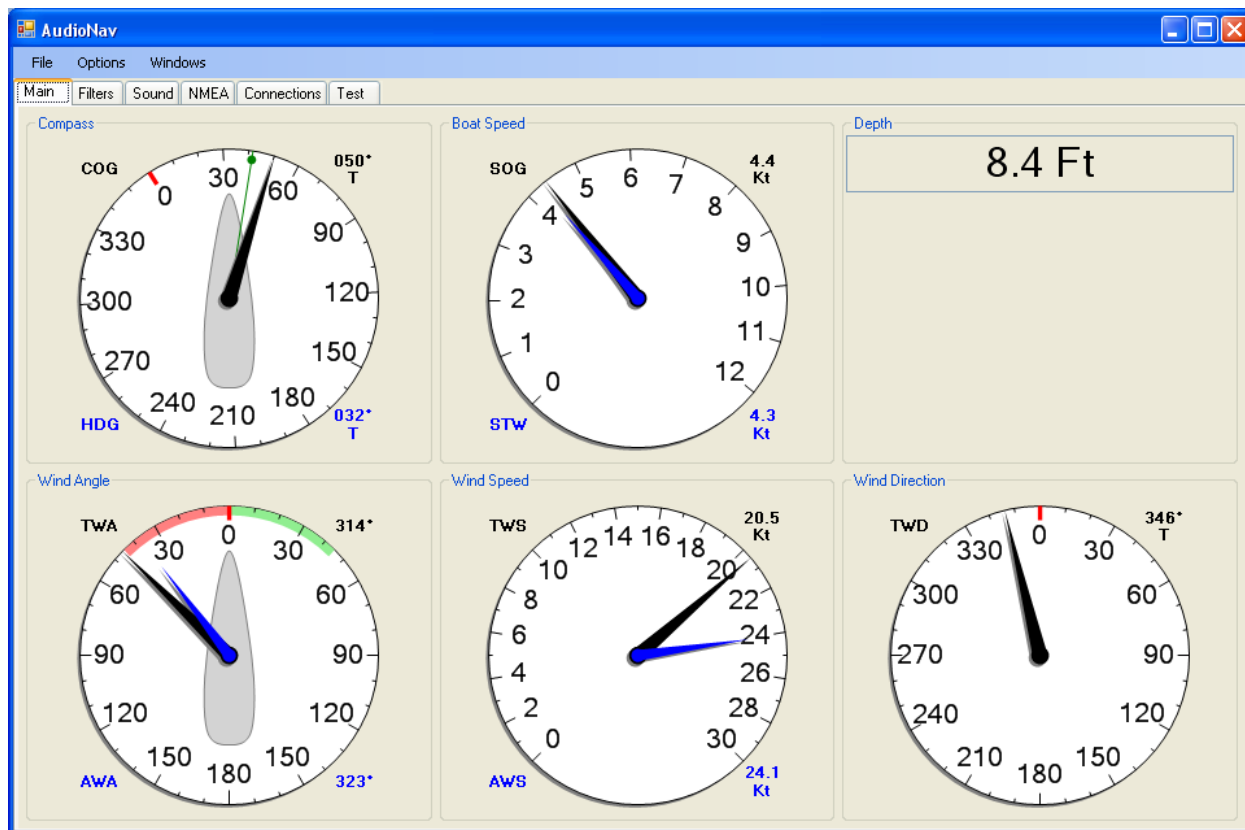


AudioNav

A Windows program for the visually-impaired sailor



Disclaimer

AudioNav is currently in the very early stages of design and testing. At this point it is more a test-bed for the various features that may appear in the final version. Many necessary features are missing, and the program is guaranteed to contain bugs. We take no responsibility for any problems resulting from the installation or use of AudioNav.

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Version

This document covers AudioNav Version 1.0.0.36 – which is probably not an appropriate version number for the first test release. Future versions may not continue this version sequence.

