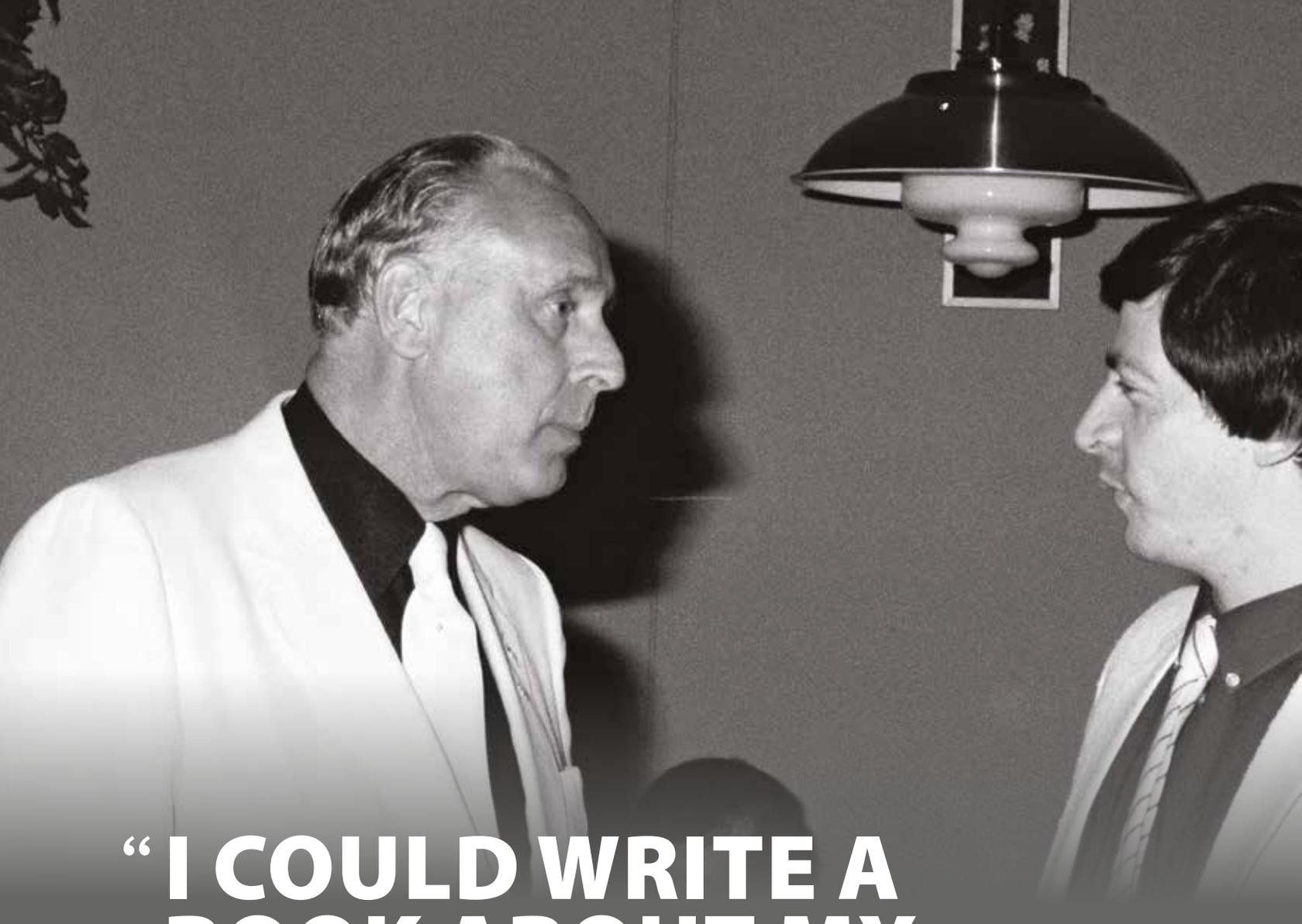




70 YEARS OF IV 1949-2019

Ivormatie magazine - June 2019



**“ I COULD WRITE A
BOOK ABOUT MY
40 YEARS AT IV ”**



Iv-Groep will celebrate its 70th anniversary this year. I have experienced 40 of these 70 years myself. It was all very different when I came to work for the company. There were around forty people employed and 80% of our revenue was generated by only one client: Hoogovens, which is now Tata Steel. Although the remaining 20% of the turnover was from other clients, it was mostly still related to Hoogovens. Which was, of course, a very unhealthy situation, but having said that; the company was very profitable. Few costs, hardly any risks and a healthy margin, what more could you want?

