

# **Ariel of Hamble**

## **Navigation**

**Version 0.2**

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# **Ariel of Hamble Navigation Documentation**

Please note - IP addresses and passwords are not present in this document as it is available on the public Internet.

# Navigation Overview

This is an overview of the software and hardware used for Ariel of Hamble's Navigation.

NOTE: Please be aware that some information is measured and some is derived from those measurements. For example, Apparent Wind Speed (AWS) is measured and True Wind Speed (TWS) is calculated from AWS and Speed Through the Water (STW). A problem with a measured value will cause knock-on issues with values derived from it.

## TackTicks

## Depth

The depth sounder uses ultrasonic waves to measure the depth beneath the transducer.

## Speed

The speed transducer uses a paddle wheel.

## Wind Speed and Direction



The Wind Speed and Direction unit at the top of the mast is solar powered. It transmits the information to the unit in the Navigation locker using a proprietary format called **Raymarine Micronet**. The unit in the navigation locker then converts the proprietary data to standard NMEA 0143.

## EmTrak AIS

The EmTrak AIS is a multipurpose device. It is the vessel's source of location data, it is an AIS class B+ transceiver, sending the boat's location to other vessels and, when in range, shore stations, it receives the locations of other vessels and it has an inbuilt switch connecting both the internal AIS and the VHF to the mast-head antenna.

To prevent the VHF being powered on and transmitting in to a switched off AIS unit, both the EmTrak and VHF are on the same power switch "VHF". Please switch on "VHF", wait until it acquires a position and displays it on the VHF front panel and then switch on the "Navigation" switch.

## GPS Information

The EmTrak sends the following GNSS information to the Navigation system:

- Location
- COG and SOG
- Rate of Turn
- Time
- Number of Satellites
- Precision

NOTE: The EmTrak unit uses the US GPS, EU Galileo, Russian Glonass and Chinese Beidou locations satellites.

## AIS Targets

The EmTrak also sends:

- Class A Vessel Location
- Class B Vessel Location
- Class A Vessel Type, Cargo, Destinations etc.
- Search and Rescue Aircraft
- Aids to Navigation (“Virtual Buoys”)
- Safety Messages (MOB devices, SARTs etc.)

# Standard Horizon VHF

## Open Plotter

## RaspberryPi

## SignalK

SignalK is software designed to import data from a variety of sources around the boat and stores it in a central database which can be accessed by other software. On Ariel, the SignalK server takes data from a range of inputs such as the NMEA 0143 bus used by the TackTicks and EmTrak, from the barometer and thermometer in the navigation locker and software modules running on the Raspberry Pi and imports them in to the database. SignalK also stores a range of static data in this database which can be used in calculations, e.g. vessel draught.

SignalK stores data addresses and values, for example:

```
/vessels/<mmsi>/environment/windSpeedTrue 4.23
```

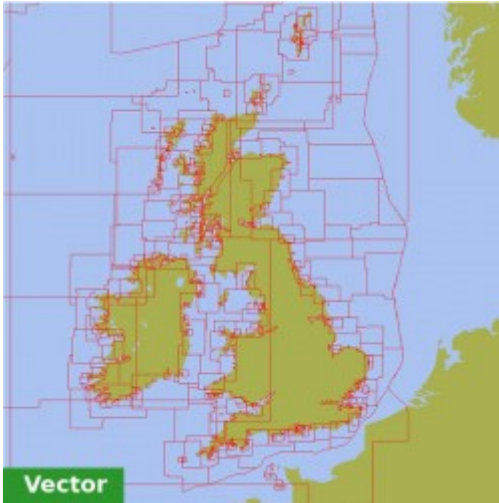
```
/vessels/<mmsi>/navigation/position 51.23453,-0.12248,2.34
```

This database is available to other software to read from - the plotter software, OpenCPN, receives all of its location details, AIS vessels to overlay, DSC alerts directly from the SignalK database. SignalK also has a number of output plugins so the data is converted back to NMEA 0143 so derived values can be displayed on the TackTicks, to a data stream that can be used by Navionics or similar on member's phones and tablets and in some cases to files so that trends can be observed (e.g. we're actively monitoring battery state to see if we can understand better what is causing mysterious battery drainage).

Further details on SignalK can be found at [SignalK Website](#)

## OpenCPN

### O-Charts



**O-charts** use the latest information from a number of European hydrographic offices to create chart packages specifically designed for OpenCPN. Each purchase is licensed to a USB key that is plugged in to the Raspberry Pi.