Technology

AudioNav is written in C#, under the Microsoft Visual Studio design framework. This is a new language and environment for us, so we may not always get it right.

This program provides voice annunciation of many navigation parameters (course, speed, depth, etc). The speech synthesis uses Microsoft's Text-To-Speech capability, which is provided with the Windows operating system.

AudioNav is designed to connect to the NMEA 0183 data stream generated by the boat's navigation electronics. This connection can be via a serial port, or by a TCP/IP connection. Initially, only a small subset of the available NMEA messages are being decoded (RMC, RMB, HDG, MWV, MWD, VWR, VHW, DBT). These are sufficient for evaluating the program's capabilities, but the decoding capability will be expanded as development proceeds.

It may be useful to run the NavMonPc program as a front-end for the testing of AudioNav. NavMonPc can be used to play back a captured NMEA file, and provide this data via a "Virtual" serial port, or by NavMonPc's TCP/IP server. NavMonPc can also optionally generate NMEA RMB, MWD, and MWV sentences, which can be decoded by AudioNav.

Installation

The AudioNav can be installed from the FourFathom.com website:

<http://www.fourfathom.com/audionav>

Click the **Download** link and the installation program will run. We have not used this deployment method before, and are still figuring out the details, so things may not always go smoothly. We will try to provide both the ability to install from the website, or to download a file (or group of files) for installation on a not-web-connected computer.

Using the Program

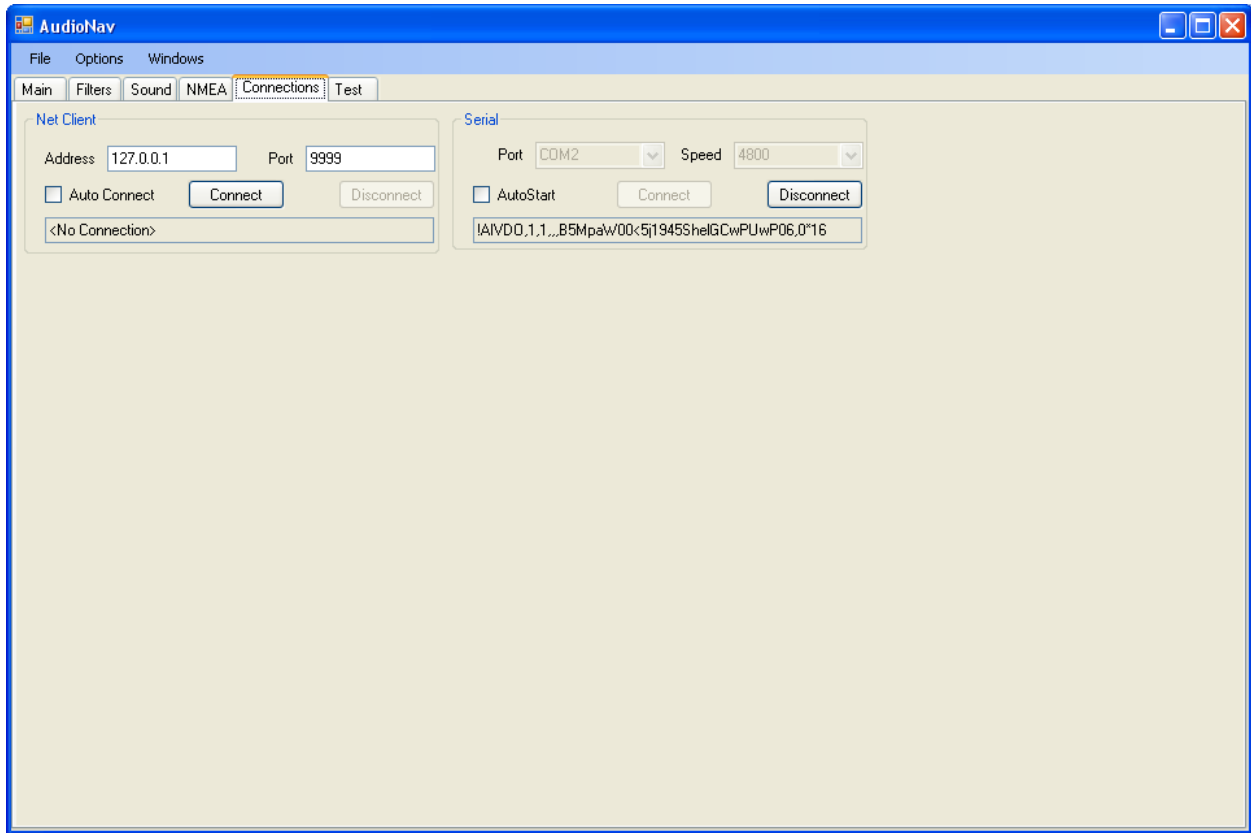
Note that the layout of the various program screens is not final. Instead, these are arranged for testing and troubleshooting. The final program may look much different.

