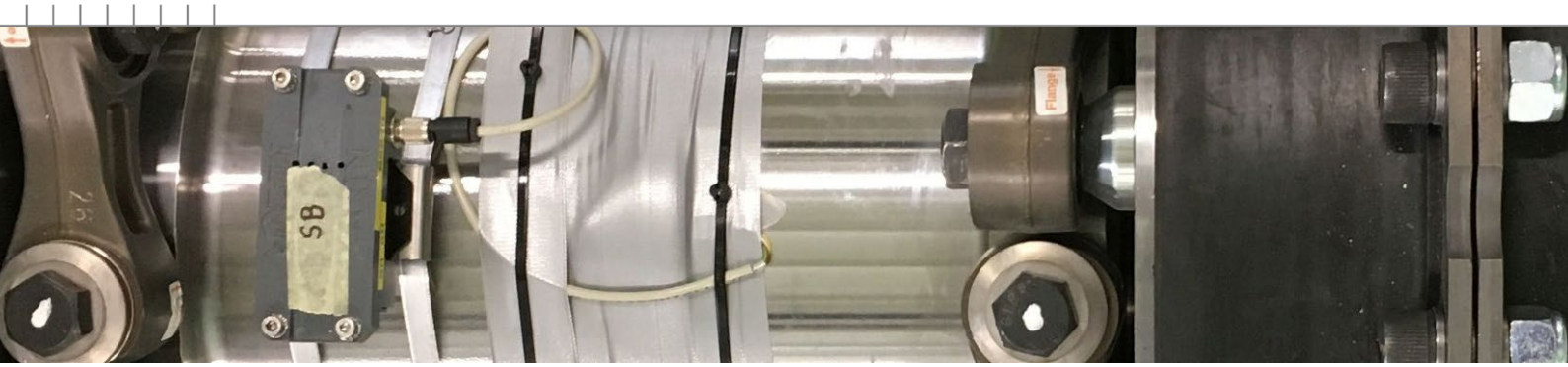


Outdoor equipment selection

MARIN performs measurements anywhere, anytime. With the expertise of our specialists, we perform measurements during sea trials, for troubleshooting, and research topics. This leaflet shows a selection of the tools and instruments that we use.

Stereo digital image correlation (Stereo-DIC)

3D deformation mapping

Stereo Digital Image Correlation (DIC) techniques make it possible to measure 3D locations and deformations of surfaces using two camera's. MARIN has already applied this technique for years to measure the deflection/location of propellers, floating solar panels, ship motions and even waves and wake fields of full-scale vessels. We typically explore the boundaries of the stereo vision techniques and use advanced cameras, lenses and calibration methods to get accurate results. The main advantage of DIC is that a surface can be measured from a distance, without the need of instrumenting the surface, as long as the surface itself has distinctive features which can be traced with the cameras.

Available camera selection

Compact and high speed cameras

Cameras are selected for the best image quality under expected trial conditions. For example the Phantom VEO 410 is a very light sensitive, compact camera which has a large image sensor to give the best results on propeller observations through a window. If light conditions allow, we typically shoot at 2000 or up to 3000 frames per second at full resolution. If there is limited space above the window, we might use IDT OS7 high speed cameras. This camera is half the size of the Phantom camera and also operates very well in low light conditions shooting up to 1300 frames per second. This camera can be used both for window and borescope observations.

Strain gauge

Strain gauge force measurements

Strain gauges are used to accurately measure forces in steel structures or shafts, for temporary or long-term applications.

Possible applications are power measurements on engine or propeller shaft, stresses in beams and fatigue monitoring.

Load cell

Tension load measurements

For the measurement of loads, such as weights or the 'bollard pull' of tugs, we use specially selected load cells ranging from 6,5 to 350 Ton. Wireless read-out using our long range transmitter gives the opportunity for live feed on the bridge.

SATEL

Long range communication

To transmit data over a long range (up to 20 km), MARIN uses 403 - 473 MHz transmitters which can be used in combination with various measurement equipment for central data acquisition of remote sensors.

