



Need to weigh fish accurately in bulk on board a moving ship? This is how you do it!

## Bart Driessen

Weighing fish on board a large trawler that is constantly vibrating and moving with the waves is a serious challenge – yet PENKO Engineering has found a way. Aboard the Navigator, pelagic fish species are weighed and batched to within 1% of the desired weight. This level of accuracy with which bulk quantities can now be weighed in a motion environment, is a major innovation.

Mario van den Heuvel is the PENKO Field Service Engineer who worked hard on this project. Together with his colleagues, he wrote the code for the weighing installation on board the Navigator.

According to Van den Heuvel, “The reason why fishing companies want to weigh and



Mario van den Heuvel, Field Service Engineer,  
PENKO Engineering B.V.

package their products as accurately as possible is primarily a question of money. Delivering extra fish actually represents a loss of income. On a large processing ship such as the Navigator, this can easily amount to thousands of kilos of fish given away for free. That’s why accuracy is hugely important for weighing and batching. Through accurate weighing, the fisher can minimise the quantity of extra fish delivered. The challenge for us was thus to provide

a weighing solution that worked much more accurately than any existing solutions.”

### Churning waves and vibrating machinery

So what exactly did the challenge involve? “Extremely accurate weighing is not really a challenge for us – we’ve been doing that for a long time now. Our weighing instruments carry out 1,600 measurements per second, and as far as I’m aware, this speed has yet to be matched by someone else. However, weighing things on board a large ship is another story. ‘Weigh’ and ‘wave’ may sound very similar, but in practice the two words don’t go together at all. The sea is always in motion, and the resulting swell means that each measurement is constantly changing – especially if you are trying to weigh fish on a conveyor belt. You can compensate for the swell using advanced software, but even that’s not enough to solve the problem, as the engines and machinery on the ship are at least as important a factor. The ship’s

*“Accurate weighing on board a sailing ship is possible by compensating mechanical noise derived from processing machines on board, the motor vibrations of the vessel itself, as well as the constant dynamic motion created by wave swells.”*

engine, its prop shaft, and different kinds of pumps, winches and lifting equipment all produce vibrations that have an even bigger impact on the weighing data.”

### Corrected weighing

How can you solve the problem of taking measurements while the ship is constantly rolling and vibrating? “Our solution is to compensate for all of these deviations in the output signal. The measurements themselves are carried out using ten load cells that are mounted along the entire length of the conveyor belts. We measured the initial deviations by weighing the belts on dry land. Then we measured the deviations at sea, with the conveyor belt both empty and laden with fish. Based on the differences we detect, we can determine a corrected measurement value. This gives us a corrected value that comes very close to the actual value regardless of the circumstances. So what we’re doing is ‘corrected’ weighing.”

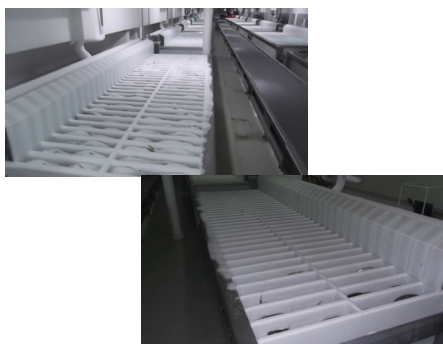
### Precise batching

As well as weighing, the machine also needs to divide the fish into exact portions, which is called batching. “On board the Navigator, the fish is portioned into batches of 1,280 kilograms at the end of the conveyor belt. After that, the fish is manually separated into 64 containers, or ‘frosters’, each holding around 20 kilos. These are then stored in the freezer compartment.

An important requirement for batching is that the batch size should never fall below 1,280 kilos. At the same time, the extra quantity of fish in each batch needs to be as small as possible. During tests, we managed to reduce the extra quantity per batch to a minimum; and the nice thing about our batching solution is that it does this both automatically and very quickly. Af-

ter just five batching operations, the excess per batch was around 0.5%. That means it would certainly be possible to weigh smaller amounts of fish.”