AudioNav will provide a simple keypad-driven method for program control, with voice prompt feedback. This is not currently implemented.

Most AudioNav options will be saved on program exit and restored when the program is again started. Optionally, using the **Options / Restore Defaults** menu selection the options can be cleared on program exit so when AudioNav next starts the default options will be loaded.

For the moment, AudioNav only displays data in True North format, and needs magnetic variation value (provided by the NMEA HDG sentence) to convert magnetic heading data to true. Full True/Magnetic flexibility will be provided in future versions.

Data Connections

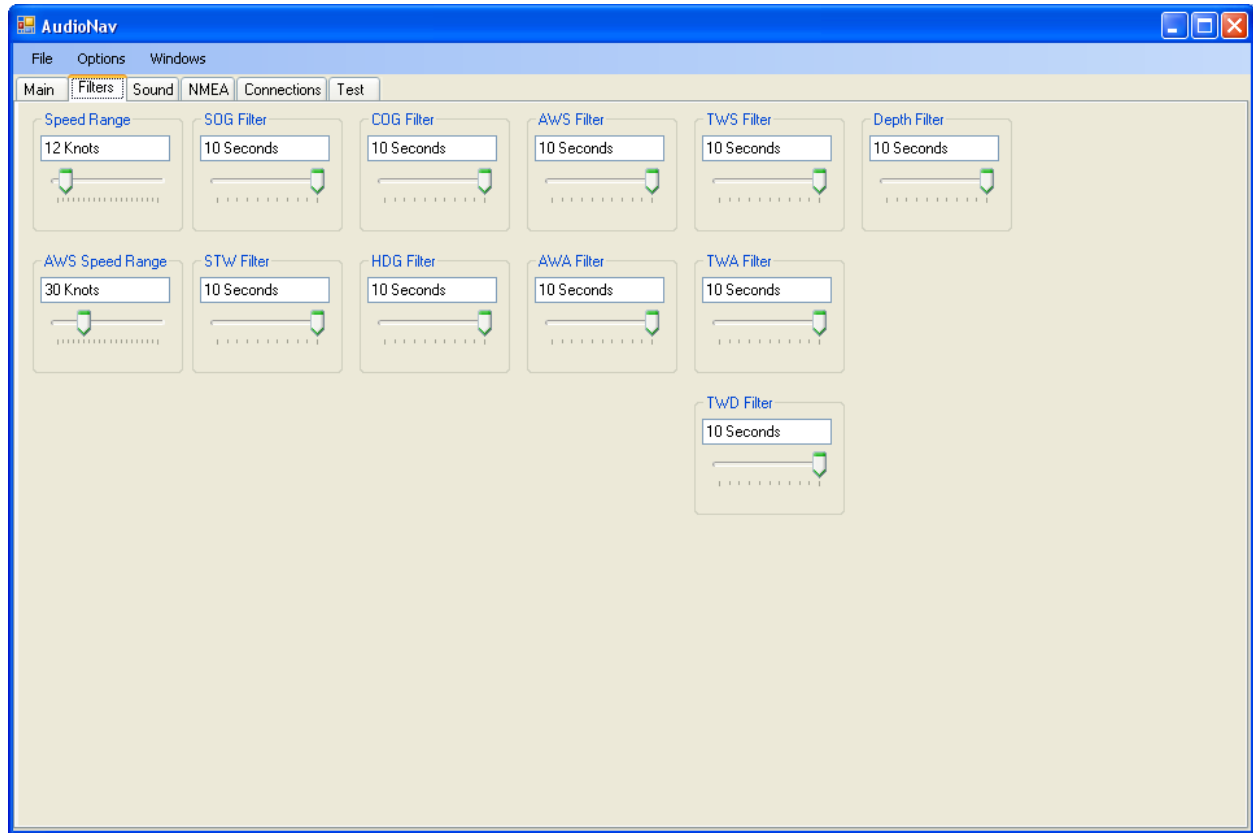


The **Connections** tab contains the controls for the serial port and TCP/IP network connections. The program will attempt to keep a connection open – if ten seconds of silence is detected on a connected port, the program will disconnect and reconnect.

The **Auto Connect** (or **AutoStart** – I will clean this up) box is checked, on program start AudioNav will attempt to connect to most-recently used port.

The default TCP/IP address and port match those used by NavMonPc's server.

