Introduction to boat electronics

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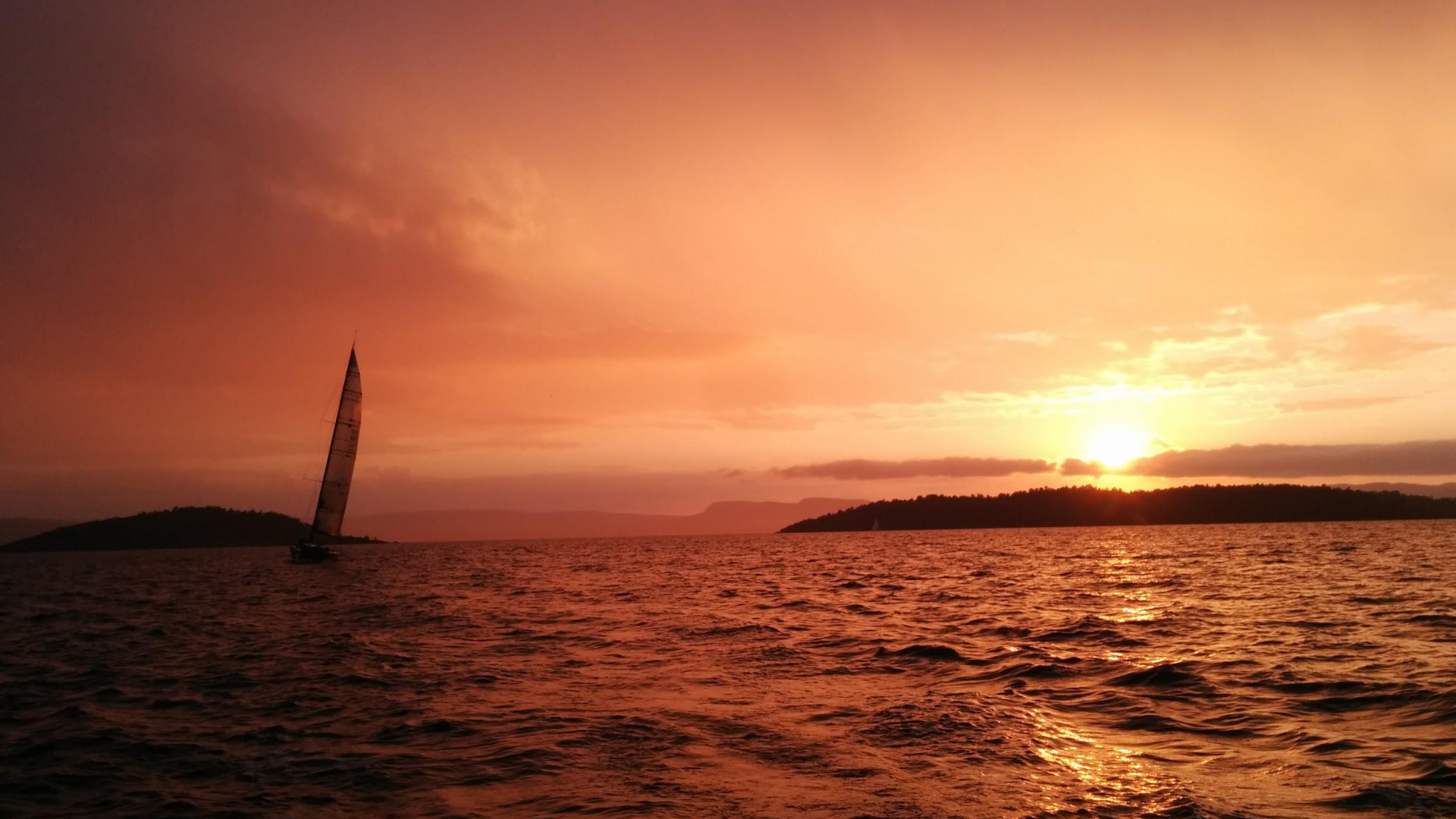
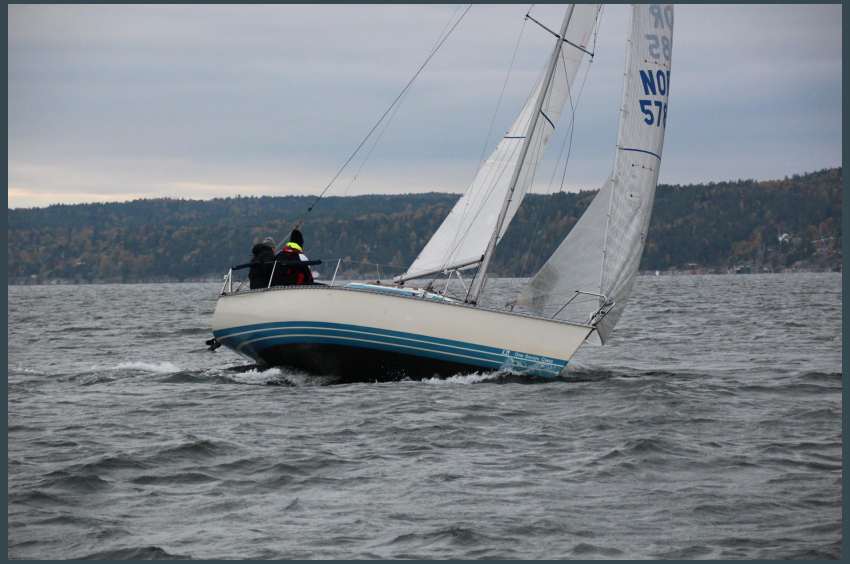
Agenda