NOTE: without the USB key, the charts will not be displayed.

Each year we purchase the entire UK chart set plus any required for the summer cruise, e.g. Atlantic France. If you are planning on sailing anywhere that could require new charts, please contact the Commodore. Charts can be installed remotely. Charts receive updates every four weeks - again updates can be run remotely.

### MOB and Safety Notifications

## Dashboard

## Custom Software

Our custom software uses a number of tools that are built in to the Raspberry Pi's operating system. The majority use a service called `cron` which runs a specific programme at a specific time.



## Engine Hours

The engine hours meter works by sampling the voltage output from the alternator. If a voltage is present, the alternator and engine are running. The total hours value is stored in a text file. Every 3 mins the software checks for the presence of voltage and if present, increments the time stored in the file and sends to new value to the SignalK database.

## Offsite Notifier

The offsite notifier uses a service called ([ntfy.sh](https://ntfy.sh)) - sending short notifications from the Raspberry Pi which can be read by the Boatswain's team and committee. To ensure that Skippers and Mates are aware that a notification is running, a short jingle is played. For information on the NTFY channel that you need to subscribe to, please contact the commodore.

## Location

The location notification checks if the boat is approaching a fixed location and sends a ntfy.sh notification. This is mainly used on the approach to Elephant Boatyard to know when the boatswain's team can visit the yard to do work.

## Sunset

The sunset notification lets us know that the navigation system is running at sunset, so we know that a night sail is taking place.

## Future Projects

### Better Data Dashboard

### Shutdown Information

We are planning to use the offsite notifier to send a set of data when the navigation system is shutdown. This would be used for information important to planning maintenance and spotting early indications of issues. In the initial rollout we're hoping to send engine hours, battery status and cabin humidity with a hope to add further information such as fridge minimum temperature, engine maximum temperature, bilge water level etc.

Better Engine Information

Better Battery Information

# Starting the Navigation System

# Basic Use of OpenCPN Plotter

Interface Overview

Zooming and Panning

Getting Information on Chart Item

# Advanced Use of OpenCPN

# Data Dashboard

# Other OpenPlotter Software

XyGrib

VLC

Screenshot

# Switching Off the Navigation Systems



# Troubleshooting

# Reporting a Fault

Please send fault reports with the system to the Commodore and the Boatswain.

In the fault report please include:

- A description of the error including, if possible, what data values are faulty.
  - For example, Depth is showing “—” on the TackTick display, but is present on the plotter display. Reports such as speed is wrong, without
- a description of what is happening are difficult to remotely diagnose.
  - Screenshots, photos, videos etc. are always helpful!
- The date and time that the error occurred.

The Commodore and Boatswain have remote access to the system, so they may ask you to leave it switched on when you're doing something else.

test

# Update List

version	description	date
0.2	Automated PDF creation	21/01/26
0.1	Automated webpage creation	21/01/26

## *Version 0.2*

- Set up creation of PDF using Sphinx SimplePDF

## *Version 0.1*

- Set up publishing to GitHub pages - online documentation

# SimplePDF Debug output

This is some build environment specific output. It shall help to identify problems during the build process.

You see this output because **simplepdf\_debug=True** is set on the **conf.py** file.

# Sphinx

**Version:** 9.1.0

**Srcdir:** /home/runner/work/ArielOfHamble-NavigationDocumentation/ArielOfHamble-  
NavigationDocumentation/doc

**Confdir:** /home/runner/work/ArielOfHamble-NavigationDocumentation/ArielOfHamble-  
NavigationDocumentation/doc

**Outdir:** /home/runner/work/ArielOfHamble-NavigationDocumentation/ArielOfHamble-  
NavigationDocumentation/doc/pdf\_build/simplepdf

## Extensions

Used Sphinx extension can be also found in the packages list of Python, which also includes the used version.

myst\_parser  
sphinx.ext.mathjax  
sphinx\_simplepdf

## SimplePDF Configs

**simplepdf\_vars:** {}  
**simplepdf\_file\_name:** AoH-Navigation.pdf  
**simplepdf\_debug:** True  
**simplepdf\_weasyprint\_timeout:** None  
**simplepdf\_weasyprint\_retries:** 0  
**simplepdf\_weasyprint\_flags:** None  
**simplepdf\_weasyprint\_filter:** []  
**simplepdf\_use\_weasyprint\_api:** None  
**simplepdf\_theme:** simplepdf\_theme  
**simplepdf\_theme\_options:** {}  
**simplepdf\_sidebars:** {'\*\*': ['localtoc.html']}

# Python

**Executable:** /opt/hostedtoolcache/Python/3.13.11/x64/bin/python

**Operating System:** Linux (Release: 6.11.0-1018-azure)

## Packages

This chapter shows a list of installed packages in the current Python environment, which was used to build this PDF. The second value is the version number.