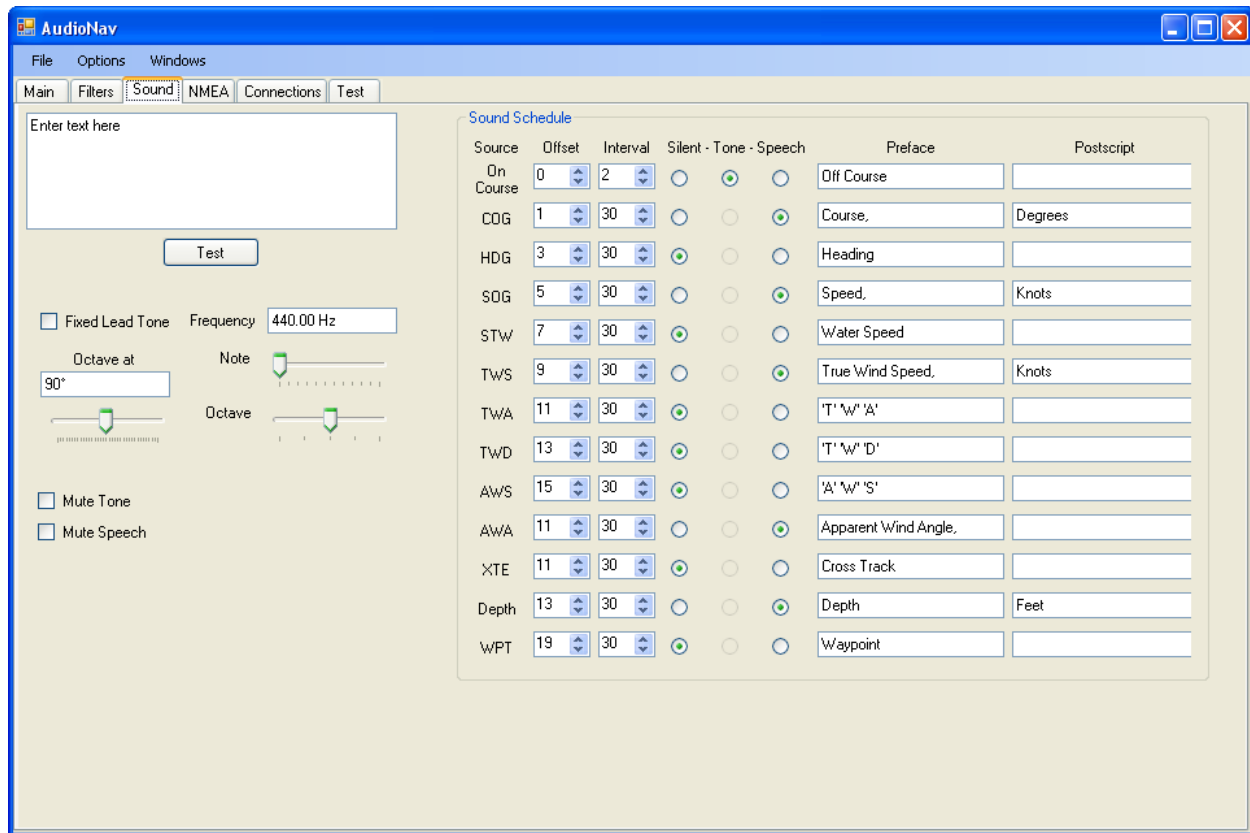
Filters



The **Filters** tab contains data filters and dial range setting controls. The values provided by the NMEA messages can jump around quite a lot, so filters are provided that will smooth this data. These filters have a very simple digital “single pole” characteristic. The time shown is the rise-time of the filter: 0 seconds equals no filtering, and with the 10 second setting the data will take ten seconds to reach 63% of its final value.

The speed dial range settings are only approximate – due to the scaling algorithm used the displayed dial range may not exactly agree with the range control. This will be cleaned up.

Sound and Voice Controls



The **Sound** tab page is where the speech annunciation and tone generation is controlled.

The speech controls allow you to select the rate and sequence for speech annunciation of navigation data. AudioNav provides a sixty-second cycle for potential tone and speech events (this could be longer if desired). The **Interval** selector controls how often the event takes place: as shown above the “On Course” event occurs every two seconds, and there is a zero **Offset**: this event occurs at 0, 2, 4, 6 ... 58 seconds. The “SOG” event occurs at 5 and 35 seconds. It is possible to schedule several events to occur simultaneously, and this should probably be avoided.

There are **Preface** and **Suffix** options for each speech event, which can be changed as desired.

Steering Error Indicator Tone

At the moment the tone output is only used to indicate the steering error: COG vs Course to Waypoint, or COG vs a selected course(see the **Test** tab page for the **Hold Course** control)). Other tone generations options will be necessary.

The steering error tone indicator uses a pair of short beeps to indicate the steering error. When these beeps are at the same pitch, there is no error. As the error accumulates, the beep frequencies will diverge. When the boat is steering to port of the desired course first beep is higher-pitched than the second. When the boat is steering to starboard of the desired course the first beep will be lower. If you

are listening in stereo, the first beep will be centered, and the second beep will be coming from the direction of the course error – *steer towards the second beep*.

The **Fixed Lead Tone** option forces the first beep frequency to be fixed, only the second beep frequency will vary. Otherwise, both beeps will change pitch, each in an opposite direction.

The **Octave At** control changes the sensitivity of the beep frequency change. Here we can provide more or less sensitivity. Too much sensitivity will result in frequencies beyond our ability to easily hear, when there is a large steering error.

The **Note** and **Octave** controls set the frequency of the on-course beep.

For testing the speech synthesis capability, a text box is provided. Enter the text in the box and click the **Test** button.

Mute Tone and **Mute Speech** boxes are provided.

