and the one RO’s need to use as this is the one sailors use!
  - It’s calculated from AWA, AWS and STW (speed thru water)
  - Add compass heading to get TWD.
  - Difficult to calculate on a CB. You have to measure the current set and drift.
How many types of wind are there?

- **Wind Shear (Mast head v Deck)**
  - Earth friction slows air and alters direction.
  - Coriolis/Buys Ballots Law (pulls wind left in Northern Hemisphere)
  - Most noticeable on spring days when water temp is cooler
On Board Electronics – Advanced Functions

- GPS Start line products
- Wind/weather overlay (GRIB)
- Tidal Current overlay
- Routing
- “What If” Scenarios
  - 1 hour on
  - Wind shifts 20 degrees
- Time on Port/Time on starboard
- Polars/Targets
- 9-Axis AHRS compass.
- Laylines

- True wind correction
  - Accurate calibration
  - Sonic speed Sensors
  - 9-Axis heading Sensors
  - Up wash correction
  - Heel correction
  - Software filters
  - Correction tables.

- Wifi routers to handheld devices
  - Racing apps use boat data via NMEA
  - Much more intuitive and easier to use.

- GPRS data
True wind correction – Up Wash and Airflow

Air-flow accelerates downwind

Airflow is bent by the sails
### True Wind Angle (Direction) Calibration table

<table>
<thead>
<tr>
<th>True Wind Speed in knots</th>
<th>5knots</th>
<th>10knots</th>
<th>15knots</th>
<th>20knots</th>
<th>25knots</th>
<th>30knots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upwind</td>
<td>-8</td>
<td>-4</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Reaching</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Downwind</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### True Wind Speed in knots

<table>
<thead>
<tr>
<th>Correction at 180 degrees</th>
<th>5knots</th>
<th>10knots</th>
<th>15knots</th>
<th>20knots</th>
<th>25knots</th>
<th>30knots</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.7</td>
<td>-1</td>
<td>-1.5</td>
<td>-2</td>
<td>-2.5</td>
<td>-3</td>
<td></td>
</tr>
</tbody>
</table>
True wind correction – Yaw, Pitch and Roll

What is a 9-Axis Sensor?
• Solid state Compass, Gyroscope and Accelerometer
• Measures Yaw, Pitch and Roll for each
Weather overlay
TWS/TWD Plots

GPS: 7:29:10 PM
Time 7/14/2008
Local: 8:38:59 AM
Time 2/15/2009
Lat: 37° 49.985' N
Lon: 122° 27.773' W
HDG: 149° T
COG: 151° T
SOG: 8.2 kt
STW: 7.6 kt
AWS: 13.8 kt
AWA: 043° Stbd
TWS: 9.6 kt
TWA: 079° Stbd
TWD: 228° T
Depth: 136.3 Ft
GPS Status: OK
Ais Targets: 59
Ais Status: OK
Log Status: Log Off

Wind Direction (° T)
Wind Speed (Kt)

Windspeed Range: 20 Kt
Time Scale: 10 Min
Routing
Start line Feature – Number based

1. Ping the committee-boat end of the starting line.
2. Ping the pin end of the line.
3. Press the “Gun” button to start the timer.
## Start Line Feature – PC Software

![Software Interface]

<table>
<thead>
<tr>
<th>Time</th>
<th>Distance</th>
<th>LOA</th>
</tr>
</thead>
<tbody>
<tr>
<td>02:41</td>
<td>0.30 Nms</td>
<td>00:00</td>
</tr>
<tr>
<td>01:59</td>
<td>0.14 Nms</td>
<td>00:42</td>
</tr>
<tr>
<td>02:21</td>
<td>0.19 Nms</td>
<td>00:21</td>
</tr>
<tr>
<td>05:14</td>
<td>0.66 Nms</td>
<td>-02:32</td>
</tr>
</tbody>
</table>

**Wind Data**
- TWS = 15.1 Kts
- TWD = 257°
- Square Line = 254°
- Unfreeze Wind

**Range & Bearing**
- From Port End: 3.91 @ 254°
- From Stbd End: 4.01 @ 241°
- From Boat: 4.25 @ 247°

**Split Times & Totals**

<table>
<thead>
<tr>
<th>Time</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>44m 43s</td>
<td>51m 15s</td>
</tr>
<tr>
<td>37m 13s</td>
<td>57m 34s</td>
</tr>
<tr>
<td>43m 58s</td>
<td>58m 58s</td>
</tr>
</tbody>
</table>

**Bias**
- Degrees
- Distance

- Now 8.6 LOA
- Mean 8.9 LOA

[www.rya.org.uk](http://www.rya.org.uk)
Start Line Feature – MFD/Instruments
Polars
More Polars/Targets...