Later I started to appreciate Eli and we even became friendly with each other.

This all came to an end when, on a good (bad?) day, Hoogovens informed us that our revenue from Hoogovens should not exceed 20% of our total revenue. The messenger was the head of engineering, Eli Herremans. Eli was rightly appointed to this position and wanted to make a statement. I immediately took a disliking to this man for delivering such a message after (what seemed like) only 5 minutes of taking on this position. But, of course, he was right. For us, it would be the start of new things to come. This was a development that has ultimately led to what we are today: an engineering company, 800 employees strong, broad market presence, all disciplines in-house. Later I started to appreciate Eli and we even became friendly with each other.

Given the anniversary number of this issue, here's another anecdote from the past.

Henk Veth (left on the photo) was the founder of the company. He was still at the helm when I came to work for Iv. Henk was living the high life: to begin with, he married a very expensive woman, Sassina, an actress who loved to be seen in the jet set; two panthers, a butler, a driver, a Rolls-Royce and to top it all: a private aircraft with a pilot. In 1983, Henk sold the company and left for Spain. He forgot to adjust his spending habits to suit their new circumstances and it soon became clear that he had to start cutting back. And so: the aircraft had to go, the panthers and the butler were gotten rid of and eventually his wife too. When it was time to part with the car, Henk was personally bankrupt. 'What should I do about all of this?', Henk thought to himself: marrying a rich woman, that was the solution. Henk embarked on a search and found a pretty lady from Switzerland who was looking for a castle in the nearby area. Henk was off; he picked her up, showed her around the region and within a few months, they were married. And then came the big confession: 'Well', said Henk, 'I may have given you the impression that I am a rich man, but actually...' 'Oh', said his wife, 'then maybe I should tell you something. I got divorced from my husband last year, he was rich, but I didn't get anything from him. So, I thought to myself, if I pretend to be very rich and act as if I'm looking for a beautiful castle, then a very rich man will almost certainly approach me'. And it happened. Soon after, the two were divorced again.

I have experienced a lot in these 40 years; I could write a book about it.

Rob van de Waal
CEO Iv-Groep



Volume 33, Number 1, June 2019

Editorial Staff
Iv-Groep, Corporate Development & Marketing

Ivormatie
A publication of Iv-Groep b.v.

Editorial Office
Iv-Groep b.v.
P.O. Box 1155
3350 CD Papendrecht
The Netherlands

marketing@iv-groep.nl
www.iv-groep.com

Sign out
Would you prefer to receive Ivormatie digitally or no longer?
Let us know via marketing@iv-groep.nl.

Copyright © 2019 Iv-Groep. All rights reserved. Reproduction
in whole or in part requires written permission.



CONTENT

- 6 From fossile fuel to wind energy
- 14 Is smart mobility the future for our traffic issues?
- 20 70 years of Iv: stories from the old days
- 28 Performing work at a non-stop BRZO company
- 34 The urgency for Crystallisers in China
- 40 Working together on scrubber projects
- 46 'De Passie' school building: from 4,300 m² to 6,300 m²
- 52 Significant and sustainable renovation of Sluisjesdijk
sludge processing company
- 58 A new method for hydro-structural ship analysis

“‘OLD’ AND ‘NEW’ OFFSHORE”





| From fossile fuel to wind energy

Iv has been actively involved with engineering work for oil and gas extraction at sea since the 1970s. We began with steel calculations for offshore constructions, and a little later, progressed to the complete multidisciplinary engineering of production platforms. Since the turn of the century, our area of work has expanded to include the design of substations (platforms that collect and transform electricity generated by offshore wind turbines). To underline the expansion of our activities, the name Iv-Oil & Gas was changed in 2018 to Iv-Offshore & Energy.

