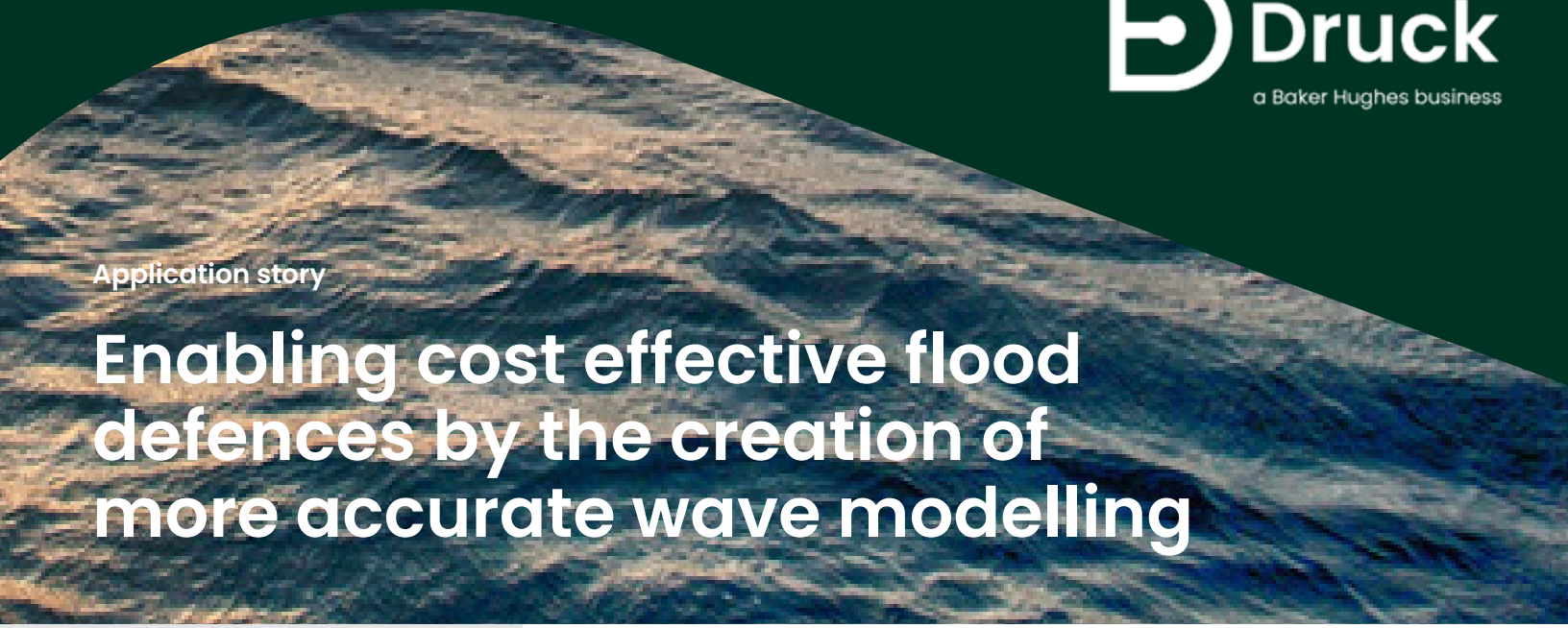

Application story

Enabling cost effective flood defences by the creation of more accurate wave modelling

The Dutch Flood Defence Authority was experiencing difficulties in planning the height and construction style of dykes to prevent flooding at minimum cost because it does not have accurate data on sea behaviour in storm conditions.

Industry supplied
Hydrology

Application
Long-term wave overtopping measurements

Product/service
UNIK5000 Series

Customer type
Hyrdo and oceanographic consultancy

Customer's challenge

The Wadden Sea and in particular the Eems-Dollard estuary, in the Netherlands, is a complex marine environment. This is due to numerous islands, tidal channels and the funnel form of the Ems-Dollard. Combined with local winds, these elements have unusual effects on the water levels and waves and pose a challenge to existing prediction models. Druck's customer needed a solution for measuring the storms and wave overtopping in order to improve the existing predicting models. Located in the dykes, the wave overtopping tanks collects accurate data on wave and tidal surge, to develop year on year understanding of sea level with the aim of ensuring citizens stay safe as the threat of disasters resulting from global warming endures. These models are used to set the strength and height of the dykes so improved models can reduce the risk of damage to the Dutch coast whilst minimising the cost.

The sensors required for this work face a marine environment that is alternately inundated with cold sea water and exposed to varied atmospheric conditions. The sensors are in remote locations, transmitting data via GSM, with power supplied by solar panels and batteries. The depth of water in each tank is relatively low, at about 1 m equivalent to only 100 mbar.

Druck's solution

To carry out the long-term measurements of the effect of storms, two 'wave transfer bins' are installed one above the other at key locations on the dyke. Waves wash up the dyke, partially filling the bins. Sensors are then used to measure the amount of water in the bins and the rate at which the water flows out of the bins. This tells the scientists how the waves are behaving.

The Druck team selected optimised solutions to all 4 locations on each site from our UNIK5000 series. Items considered include; measuring range, accuracy, response speed, materials compatibility, power consumption, ingress protection, electrical output and price.

The first sensor selected was a UNIK5000 part number PDCR5031. This sensor is mounted at depth offshore and detects the wave flowing into the monitoring

tank. When the wave enters the tank, this sensor switches the rest of the system on, including the other sensors and data logger.

For the tank level sensor in the dyke a UNIK 5700, part number PTX57N2 was selected. Four of these are installed, two in each tank. They are used to measure water height, which is related to the wave overtopping into the tank.

The second sensor in the tank measures how the sea water flows out of the tank through a calibrated flow channel. Again, a UNIK 5700, part number PTX57N2, this time with a slightly higher-pressure range was specified.

Druck advised the customer to add a Barometer so they could relate the conditions to the local atmospheric pressure. An additional UNIK5000 was decided upon, part number PDCR5021 with a 750 to 1150 mbar barometric range, to provide an economical Barometer. In combination sea water depth, wave height, tank depth, exit flow, and barometric pressure, enable Druck's customer to build a better storm prediction model as well as providing trends analysis.

Picture 1: Druck's UNIK5000 Pressure Sensing platform

Druck's added value

Druck offered robust solutions at an appropriate level of accuracy from sensors with a good stability that will enable many years of data collection with a low cost of ownership, all from the same supplier.

The different models were selected for different reasons:

Two sensor outputs were chosen, the mV outputs for the offshore control sensor and the Barometer enabled less energy to be used. In these locations the sensors are permanently on (and in the offshore location running at a fast sample rate).

Low power sensors reducing the demand for large expensive solar panels. The mA output from the tank sensors enabled very accurate readings to be maintained over the long cable runs.

Injection moulded fully submersible cables were chosen for obvious reasons except for the Barometer where a more standard lower cost cable was selected.

Different pressure ranges were selected for the different applications balancing the needs for high resolution data with protection from damaging overpressures.

Titanium construction was offered to avoid corrosion in the locations where alternate sea-water and air are present as the waves move naturally.

View the UNIK5000 datasheet here: https://www.industrial.ai/sites/g/files/cozyhq596/files/2019-07/unik_5000_datasheet_-_english.pdf

Find out about Druck's products and services for the Hydrology Industry here: https://info.industrial.ai/digital-solutions-druck-19-accuracy-under-pressure-hydrology-brochure-lp.html

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