Selection of MRU's

Motion measurements

Selecting the optimal motion sensor depends on the conditions to be measured. MARIN has a selection of sensors available ranging from small and easy to install MTI's to the PHINS for high precision in harsh environments. The PHINS (Photonic Inertial Navigation System) from IXBlue is a compact device which gives all-in-one high-accuracy 3D positioning with heading, roll and pitch.

Range of pressure sensors

Pressure pulse measurements

Measuring the propeller pressure pulses on full-scale vessels is one of our main full-scale applications of pressure sensors. The holes for the pressure sensors can be drilled while the vessel is in service. A typical application is verifying the theoretical pressure pulses of the propeller. Sampling rates up to 250 kHz are possible.

Drone MV Auris

Test bench for autonomous sailing

The MV Auris is a 5.7 m long RHIB (Rigid Hull Inflatable Boat) with a removable, modular sensor frame. The sensor frame and its control systems allow autonomous sailing inland or at sea utilizing several sensors for situational awareness. In-house developed sensor fusion, collision avoidance and path planning algorithms are implemented for autonomous operation. Situational awareness is provided by DGPS, RADAR, LIDAR, AIS and infrared cameras. The 140hp outboard gives it a max speed of 30 knots.

Bruel & Kjaer 2250

Sound level meter

For sound measurements we use our B&K2250 sound level meter and analyser. It features frequency analysis, FFT and signal recording.

Range of accelerometers

Vibration measurements

A range of fixed and handheld accelerometers is available, selected on the specifications of the challenge at hand. From quantifying pressure pulses, determining comfort levels to identifying vibration modes.

Radiated wave measurements

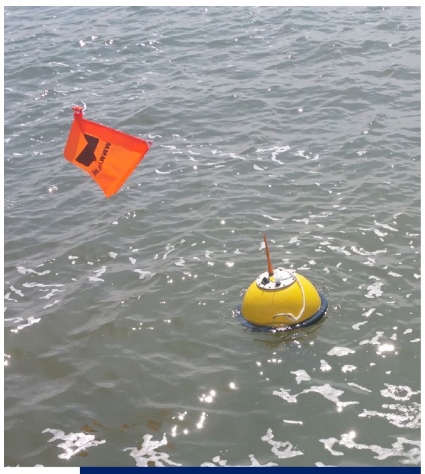
Ultra sonic distance sensor

Ultra sonic distance sensors can measure the distance to a surface in a range from 0.5 to 10 m. The surface can be solid or liquid which makes it possible to measure the wave height of passing vessels. In The Netherlands some vessels have to meet requirements on their radiated waves. MARIN measures these waves on a carefully selected spot and separates the waves of the vessel from the undisturbed waves.

Encountered wave measurement

Wave radar

A wave radar is used to record waves from a vessel or structure. The device records the distance to the water surface and is corrected for ship motions on the platform, using a motion sensor. The wave radar provides wave height and period. The wave direction needs to be determined visually. The solution if a wave buoy cannot be deployed or retrieved in the area.



Datawell Directional Wave Buoy DWR G4

Free floating wave buoy

This free-floating buoy of 0.4 m diameter and a weight of approximately 30 kg is ideal for accurate wave measurements.

This buoy transmits the measured data to a receiver up to a distance of 20 nm. For larger distances, position tracking by GPS is available. The system delivers:

- Wave elevation (raw data)
- Wave statistics (H_s, T_p, T_z, directions)
- Wave spectra (incl. directionality)

The buoy is free-floating and drifts with the current. A moored buoy can be used for long-term monitoring.

C-Drone

Self-propelled wave buoy

The usage of wave buoys can be unpractical in situations where it is hard to retrieve the buoy after use. In this case we use the C-drone which is a self-propelled wave buoy with autopilot for autonomous operation.

Windsonic

Near field wind speed and direction

The ultrasonic wind meter is the easy to install solution to measure local wind speed and direction.

WindCube 200S

Far field wind speed and direction

The WindCube 200S uses infrared laser light to measure the velocity of particles in the air up to 10 km away. Using light eliminates the need to have a structure present to measure the wind velocity at various heights and gives the unique opportunity to measure the undisturbed air flow.

We have plenty other sensors and tools and can measure basically everything. Contact us for more information:

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