Get an overview of the electronics on board of an amateur sailing yacht or power boat, and how they are connected.



Who am I

- Varnish Cache developer
- Racing sail boats in Oslo, Norway
- Active in Oslo hackerspace Hackeriet (https://hackeriet.no/)



What electronics are there?

compass

navigation lights

chart plotter

VHF radio transceiver

AIS transmitter

trim angle adjustment (power boats)

sensors like gps receivers, wind

autopilot

radar

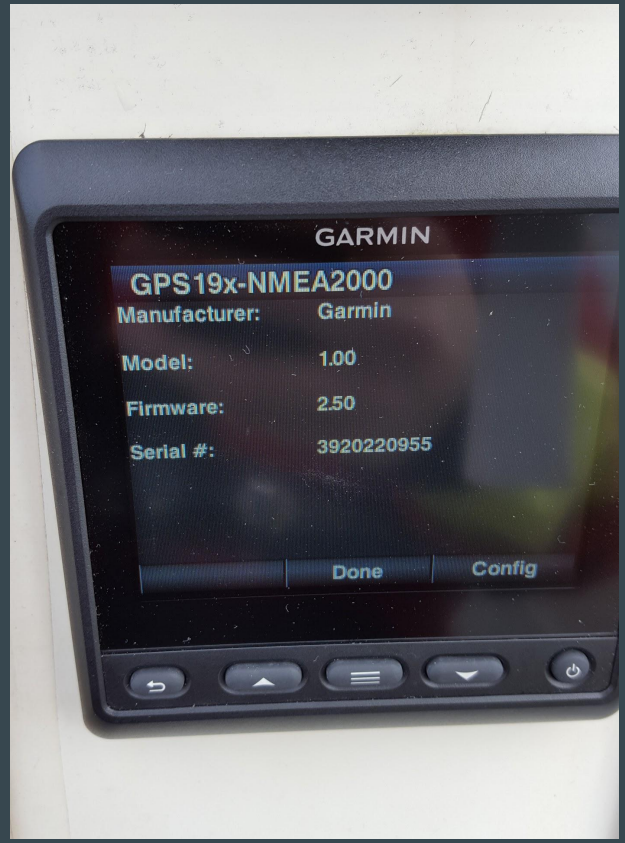
computing nodes (racing)

“3D compass” (racing)

rig tension sensors (racing)