But how can 'old' knowledge be utilised to help with new developments? Which steps can still be taken? And how should the redevelopment or even removal of old oil and gas platforms be carried out? Mark Bloemsma, Business Development Manager, describes the recent developments within Iv-Offshore & Energy. Wybe Ligtoet and Teye de Jong, who undertake 'old' and 'new' offshore, respectively, share more about their daily work.

There is still plenty of work for us in terms of maintenance and even the dismantling of installations previously used to extract oil and gas in the North Sea.

"In the past, we pretty much focused primarily on oil and gas", says Mark Bloemsma. "We have built up a huge amount of specific knowledge of oil and gas and in the last ten years, wind energy has also become an important focus. Offshore wind accounts for a substantial portion of our revenue, but we also implement projects in the geothermal, gas processing and onshore midstream sectors. Traditional offshore operations in the North Sea are currently struggling as elsewhere in the world, there are larger oil and gas fields that are cheaper to develop. Having said that, this does not alter the fact that there is still plenty of work in terms of maintenance and even the dismantling of installations previously used to extract oil and gas in the North Sea. We often work closely with our colleagues from Iv-Consult and Iv-Industrie when it concerns a dismantling, geothermal or midstream project."

Thanks to our extensive knowledge of offshore jackets, we are currently developing applications to also place wind turbines on jackets.

Foundations for wind turbines

A more recent development is the design of foundations for wind turbines, says Mark: "Currently, monopiles are generally used for this, these are large tubes, having the same diameter as the mast, driven deep into the seabed. But now there is a desire to place larger and therefore heavier turbines in deeper water, but the technical limits have already been reached with this type of foundation. However, thanks to our extensive knowledge of offshore jackets, we are currently developing applications to also place wind turbines on jackets. Besides this, designs are also underway for floating wind turbine foundations."

Modifying and decommissioning

The energy transition is in full swing and there are still many platforms in the North Sea for the extraction and production of oil and gas (more for gas than for oil). Project Manager Wybe Ligtoet, currently has his hands full with modifications to existing platforms with the aim to increase production and ensure the safety of systems. And not to mention; the decommissioning of the first platforms where production has ceased to continue. "We work with a team of around thirty specialists from different disciplines, mainly for Neptune Energy which has around fourty platforms in the North Sea. This number is falling due to decommissioning. Last year four platforms were taken out of production."

Gas is still being found and extracted in the North Sea. "From an existing platform, it is possible to drill diagonally to a new extraction site, which is then connected to the system, a flow line", says Wybe. "Because more gas is entering, we have to recalculate everything and have valves replaced or install new, larger pumps. Five flow lines were installed last year and another three have already been selected for this year."

With 3D images we can check in advance exactly whether something will fit in the intended space. Previously, a specialist would have to go to the offshore platform and manually take measurements. This was, of course, much more expensive and less accurate.

Fitting and measuring

Old platforms were built according to old standards which means they are very compact. This can cause problems with available space. Wybe: "Due to the current increased safety requirements, a higher degree of safety is now required. There are now more valves present in certain pipe sections and this often causes complications during the design phase because of the lack of space. At the time, it was taken into account that additional compressor modules would need to be added in the future, but due to stricter emission requirements, gas engine models have also become larger. The challenge here is that these issues must be solved in a limited space. What has been a big help with this is that for the last number of years, a 3D laser



scanner has been mapping the area. The 3D images of the platform are used during the design phase. This allows us to check in advance exactly whether something will fit in the intended space. Previously, a specialist would have to go to the offshore platform and manually take measurements. This was, of course, much more expensive and less accurate."

Even if the pressure from the source drops, it is still possible to extract almost everything that is still there, according to geologists.