### Important packages

**PIL:** unknown

**sphinx:** 9.1.0

**sphinx\_simplepdf:** 1.7.0

**weasyprint:** 68.0

### Other packages

\_\_future\_\_: unknown

\_\_hello\_\_: unknown

\_\_phello\_\_: unknown

\_aix\_support: unknown

\_android\_support: unknown

\_apple\_support: unknown

\_asyncio: unknown

\_bisect: unknown

\_blake2: unknown

\_brotli: unknown

\_bz2: unknown

\_cffi\_backend: unknown

\_codecs\_cn: unknown

\_codecs\_hk: unknown

\_codecs\_iso2022: unknown

\_codecs\_jp: unknown

\_codecs\_kr: unknown

---

`_codecs_tw`: unknown  
`_collections_abc`: unknown  
`_colorize`: unknown  
`_compat_pickle`: unknown  
`_compression`: unknown  
`_contextvars`: unknown  
`_csv`: unknown  
`_ctypes`: unknown  
`_ctypes_test`: unknown  
`_curses`: unknown  
`_curses_panel`: unknown  
`_datetime`: unknown  
`_dbm`: unknown  
`_decimal`: unknown  
`_elementtree`: unknown  
`_gdbm`: unknown  
`_hashlib`: unknown  
`_heapq`: unknown  
`_interpchannels`: unknown  
`_interpqueues`: unknown  
`_interpreters`: unknown  
`_ios_support`: unknown  
`_json`: unknown  
`_lsprof`: unknown  
`_lzma`: unknown  
`_markupbase`: unknown  
`_md5`: unknown  
`_multibytecodec`: unknown  
`_multiprocessing`: unknown  
`_opcode`: unknown  
`_opcode_metadata`: unknown  
`_osx_support`: unknown  
`_pickle`: unknown  
`_posixshm`: unknown  
`_posixsubprocess`: unknown  
`_py_abc`: unknown  
`_pydatetime`: unknown  
`_pydecimal`: unknown  
`_pyio`: unknown  
`_pylong`: unknown  
`_pyrepl`: unknown  
`_queue`: unknown  
`_random`: unknown

\_sass: unknown  
\_sha1: unknown  
\_sha2: unknown  
\_sha3: unknown  
\_sitebuiltins: unknown  
\_socket: unknown  
\_sqlite3: unknown  
\_ssl: unknown  
\_statistics: unknown  
\_strptime: unknown  
\_struct: unknown  
\_sysconfigdata\_\_linux\_x86\_64-linux-gnu: unknown  
\_testbuffer: unknown  
\_testcapi: unknown  
\_testclinic: unknown  
\_testclinic\_limited: unknown  
\_testexternalinspection: unknown  
\_testimportmultiple: unknown  
\_testinternalcapi: unknown  
\_testlimitedcapi: unknown  
\_testmultiphase: unknown  
\_testsinglephase: unknown  
\_threading\_local: unknown  
\_tkinter: unknown  
\_uuid: unknown  
\_weakrefset: unknown  
\_xtestfuzz: unknown  
\_yaml: unknown  
\_zoneinfo: unknown  
abc: unknown  
alabaster: 1.0.0  
antigravity: unknown  
argparse: unknown  
array: unknown  
ast: unknown  
asyncio: unknown  
babel: 2.17.0  
base64: unknown  
bdb: unknown  
binascii: unknown  
bisect: unknown  
brotli: 1.2.0  
bs4: unknown

bz2: unknown  
calendar: unknown  
certifi: 2026.1.4  
cffi: 2.0.0  
charset\_normalizer: 3.4.4  
cmath: unknown  
cmd: unknown  
code: unknown  
codecs: unknown  
codeop: unknown  
collections: unknown  
colorsys: unknown  
compileall: unknown  
concurrent: unknown  
configparser: unknown  
contextlib: unknown  
contextvars: unknown  
copy: unknown  
copyreg: unknown  
cProfile: unknown  
cssselect2: 0.8.0  
csv: unknown  
ctypes: unknown  
curses: unknown  
dataclasses: unknown  
datetime: unknown  
dbm: unknown  
decimal: unknown  
difflib: unknown  
dis: unknown  
doctest: unknown  
docutils: 0.22.4  
email: unknown  
encodings: unknown  
ensurepip: unknown  
enum: unknown  
fcntl: unknown  
filecmp: unknown  
fileinput: unknown  
fnmatch: unknown  
fontTools: 4.61.1  
fractions: unknown  
ftplib: unknown



