



History of Datawell

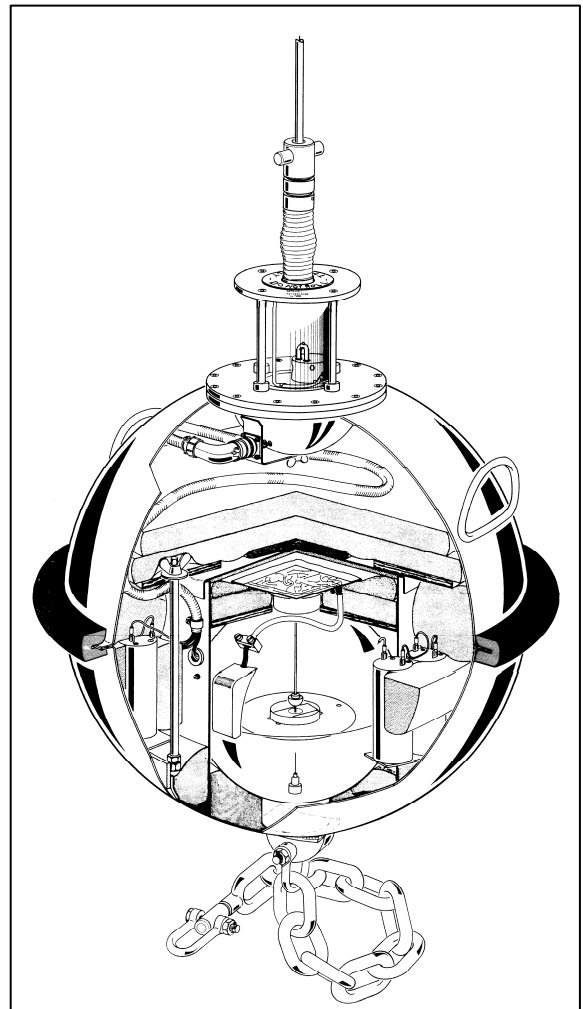
Before the start

Although formally founded in 1961, Datawell has a longer history. Its founders were ir. C.M. Verhagen and some of his co-workers at TNO/TPD (the Netherlands Organisation for Applied Scientific Research). Apart from scientific research, Verhagen's team was engaged in research for outside organisations, triggered by problems requiring analog computational capacity. A vivid example is the Deltar (Delta tide analogon computer), an analog computer comprising over one hundred basic sections, each representing a part of a river-basin, and forecasting water-levels.

It was Verhagen's ambition to start a private company. This required the development of a suitable product, whereas TNO/TPD focussed on research or experimental set-up. Rijkswaterstaat's request for the development of a buoy measuring the wave height opened the possibility of a commercial product. It was realised that - with no reliable wave measuring buoy on sale - the market for such a buoy would be wider than Rijkswaterstaat (the Netherlands Directorate-General of Public Works and Water Management).

The need for a wave height measuring buoy originated from the tragic floods in the province of Zeeland, in 1953. In order to prevent such catastrophes in the future, the government decided to close the sea-arms

and raise the dikes. The required dike height is not only determined by the maximal water level, but also by the height of the waves threatening to wash over the dikes.





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The sensor

For measuring wave height it suffices to register the vertical acceleration of a correctly moored buoy. Double integration of the acceleration yields the vertical displacement, being the wave height.

Although simple in principle, the measurement depends crucially on the instrument's design and construction. The nut to be cracked is how to determine the vertical direction (i.e. the direction of the gravitational acceleration) in a randomly swaying buoy. An onboard accelerometer measures the sum of this gravitational acceleration and the waves induced accelerations of the buoy. Obtaining the correct gravitational direction by averaging the accelerations is the heart of the wave height measuring buoy.

The solution was found in introducing a so-called stabilized platform, serving as an artificial horizon, on which the accelerometer is mounted. It serves as an artificial horizon, because a small weight just below its centre makes it "gravitationally oriented". Horizontal accelerations do not perturb it, because it covers a sphere of liquid: it takes the small weight a long time to get the liquid rotating, a time that cannot be realized by the short-lived waves that generate the horizontal accelerations. A natural period of 40 seconds turns out to yield an adequate artificial horizon.

The Waverider

On the above sensor concept - and its presumed commercial potency - Datawell was founded as a "laboratory for instrumentation". A good concept not yet being a salable product, the Waverider took years before entering the market. The funding by Rijkswaterstaat did not suffice to run the company, and the TNO/TPD practice of contract research was prolonged. For the Waterloopkundig Laboratorium

several marine steering systems were developed and produced; for the Dutch Navy a torque meter on the propeller-shaft was designed; etc. In exchange for facilities, research was carried out for the Delft University of Technology.

The realisation of the Waverider likened an endless hurdles race:

- The platform material and the liquid had to have matching specific weights and coefficients of thermal expansion. Initially this was accomplished by dissolving enormous amounts of sugar in hot water, which gave Datawell to the surprised passer-by the appearance of an illegal distillery.
- An accelerometer had to be developed that would keep the delicate balance on the platform.
- A mooring, robust in keeping the buoy near the anchor stone, yet flexible enough to let it ride the waves, had to be designed.
- Telemetry was needed for transmission and reception of measurement data.
- Data storage and processing, in our PC era "piece-a-cake", occasioned much brain-racking.

The most time-consuming component was obviously the sensor: stabilized platform plus accelerometer. Prof. J.F. Schönfeld of Rijkswaterstaat, appreciating the elegance of the sensor, contributed to its development for many years. An energy-saving and robust wave height measuring buoy resulted, suited for a long, battery-supplied stay in the harsh environment of the sea. From the onset, the importance of robustness was realized. Datawell arranged a tug-boat mandated to sail the buoy to pieces. When approached with high speed, the buoy was stowed away by the bow-wave. When approached with low speed, it was not hit hard enough. After a day of vain smashing, Datawell considered the job done.