End of lifespan

Oil and gas extraction in the North Sea started towards the end of the 1960s and was fuelled by oil crises in 1973 and 1979. Fifty years later, platforms are being dismantled due to the exhaustion of resources. Yet there is still much work to be done on platforms that are approaching the end of their lifespan. Wybe: "Even if the pressure from the source drops, it is still possible to extract almost everything that is still there, according to geologists. A CO₂ compressor (which was used to inject CO₂ from the gas back into the source) is currently being converted into a 'depletion' compressor, which is



Bron: TenneT TSO GmbH

capable of extracting the remaining recoverable gas.” At the same time, preparations are also underway for the removal of the platform later. “What makes this difficult is that the drawings, including modules added later, are mostly not available in digital format. From a safety point of view, it is imperative to know exactly which of the dozens of pipes and cables can be removed first.” Furthermore, Neptune is investigating whether valves and pumps can be reused. “Financially, it is very worthwhile, as a new valve may easily cost 10,000 euros. Because it can often take quite some time before all involved parties agree on the financing of a modification, it is therefore beneficial that the valves from a decommission location are immediately available to use. The delivery time of a new valve can take up to thirty weeks.” Wybe is a senior expert in the business. He used to visit platforms in the past but nowadays he prefers to leave that to the younger generation. “I think young people should also get opportunities”, he says with a grin, “I sit at my desk now and make sure everything goes according to plan.”

Borssele Alpha and Beta

Iv-Offshore & Energy in collaboration with HSM Offshore in Schiedam is working on the Borssele Alpha and Beta transformer substations. Besides the engineering, the design of the platform and the supporting construction (jacket), all related procurement is taken care of including the integration of the high-voltage components supplied by TenneT and all balance-of-plant materials. TenneT TSO B.V. (administrator of the Netherlands’ high-voltage

network) transports the electricity from the offshore wind farms to land. Borssele Alpha offshore will be ready in August of this year, and the almost identical Borssele Beta is expected to follow one year later. The Borssele 1 & 2 wind farms in Ørsted and Borssele 3 & 4 of the Blauwwind Consortium are situated some 22 kilometres off the coast of Zeeland and have 94 (8 MW) and 77 (9.5 MW) turbines respectively, a combined capacity of 1400 MW, which is to be connected to Borssele Alpha and Beta. Enough to provide for the energy needs of around 1.5 million households.





Borssele Alpha and Beta are unmanned stations. Everything is designed in such a way that they will be able to operate for at least six months without maintenance.

Procurement process

Teye de Jong, Supply Chain Manager for the Procurement department of Iv-Offshore & Energy is intensively involved with the procurement process and subcontract management of the Borssele Alpha and Beta transformer substations. "These are unmanned stations. Everything is designed in such a way that they will be able to operate for at least six months without maintenance. This means that all kinds of standards that guarantee quality must be met. Nothing is purchased without specification."

Knowledge of the business

Teye: "We request quotes from different parties, in which price, delivery time and specifications are key. The contract conditions are negotiated when we are ready to purchase. The contract follow-up is very important. I ensure that what we have ordered is delivered within the stipulated period and according to the quality specified in the contract conditions. It's essential to have a lot of knowledge about all sorts of things." Teye lists all the parties with which he is involved: "Engineering, project management, logistics, subcontractors, project controls, authorities, classification societies and suppliers. I also maintain close contact with the customer."

Teye explains his story further with an example of the material mounted on Borssele Alpha. "There is no helicopter platform on the topside itself. A jack-up barge with a helicopter platform is placed next to it during the installation, but later, goods are delivered by boat and hoisted. There is a height difference of approximately 29 metres from the surface of the water to the entrance and it's about 47 metres up to the roof deck. In combination with a wave height of two to three metres, the crane, among other things needs to be of high technical quality. In accordance with our specifications, a special paint system must also be applied so that the crane can withstand the harsh conditions at sea."

Repairs are better done ashore than offshore, as offshore maintenance costs around ten times as much.

Better ashore than offshore

Teye shows photos of what was discovered during an inspection. "Damage to the paint around a number of bolts and nuts, which, of course, cannot be overlooked as corrosion will occur very quickly at sea. The supplier will need to instigate a repair procedure. It may be the case that the material for that part will need to be disassembled. Better ashore than offshore, as offshore maintenance costs around ten times as much. Sometimes a supplier fails to resolve a problem within the given time. We will then ensure that it's achieved and at their expense."