“Absolutely – it’s technically possible to produce batches of any size. The batching works perfectly and very fast. It’s also possible to adjust the batch size – the user has the freedom to do that. However, I have



The frosters were previously filled too generously ensured that

not everybody has access to the various settings. The batch size setting can only be adjusted by the fish master, for example. This will avoid errors and ambiguity. This is why access to automated machinery needs to be authorised using passwords.”

“DataReporter allows the user to collect data for storage in databases, present it in a clear way using graphs, and run analysis on batches, recipes and down times alongside a host of other diagnostic functions.”

### Making data accessible

Nowadays, an additional aspect of modern machine automation is providing access to all kinds of data – and the weighing system on the Navigator has also been equipped with a solution for storing and analysing data.

“To make data accessible, every new weighing application we deliver comes with DataReporter. DataReporter allows the user to collect data for storage in databases.

Its second function is to present data in a

| Date/time          | Target | Actual |
|--------------------|--------|--------|
| 22.6.2017 15:04:26 | 1360,0 | 1366,4 |
| 22.6.2017 16:37:41 | 800,0  | 804,5  |
| 22.6.2017 16:52:30 | 1360,0 | 1364,6 |
| 22.6.2017 17:05:50 | 1360,0 | 1364,7 |
| 22.6.2017 17:18:08 | 1360,0 | 1365,7 |
| 22.6.2017 17:59:26 | 1360,0 | 1365,3 |
| 22.6.2017 18:31:16 | 1360,0 | 1363,9 |
| 22.6.2017 18:42:36 | 1360,0 | 1365,2 |
| 22.6.2017 18:52:55 | 1360,0 | 1372,5 |

clear way using graphs, while the third function is diagnostic. This refers to the analysis of batches, formulas and downtimes, alongside other diagnostic functions. A new feature of DataReporter is that the solution can now log and report on 15 different processes at the same time. This also makes it possible to generate reports and analyses based on data stored in SQL. The crew of the Navigator is particularly interested in trend analysis relating both to batching and to filling and packaging the fish.”

### Partnership with AFAK

This weighing application project completed by PENKO forms part of a bigger project being carried out by Afak Techniek on behalf of the owner of the ship, the Icelandic company Uthafsskip. Afak (based in Katwijk in the Netherlands) is a leading contractor for projects of this kind, and specialises in developing and building machinery for fish processing companies. Its machines are used both on dry land and on board fishing vessels. Afak oversees the physical assembly of the transport, sorting and stacking installations. PENKO and Afak have been working together for over 25 years, and the two companies have completed many projects within the fishing industry, ranging from weighing and transport to batching systems for fish. PENKO’s contribution to these projects has been to fully automate the transport, sorting and stacking of the fish products, as well as to supply and install the associated control systems, PLCs and control cabinets for the weighing technology. In the Navigator project, PENKO’s

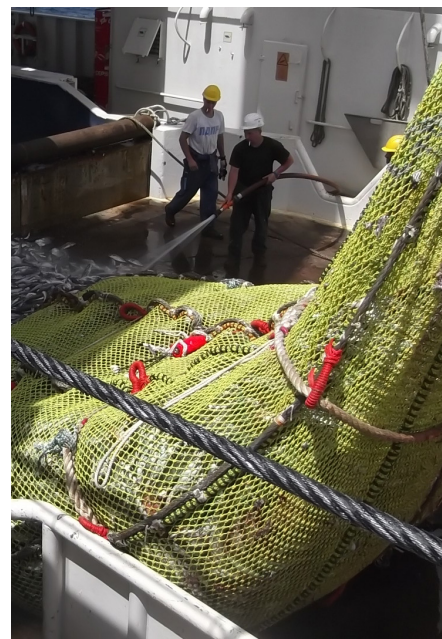
main responsibility was to supply the required weighing technology.

### Antarctic Navigator

The Navigator is a factory trawler belonging to the fleet of the Icelandic shipping company Uthafsskip. At 121 metres long, it is one of the largest ships in its category.



One of the conveyor belts built by Afak and fitted with weighing technology by PENKO



The Navigator catches pelagic fish for immediate freezing

The Navigator is used for fishing and freezing the catch. Important fishing grounds include the coast of West Africa and large sections of the Atlantic Ocean.