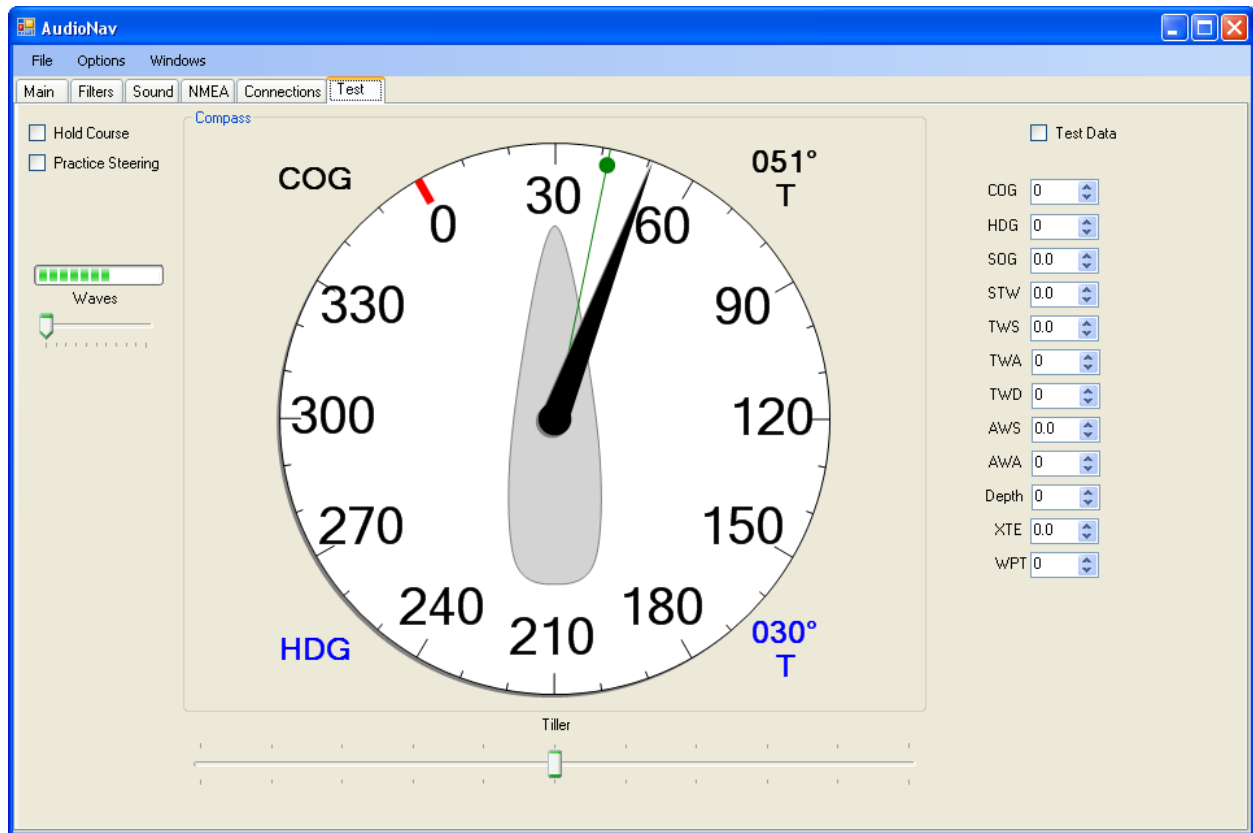
NMEA Monitors

The screenshot shows the AudioNav NMEA Monitors window. It contains several sections for monitoring different NMEA data types:

- HDG**: HDG 018.6°, VAR 015.0°, DEV NaN°, NMEA \$M1HDG,18.6,...,15.0,E*55
- RMC**: LAT 38.8608°, SOG 4.1 Kts, MAG 015.0°, UTC 071005.00, LON -124.0626°, COG 061.0°, 240609, NMEA \$GPRMC,071005.00,A,3851.64664,N,12403.75582,W,4.121,61.02,240609,A*45
- RMB**: WP Pt Arena, WpLAT 38.9450°, WpLON -123.9667°, Arrival False, Range 6.75 NM, XTE -6.629 NM, Bearing 041.5°, VCL 3.3 NM, NMEA \$NMRMB,A,6.629,R,,Pt Arena,3856.70,N,12358.00,W,6.75,41.5,3.3,V,*62
- DBT**: DBT 7.0 Ft, NMEA \$M2DBT,007.0,f,002.1,M,001.1,F*6A
- MwV**: AWS NaN Kt, AWA NaN°, TWS 20.4 Kt, TWA 303.9°, NMEA \$NMMwV,303.86,T,20.40,N,A*00
- VwR**: AWS 23.1 Kt, AWA 316.0°, NMEA \$M2VwR,044,L,23.1,N,11.8,M,042.8,K*30
- MwD**: TWS 20.4 Kt, TwDt 337.5°, TwDm 322.5°, NMEA \$NMMwD,337.46,T,322.54,M,20.40,N,10.50,M*4
- VHw**: Stw 3.96 Kts, HdgT NaN° True, Hdgm 016.0° Mag, NMEA \$M2VHw,,T,016,M,03.96,N,07.33,K*16