Teye is often present at the yard where the topside is built. "I am very critical of everything that is supplied and always check whether the materials have been delivered on time and whether there are enough people available to implement the job. For example, I may send an inspector to check whether everything meets the required quality. At first glance, I seem quite nice, but I can also be very serious, and business orientated", laughs Teye. "Project delays can become extremely expensive, and this is something we do not want to have to contend with." ●



**“ BETTER ASHORE
THAN OFFSHORE ”**



“ A SPECIAL BRIDGE MANAGEMENT SYSTEM ”



Is smart mobility the future for our traffic issues?



“The bridge operator and I were sitting together in his control cabin in Oude Wetering at the bridge over the Ringvaart when suddenly a bus driver got out and asked: what’s going on? These days, I’m always able to continue, the bridge never seems to be open anymore.” In 2018, as part of the so-called ‘Blue Wave’ project, around thirty bridges in North Holland were linked to a smart mobility application that would improve road and waterway continuity. This includes the bridge in Oude Wetering. Smart mobility; is this really the future for our traffic issues? According to Bertjan de Boer, Senior Traffic Engineering Specialist at Iv-Infra, the technology certainly has a lot of potential, if applied properly.

A combination of technology and usage

It’s not just the technology that is important, but rather what you do with the new opportunities that smart mobility presents for users: how can traffic be made safer? What’s the best way to reach my destination? How can I achieve my goal with less inconvenience (air and noise)? Only when these goals are achieved does smart mobility provide added value - for the user, the developer, the service provider and for the road administrator.

From an international perspective, the Netherlands is at the forefront when it comes to smart mobility. A relatively large budget is, therefore, made available for this. Many of the developments could potentially help resolve traffic issues. But the question is; how exactly? An example is the installation of intelligent traffic lights throughout the country, but it’s now about how this technology is used to offer a solution to our traffic issues. It’s not enough to only place these intelligent traffic lights. They have to be ‘told’ how to behave, which must be the correct information provided and tailored by the user behaviour in practice.

By creating a blue wave, ships are encouraged to sail in a convoy.

The Blue Wave

The same applies to the ‘Blue Wave’ project, which is currently being rolled out in North Holland. This project is part of the national Blauwe Golf Verbindend (Blue Wave Connected) project, which aims to convert all bridges in the RVM (regional traffic management) network into ‘smart’ bridges. In North Holland, the opening of bridges causes a tremendous amount of delay every year, especially in the summer period when the waterways are busier.

The waterway network in North Holland has a total of 285 movable bridges, of which 130 are situated on a main road and/or waterway. The Province of North Holland is currently working with other waterway/road administrators such as Rijkswaterstaat, District Water Control Board Rijnland, Waternet and the municipalities of Alkmaar, Amsterdam, Haarlem, Haarlemmermeer, Purmerend and Zaanstad to create a blue wave which will control and improve road and waterway traffic flow. The goal is to predict the opening of bridges at least fifteen minutes in advance, so that road and waterway users can anticipate their travel and choice of route more accurately. By creating a blue wave, ships are encouraged to sail in a convoy. This could be considered the same as the famous green wave, but then on the water. Road traffic largely benefits from this as the bridge opens less often.

The blue wave is to be created through smart mobility technology. Currently, 70 of the 130 bridges are already operational. The question now is: does this technology actually function efficiently in practice? Are all the settings correct? Is the result as intended? Has the flow of traffic really improved, and is maritime navigation better served? This is what Iv-Infra is currently investigating. To ensure as little inconvenience as possible is experienced by road and waterway users, we provide traffic management at all locations where the bridge management system has already been rolled out and we establish proper coordination and set-up from advice obtained from the system.

A special bridge management system

The ideal situation would be to optimally coordinate road and waterway traffic. Ships must be able to travel

along waterways as quickly as possible to arrive timely at their destination. When a skipper departs at a certain time, he should be able to pass all bridges on his route one after the other. However, the situation must also be such that road users experience less inconvenience as bridges no longer open during the rush hour traffic, and emergency services must, for example, always be able to continue their journey without having to wait for an open bridge to close.