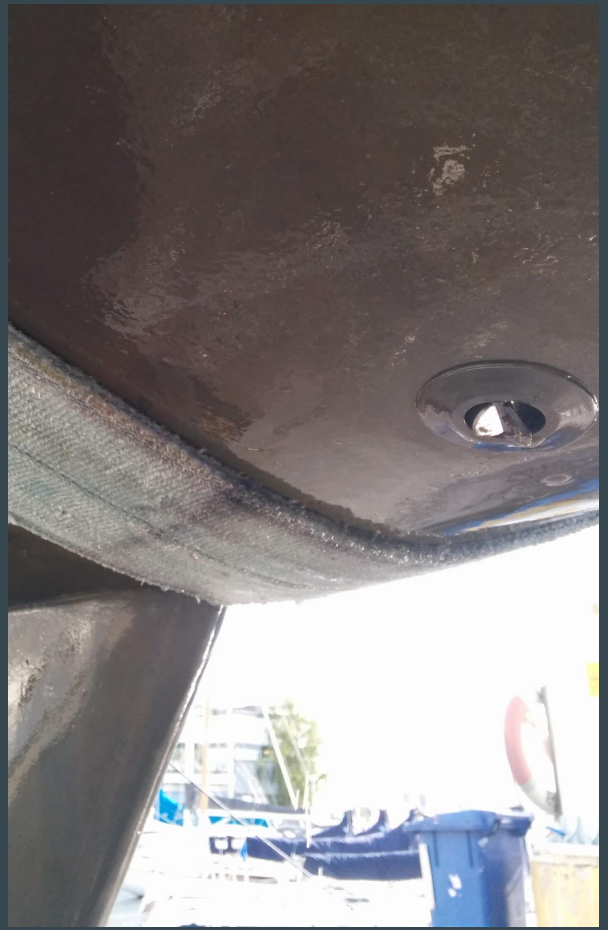
Displays

Show speed, course, wind speeds ..
Usually pretty primitive.
Needs to be waterproof