### Upwind Targets

<table>
<thead>
<tr>
<th>TWS</th>
<th>BS</th>
<th>TWA</th>
<th>AWA</th>
<th>AWS</th>
<th>Vmg</th>
<th>Heel</th>
<th>TA</th>
<th>S/M</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.9</td>
<td>4.1</td>
<td>24.1</td>
<td>4</td>
<td>1.3</td>
<td>0.9</td>
<td>8</td>
<td>2769</td>
</tr>
<tr>
<td>4</td>
<td>3.8</td>
<td>44.9</td>
<td>23.0</td>
<td>7</td>
<td>2.7</td>
<td>13.9</td>
<td>90</td>
<td>1334</td>
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<tr>
<td>6</td>
<td>5.1</td>
<td>41.8</td>
<td>22.4</td>
<td>10</td>
<td>3.8</td>
<td>8.8</td>
<td>84</td>
<td>942</td>
</tr>
<tr>
<td>8</td>
<td>5.6</td>
<td>37.3</td>
<td>21.5</td>
<td>13</td>
<td>4.4</td>
<td>14.4</td>
<td>75</td>
<td>714</td>
</tr>
<tr>
<td>10</td>
<td>5.7</td>
<td>35.1</td>
<td>21.7</td>
<td>15</td>
<td>4.7</td>
<td>15.6</td>
<td>70</td>
<td>769</td>
</tr>
<tr>
<td>12</td>
<td>5.9</td>
<td>34.5</td>
<td>22.6</td>
<td>17</td>
<td>4.8</td>
<td>15.8</td>
<td>69</td>
<td>747</td>
</tr>
<tr>
<td>14</td>
<td>6.0</td>
<td>34.4</td>
<td>23.5</td>
<td>19</td>
<td>4.9</td>
<td>15.9</td>
<td>69</td>
<td>733</td>
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<tr>
<td>16</td>
<td>6.0</td>
<td>34.5</td>
<td>24.3</td>
<td>21</td>
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<td>723</td>
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<td>20</td>
<td>6.2</td>
<td>35.0</td>
<td>26.0</td>
<td>25</td>
<td>5.1</td>
<td>16.3</td>
<td>70</td>
<td>712</td>
</tr>
<tr>
<td>25</td>
<td>6.3</td>
<td>36.4</td>
<td>28.3</td>
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<td>16.8</td>
<td>73</td>
<td>713</td>
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<tr>
<td>30</td>
<td>6.3</td>
<td>38.5</td>
<td>30.9</td>
<td>35</td>
<td>4.9</td>
<td>17.5</td>
<td>77</td>
<td>730</td>
</tr>
</tbody>
</table>

- **TWS**: True wind speed
- **BS**: Boatspeed (knots)
- **TWA**: True wind angle
- **AWA**: Apparent wind angle
- **AWS**: Apparent wind speed
- **Vmg**: Velocity made good to windward
- **Heel**: Heel in degrees
- **TA**: Tacking angle
- **S/M**: Seconds per mile (Vmg)
Heads up & Handhelds....

- Dual core CPU
- Bluetooth
- WiFi
- GPS
- HD camera
- Polarized lenses
- Changeable battery
- Optical touchpad
- High resolution display

Display:
- TGT 6.20
- BSP 05.01 KTS
- VMG 4.02 KTS
- TGT 23°
- AWA
- CGG 129
- SOG 1.9
- Max. 19.1
Laylines

- Time to Layline
- Distance to Layline
- Historic limits
- Opposite TWA
- Specified TWA
- Polar defined.

- Port/STBD splits
  - CMG
  - Time
  - Distance
- Offset to mark
Summary

• Electronics are moving so fast.
  – UI’s improving all the time.

• We can use them to enhance sailors experience

• They are becoming an essential aid for RO’s

• We need Sailing wind on our CB’s!

THANK YOU