A special bridge management system has been developed to optimally coordinate road and waterway traffic. This is an advice tool that tells the bridge operator whether it would be wise to open the bridge now or to wait a little longer. The tool considers registered vessels, road congestion, any emergency services and public transport. If a bus is running on time, the bridge can be opened as usual. But if the bus is already running late, the tool will allow the bus to cross the bridge before advice is given to open. This is how smart mobility is used to support a better balance between various interests. The bridge operator will, however, always remain in control. He or she will ultimately decide whether to open or close the bridge. The bridge management system is purely a means that helps them to operate the bridges more efficiently.

Gaining practical insight

To gain insight into practical usage and to identify any bottlenecks in the system, Iv-Infra has set up a service centre together with partner MAPtm. It's a kind of helpdesk that bridge operators, waterway users and waterway administrators can contact should they suspect something is not functioning optimally.



“WIN-WIN BY WAY OF CLUSTERING”



For example, the bridge management system may indicate that a delayed bus arrives at 1 pm, but maybe the bus doesn't arrive at all. This could be a configuration error. It could also be the case that the bridge management system calculates with a certain sailing speed, but in practice, it appears that it doesn't correspond with reality. These are examples of bottlenecks that we can clarify with the service centre and address.

We also evaluate the situation of all bridges. Among other things, we examine: how often is the bridge opened? Does the opening of the bridge correspond to the advice issued by the bridge management system? To what extent do bridge operators actually follow the advice given by the bridge management system? For example, should it appear that a bridge operator often ignores the advice given by the system, then we will request feedback from the bridge operator to determine the reasons behind ignoring the advice, as apparently, the advice provided by the system was clearly not optimal in this case.

Win-win by way of clustering

Two new apps have been developed further to provide skippers with current information of bridge openings on their route and to coordinate the bridge openings with waterway traffic: RiverGuide Recreant (recreational) and RiverGuide Binnenvaart (inland shipping). These apps have been developed by Teqplay. Iv-Infra manages the sailing schedules for marine navigation. We hereby try to offer as many routes as possible for commercial and

recreational shipping to be able to serve skippers and captains as well as possible.

The app is a fine example of the opportunities offered to users by smart mobility. It's a new development that has never been applied before but is of great value to skippers, captains and bridge operators as they are now able to access information that was previously unavailable.

By combining the waterway situation with the traffic on the road, we can determine when the ideal moment is for a two-hour peak.

The app ensures that skippers are better served and can plan their journeys more effectively. For example, they can register their presence at bridges via the app which is much better than the traditional VHF maritime mobile band. Skippers and captains have direct insight into the bridges encountered along their route, even prior to departure and including the opening moments. They are then able to adjust their timing accordingly to ensure a consecutive passage of all bridges. This is how the app encourages the clustering of navigation, meaning that the opening of bridges occurs less often, resulting in less inconvenience for road traffic. Whilst sailing, the app also provides skippers with other relevant information about the clearance heights of bridges along the route, the VHF maritime mobile band and telephone numbers for contacting the bridge operators. The expected time of arrival (ETA) at a bridge or lock is calculated based on the location, specified



sailing route and speed. This ETA is passed on to the bridge operator via the bridge management system.

The effect of these measures

Currently, there are no concrete figures showing the effect of these measures. Iv-Infra is investigating this, but is still in the phase of examining what good indicators are to suggest that there are fewer hours of congestion now. The bridges in Haarlem are currently not served between 4 pm and 6 pm. But is this really the correct time slot? Given that traffic is still very busy at 6 pm and relatively quiet around 4 pm, would

it not be better to set the closing period between 5 pm and 7 pm? By combining the waterway situation with the traffic on the road, we can determine when the ideal moment is for a two-hour peak. To be able to make a sound judgement of this, we have examined how many schedules there are for maritime navigation. If more schedules can be offered, better use of coordinated passage can be adopted, this will ultimately reduce the passage time. Theoretically, we have observed these figures and are now investigating whether and how we can also achieve these gains in practice. ●







70 years of Iv: stories from the old days

70 years of Iv, there are stories enough! As Rob already mentioned in his foreword; he could write a book about it. And he's not the only one. Because of the low staff turnover, there are many people who have been working at Iv for 35 years or more. Kees Ripzaad is one of them and tells us about his fondest memories. Kees officially retired 3.5 years ago but is still working three days a week as a controller at Iv-Groep.