functools: unknown  
genericpath: unknown  
getopt: unknown  
getpass: unknown  
gettext: unknown  
glob: unknown  
graphlib: unknown  
grp: unknown  
gzip: unknown  
hashlib: unknown  
heapq: unknown  
hmac: unknown  
html: unknown  
http: unknown  
idlelib: unknown  
idna: 3.11  
imagesize: 1.4.1  
imaplib: unknown  
importlib: unknown  
inspect: unknown  
io: unknown  
ipaddress: unknown  
jinja2: 3.1.6  
json: unknown  
keyword: unknown  
linecache: unknown  
locale: unknown  
logging: unknown  
lzma: unknown  
mailbox: unknown  
markdown\_it: unknown  
markupsafe: 3.0.3  
math: unknown  
mdit\_py\_plugins: 0.5.0  
mdurl: 0.1.2  
mimetypes: unknown  
mmap: unknown  
modulefinder: unknown  
multiprocessing: unknown  
myst\_parser: 5.0.0  
netrc: unknown  
ntpath: unknown  
nturl2path: unknown

numbers: unknown  
opcode: unknown  
operator: unknown  
optparse: unknown  
os: unknown  
packaging: 26.0  
pathlib: unknown  
pdb: unknown  
piccolo\_theme: 0.24.0  
pickle: unknown  
pickletools: unknown  
pip: 25.3  
pkgutil: unknown  
platform: unknown  
plistlib: unknown  
poplib: unknown  
posixpath: unknown  
pprint: unknown  
profile: unknown  
pstats: unknown  
pty: unknown  
py\_compile: unknown  
pyclbr: unknown  
pyparser: 3.0  
pydoc: unknown  
pydoc\_data: unknown  
pydyf: 0.12.1  
pyexpat: unknown  
pygments: 2.19.2  
pyphen: 0.17.2  
pysassc: unknown  
queue: unknown  
quopri: unknown  
random: unknown  
re: unknown  
readline: unknown  
reprlib: unknown  
requests: 2.32.5  
resource: unknown  
rlcompleter: unknown  
roman\_numerals: 4.1.0  
runpy: unknown  
sass: unknown

sasstests: unknown  
sassutils: unknown  
sched: unknown  
secrets: unknown  
select: unknown  
selectors: unknown  
shelve: unknown  
shlex: unknown  
shutil: unknown  
signal: unknown  
site: unknown  
smtpplib: unknown  
snowballstemmer: 3.0.1  
socket: unknown  
socketserver: unknown  
soupsieve: 2.8.3  
sphinx\_rtd\_theme: 3.1.0  
sqlite3: unknown  
sre\_compile: unknown  
sre\_constants: unknown  
sre\_parse: unknown  
ssl: unknown  
stat: unknown  
statistics: unknown  
string: unknown  
stringprep: unknown  
struct: unknown  
subprocess: unknown  
symtable: unknown  
sysconfig: unknown  
syslog: unknown  
tabnanny: unknown  
tarfile: unknown  
tempfile: unknown  
termios: unknown  
test: unknown  
textwrap: unknown  
this: unknown  
threading: unknown  
timeit: unknown  
tinycss2: 1.5.1  
tinyhtml5: 2.0.0  
tkinter: unknown

token: unknown  
tokenize: unknown  
tomllib: unknown  
trace: unknown  
traceback: unknown  
tracemalloc: unknown  
tty: unknown  
turtle: unknown  
turtledemo: unknown  
types: unknown  
typing: unknown  
typing\_extensions: 4.15.0  
unicodedata: unknown  
unittest: unknown  
urllib: unknown  
urllib3: 2.6.3  
uuid: unknown  
venv: unknown  
warnings: unknown  
wave: unknown  
weakref: unknown  
webbrowser: unknown  
webencodings: 0.5.1  
wsgiref: unknown  
xml: unknown  
xmlrpc: unknown  
xxlimited: unknown  
xxlimited\_35: unknown  
xxsubtype: unknown  
yaml: unknown  
zipapp: unknown  
zipfile: unknown  
zipimport: unknown  
zlib: unknown  
zoneinfo: unknown  
zopfli: 0.4.0