These are provided for debugging, and will probably not be in the final program.

Test Window



The **Test** tab page provides methods to test various features of the program. Some of this may prove useful beyond the development phase, but most of these will probably disappear in later versions.

The **Hold Course** option takes the current COG and uses this as a “steer-to” value, as shown by the green “waypoint bug”.

The **Practice Steering** option uses the **Tiller** slider to control the virtual boat’s course. Some off-course **Wave** action can be dialed in (the simulated waves are the combination of a ten-second wave and a 50% larger 22-second swell).

The **Test Data** control allows the setting of individual values for the various nav-data.

Stand-Alone Dials

Each of the **Main** tab page dials can also be viewed in their own freestanding window. Use the **Windows** menu selection to select a particular dial. These dials can be sized as desired for ease of viewing.

Under the **Windows** menu there is also a **Data Monitor** selection, which shows the NMEA data being received by the AudioNav program. This is simply a troubleshooting aid.

Compass



The Compass dial shows boat heading, Course Over Ground, and bearing to waypoint. For the present this is a True North display. As the distance to the waypoint decreases, the green waypoint "bug" grows and slides down the bearing line towards the dial center.

Boat Speed



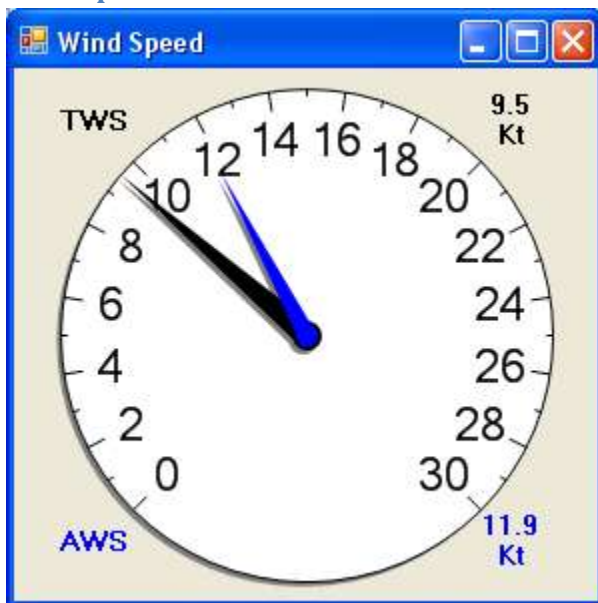
Speed Over Ground and Speed Through the Water are displayed. The full-scale range of this dial may be set on the **Filters** tab page.

Wind Angle



True Wind Angle and Apparent Wind Angle are displayed.

Wind Speed



True Wind Speed and Apparent Wind Speed are displayed. The full-scale range of this dial may be set on the **Filters** tab page.

Wind Direction



This dial shows the True Wind Direction, relative to True North. This may be referenced to the earth, or to the water, depending on the NMEA inputs. Future versions of AudioNav will provide full control of this.

Bugs

- Once connected, the serial port will always attempt to reconnect upon loss of data – even if this is because you have deliberately disconnected.

Features to be Added

- Keypad program control, speech prompting
- Complete NMEA decoding and data selection
- Easy selection of Course to Steer
- A proper depth dial
- Waypoint creation and management
- Intelligent Waypoint / Crosstrack / Course steering support.
- Much more – looking for advice and critiques.