I have never had a day that I thought: ugh, I have to go to work.

"Soon, I will mark my 40-year anniversary. I'm going to reach it", Kees says with a big radiant smile. "I have been working here since 1 December 1980. At this time, the company was still called Ingenieurs- en Architectenbureau H. Veth. Founder Henk Veth was the director at the time. In the 38 years that I have been working here, I have never had a day that I thought: ugh, I have to go to work. I have experienced so many beautiful things here that I could talk about it for hours." Kees thinks the greatest business development he has experienced is how Iv has grown. It began around 1985 when Grootint, then a well-known bridge and lock constructor, divested their drawing department and Iv took it over. The big growth really started at this point. Acquisitions followed in the Netherlands and far beyond the borders. Kees: "We also used to have a branch in

the United Arab Emirates. I also have a nice story about that. Henk Veth had his own aircraft and with that, he flew to the Emirates whenever he had to be there. I still remember working quietly on a Monday afternoon when the phone rang: 'Hey Kees, is there any news? Over.' It was Henk, he had called from his plane for a discussion about work via Eurocontrol. After every sentence, an 'over' followed and finally 'over and out'. He was quite a character. In terms of work activities, I really enjoyed the acquisitions, but of course, also all the other experiences to do with the acquisitions. For example, I once sat with the branch director of our Malaysian office at the Libyan embassy in Malaysia because we wanted to set up a Libyan entity. We had to give our passports to a porter but were unable to get them back. We were put in a room and the door was closed. There we were, on Libyan territory, without a passport. But luckily it all worked out well in the end and we eventually set up the entity."

You shouldn't outsource what you can do yourself. You should do it yourself.

"You know what I like so much about Iv, it's the freedom and responsibility you get. Our general manager, Rob van de Waal once said to me: 'Kees, you shouldn't outsource what you can do yourself. You should do it yourself.' We really do a lot in-house, that's what makes the work very versatile. And the atmosphere within the company is very

good. The corporate culture is pleasantly easy going and Iv arranges a lot for their people: good working conditions and pension schemes, big Sinterklaas and New Year parties, trips abroad to the UEFA European Championships and FIFA World Cup.”

I met Johnny de Mol in Brazil, where he asked us to be extras for a program he was filming there.

I’m still a bit angry with Louis van Gaal. Why, you may be wondering. “Because he denied us a trip to Japan when the Netherlands didn’t qualify for that particular World Cup. We have been visiting the UEFA European Championships and FIFA World Cup since 1988. Those trips are always so great. I love travelling, which is why I have always put myself forward to help organise these football trips. Prior to this, I was always exploring. This is how I met Johnny de Mol in Brazil, where he asked us to be extras for a program he was filming there. So, we did it, waving wildly with Brazilian flags and wearing Brazilian football shirts that we quickly bought when we arrived. This was such an amazing Iv adventure and I will always remember it. As I said, I could talk for hours about all the great Iv-adventures. I have been retired for 3.5 years now, but for as long as I still feel fit and able, I will continue to work three days a week. Who knows what adventures are still to follow!”

Han Vos is also a senior expert in the business and has experienced so much at Iv that he’ll never get tired of talking about it. Han retired in 2013 and recalls fond memories of special projects and events.

“My best project? There are so many! Every project was so different and the challenges so diverse that it is difficult to name just one. The assembly design and the calculation of the Erasmus Bridge. Also, the design of the railway bridge over the Hollands Diep. It took seventy people, the entire south side of the second floor of the building, to achieve the design and thus





the implementation on time. The bridge was five years old and the guarantee period was over, and not a single train had travelled over it! Firstly, they had forgotten to order the train and in the absence of supervision during construction, it turned out that the train was no good anyway. This is what happens if the client does not utilise substantive professional knowledge. We certainly have this knowledge at Iv and I'm convinced that this is our strongest point.' Han Vos worked at Iv-Infra from 1986 to 2013 and is enjoying his retirement already for several years.

| Do you have knowledge of locks?