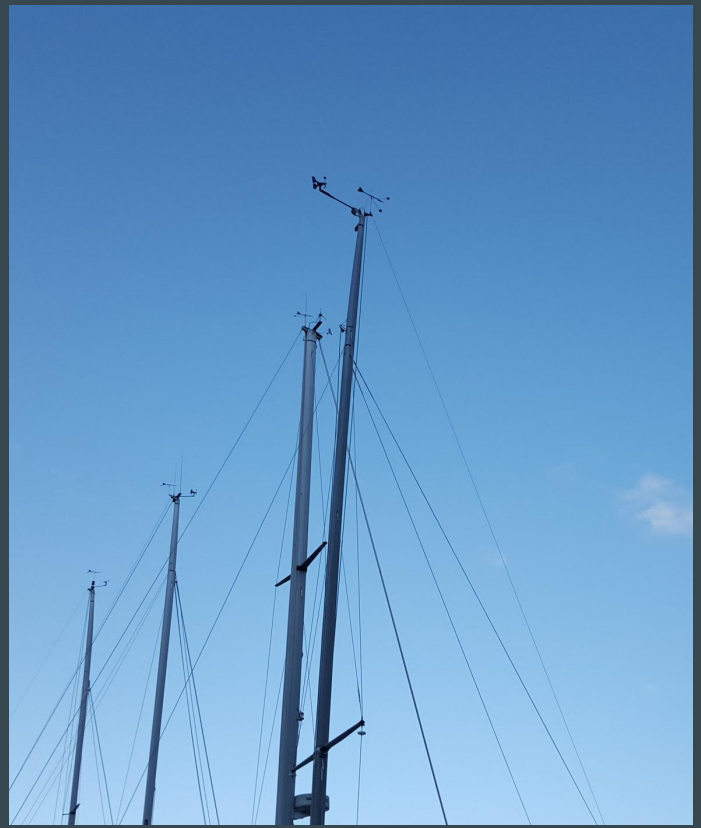
Paddle wheel

Measures Speed through water. (STW)
Endless calibration



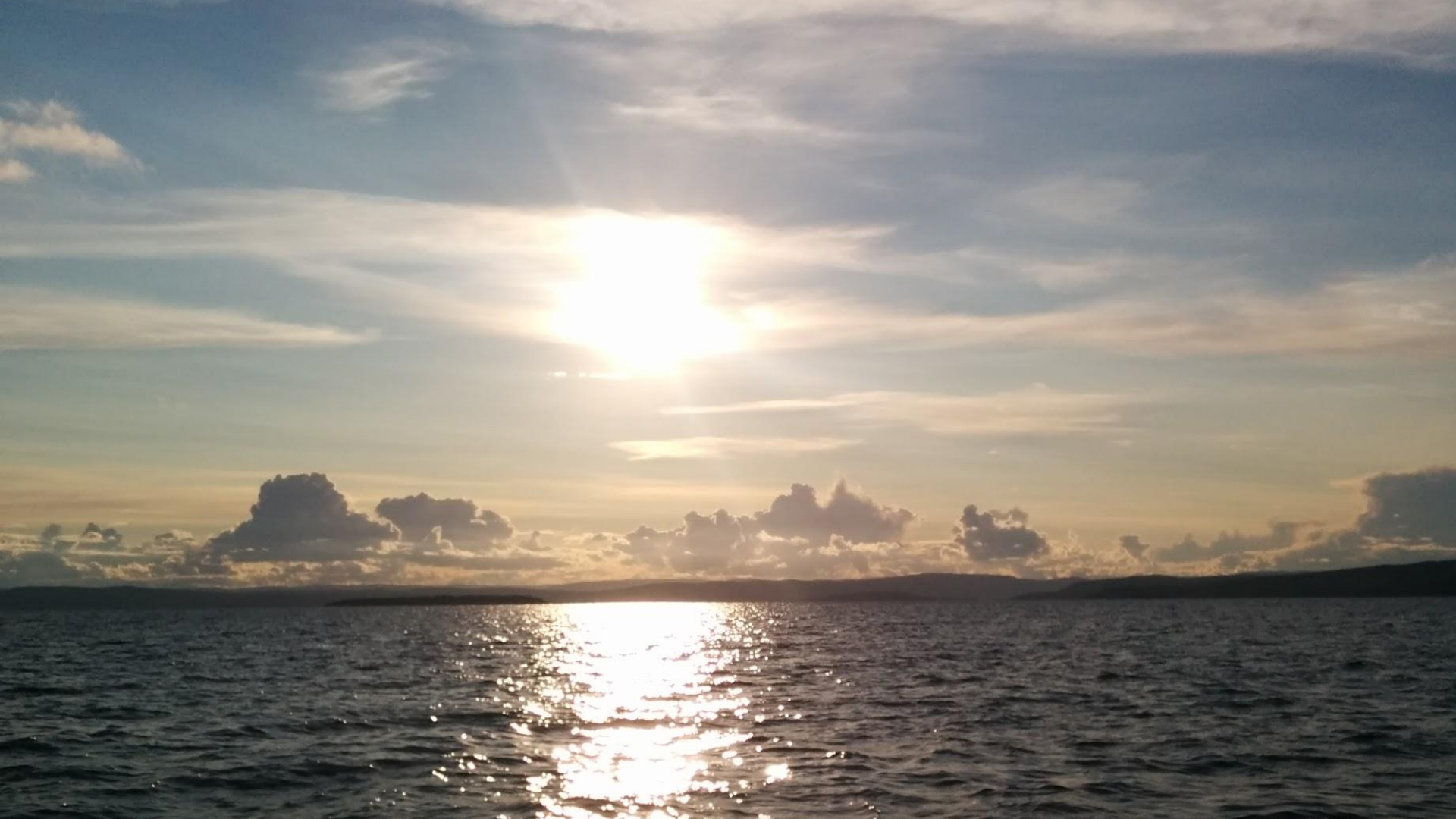
Wind sensor

Sometimes “anemometer”.
Apparent wind direction and wind speed.



GPS receiver

Marine receiver means that it is more expensive.



Power systems

- 12 volt systems
- Ni-Cd car batteries most often
- Separate battery banks for starting and consumption
- 100-400 Ah capacities

- Litium based LiFePO4 banks being introduced. (weight, charging time, available capacity)
- Damp marine environment means corrosion.

Interfacing protocols

NMEA0183

NMEA2000

NMEA2000 derivatives (SimNet, Seatalk NG, etc)

SignalK

Legacy: Seatalk, Nexus FDX

NMEA0183

- You've seen this one output from consumer GPS units.

```
$GPGGA,092750.000,5321.6802,N,00630.3372,W,1,8,1.03,61.7,M,55.2,M,,*76
$GPGSA,A,3,10,07,05,02,29,04,08,13,,,,,1.72,1.03,1.38*0A
$GPGSV,3,1,11,10,63,137,17,07,61,098,15,05,59,290,20,08,54,157,30*70
```

- serial port slowness, no broadcast.
- Pretty much universally understood and available. Well documented by third parties like gpsd.

NMEA2000

- “State of the art”. High speed! 250kbit/s!
- Binary messaging
- CANbus based physical layer
- Information model is not public.
- Some reverse engineering done (canboat project)
- Not widely available or understood. Tooling is lacking.
- Devicenet Micro-C connectors make physical installation a breeze.

Some vendor-specific “extensions” with incompatible cabling.

Legacy protocols

- Seatalk, Seatalk2
- Furuno Navnet
- Nexus FDX

(mentioned for completeness, in case you run into it)

SignalK

- Open source project
- Collects sensor metrics from all buses/interfaces
- Everything instantly available as a JSON file over HTTP/websocket
- Nice visualizations/navigation tools being written
- Some industry interest being shown (iKommunicate units)

SignalK is currently the best forum for discussing boat electronics online.

Marine electronics vendors

B&G (Navico)

Raymarine (FLIR)

Garmin

Ockam

NKE

(commercially available, “complete solutions”.)

Contact

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