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 servier 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`

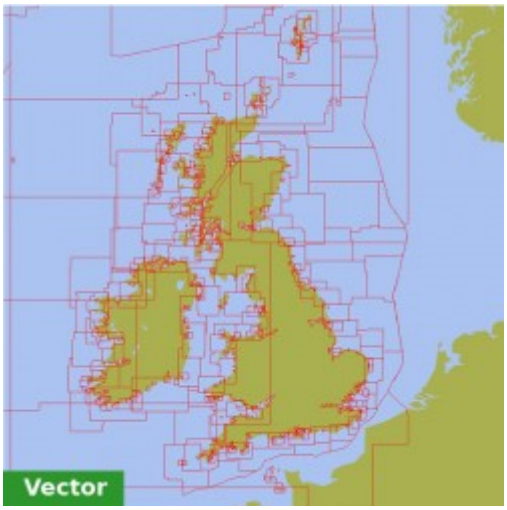
`/vessels/<mmsi>/navigation/position 51.23453,-0.12248,2.34`

This database is available to other software to read from - the plotter software, OpenCPN, receives all of its locations 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 - 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.

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

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

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
_posixshmem: 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
_xxtestfuzz: 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
pycparser: 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
smtplib: 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