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In 1968 the Waverider was launched on the market, and its warm welcome came up to expectations: the demand for wave height measuring buoys was indeed larger than Rijkswaterstaat alone. In widening the Waverider's applicability to "all of the seven seas", the experiences of its users have been of invaluable relevance. Active customers in the early days were IOS in the UK, the Trondheim University of Technology in Norway, the Scripps institute in the United States, and many others. Some regionally encountered problems were:

- Extremely polluted river streams, eating into the stainless hull within half a year. This was solved by introducing Cunifer as hull material.
- The raw north proved that rubber cords can freeze, and that ice on the antenna can make the buoy tumble upside down: plunged into the salty water, the ice melts off and the buoy comes up again, resulting in a transmission at intervals.
- Below the Wavec, a rich biotope blossoms out, including fish taking shelter. In the third world, the Wavec is reported to serve as a fisherman's refuge.
- Exceptionally a buoy returning from the United States shows bullet holes.

Shipborne motion sensors

Parallel to the birth of the Waverider, Datawell started the development of shipborne motion sensors. After all, it makes little difference whether it is a buoy or a ship, whose motion is being measured. Because manoeuvring ships generate additional accelerations, more demands are made on the stabilized platform. Whereas for the Waverider a natural period of

40 seconds suffices, a shipborne sensor requires a period of 120 seconds. Another difference regards the statistical aspects of the wave measurement: where a sea state is well-defined by the power spectrum, the ship's motion cannot do without the phase information. To this end, several analog filters were designed - no sinecure in the pre-computer age. The digital filters of the late seventies yielded a superior instrument.

Business organisation

Although intending Datawell as a commercial business, its founding fathers did not want to leave the company to the mercy of the market. In 1977 all shares were therefore transferred to a foundation, the board of which are the employees of the company. The articles of the foundation prohibit the alienation of the shares. In this way, Datawell is guaranteed to remain an independent, technology-driven company.

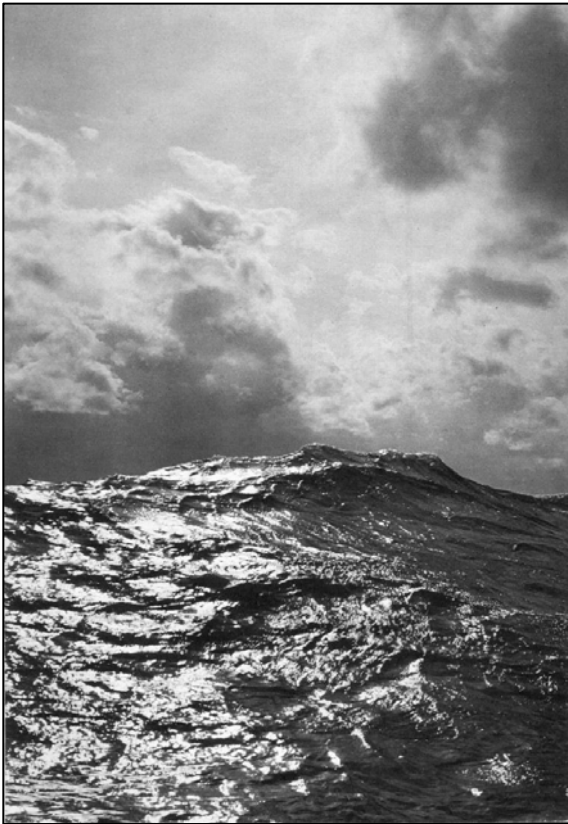
The Wavec

Satisfaction with the wave height buoy triggered in course of time the request for a buoy that would also measure wave direction. As a first attempt, extra accelerometers plus a compass were mounted on the platform, but this concept lacked feasibility. Next, the angles between the buoy's axes and the (artificial) horizon were measured and correlated with the wave height measurements. This required the construction of a buoy that would perfectly follow the sea surface at all current speeds. This approach led to the introduction of the Wavec in 1983, a disc-shaped buoy having a diameter of 2.5 metres, and the first wave direction measuring buoy on the market.



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The Directional Waverider

Although technically and commercially successful, the large Wavec fell short of handiness. Meanwhile the digital revolution enabled onboard computation of all wave motions. A much smaller buoy following the orbital movement of the water particle instead of the sea surface now became feasible. This development led to the introduction in 1988 of the Directional Waverider, a spherical buoy having a diameter of 90 centimetres. It has been the Directional Waverider that definitely opened the market to the measurement of wave direction.

Since the introduction of the (Directional) Waverider, there has been a steady stream of improvements and additions. Satellite communication has become possible, an internal data logger is available, and a GPS based position monitoring is optional. Due to

increasingly energy-saving electronics and constantly perfected batteries, these extensions took place at equal (or even increased) span of operation. In the near future a doubling of the buoy's "life span" is expected, leading to a time of operation for the Directional Waverider of more than three years. The service interval will then be determined by the inspection of the mooring.

The future

Datawell is proud to present its history of over forty years. The fact that during this period its wave height measuring buoys have been the world standard is proof of the continuous dedication of the company and its employees to the quality and technology of the product. This dedication ensures further innovations: an autonomous mini-meteo-buoy, a low-budget GPS based wave height measuring buoy, a low-frequency extension of the measurement, Datawell mooring of navigation aid buoys, etc. The need for well-engineered measuring equipment surviving in a marine environment has given Datawell a beautiful history and a bright future.

Haarlem, 2001

40 years anniversary