"If I have to mention just one project, then it has to be the design of the new lock gates for the Panama Canal. That was the biggest, most impressive and also my last major project. For Iv, this was then the largest project ever in man-hours, and yet it could have been much more. If we had tackled our offer for the concrete construction work in a different way, then the contracted hours may even have been doubled. Obtaining that contract was a special story anyway. It started with two lawyers, one from Heerema and one from New Orleans. The project for the new storm surge barrier in New Orleans was discussed, just after Hurricane Katrina. They wanted to get it sorted out, but how? One of the two knew Rob van de Waal and approached him to assist with a design which would be offered for the New Orleans storm surge barrier. The contractor (only just) wasn't awarded the contract which also put an end to our involvement. But we had cultivated contacts there with Tetra Tech, the company that later cooperated with MWH Global to expand the capacity of the Panama Canal. I received an e-mail from Chicago asking, 'Do you have knowledge of locks?' Yes of

course! Together with Rob, I went to Chicago to discuss the new lock complexes. It was then that we discussed lock gates on trolleys. In IJmuiden, similar old gates with rigid trolleys and rails were replaced by more flexible ones, to avoid wheels and rails becoming worn. We then made a design for Panama with a rubber block on each trolley to absorb the movements and transfer the forces between the gate and the trolley. We submitted the design to the contractor, who was awarded the contract due to its attractive price. We were commissioned for the engineering of the gates and the operating mechanisms.”

| Always have money with you.

Han and his wife lived in Panama for two years for this project. “Living ‘far away’, where everything is different, was fascinating. What was so different?” Han thinks for a moment... “It’s a combination of a lot of small things. It is very hot there and nature is very different. For example, in March, around the rainy season, the entire forest is buzzing and suddenly, bears (‘gato solo’) are strolling through the garden, with their distinctive tails poking up above the grass. There is also corruption, you must always have money in your passport or wallet, especially at the end of the month. The police checks are always around the 13th or the end of the month. Their budgets are mostly used up by then and they start making extra checks for ‘violations.’”

Working internationally was also a nice challenge, says Han: “We had European experience at Iv, but not outside of Europe. We had to adjust our way of working. For example, in the Netherlands, we work on A4 paper, but

internationally Letter format is by far the most used. This sounds like a small detail, but it meant that all our reports were not normally printable and were not easily read. So, I had our repro service produce special letter paper for us. We also learned how to use video conferencing or conference calls. What was the greatest challenge? The collaboration. Forming a team while we were in four different locations around the world. Try getting that to work as just one team.”

| There were people in suits jumping around with nets trying to catch balls.

Something completely different, but something that Han has fond memories of, is coming up with the annual Iv promotion for the Steel Construction Day. “Yes, the tennis ball machine! We handed out butterfly nets at the stand for visitors to catch balls with. If they caught a red ball, they won 25 Dutch guilders. If they caught a yellow ball, they were given a beer. There were all these people in suits jumping around with nets trying to catch balls. Also, the time that we made a bridge out of ice and visitors had to guess how long it would remain standing before melting. It remained standing the whole day, but when the trade show came to an end it magnificently collapsed when a support was removed. Another time was when visitors had to generate electricity with bicycles to race trains. When the huge bang from the starting pistol sounded, they had to cycle as fast as they could. The construction that would collapse if enough beer was pumped out was also a big hit. The visitors were queuing up for this one. It was all a lot of fun.” ●



**“ DO YOU HAVE
KNOWLEDGE OF
LOCKS?”**



WHAT MAKES IV SO SPECIAL?



Friendly and open culture

Iv feels like a family business: you can always drop by other colleagues to discuss your ideas. You receive a lot of freedom as well as room for entrepreneurship.



Unique projects

At Iv we work on projects that challenge us to push the boundaries of what is technically possible.



Diversity

From infrastructure to submarines: we are the most diverse engineering company in the Netherlands.



Down to earth

Instead of just following trends, we examine the content critically. We innovate because we really want to contribute to the world of tomorrow.



Work hard, play hard

We also think it's important to have fun with each other. That's why, for example, we attend the UEFA European Championship and FIFA World Cup.





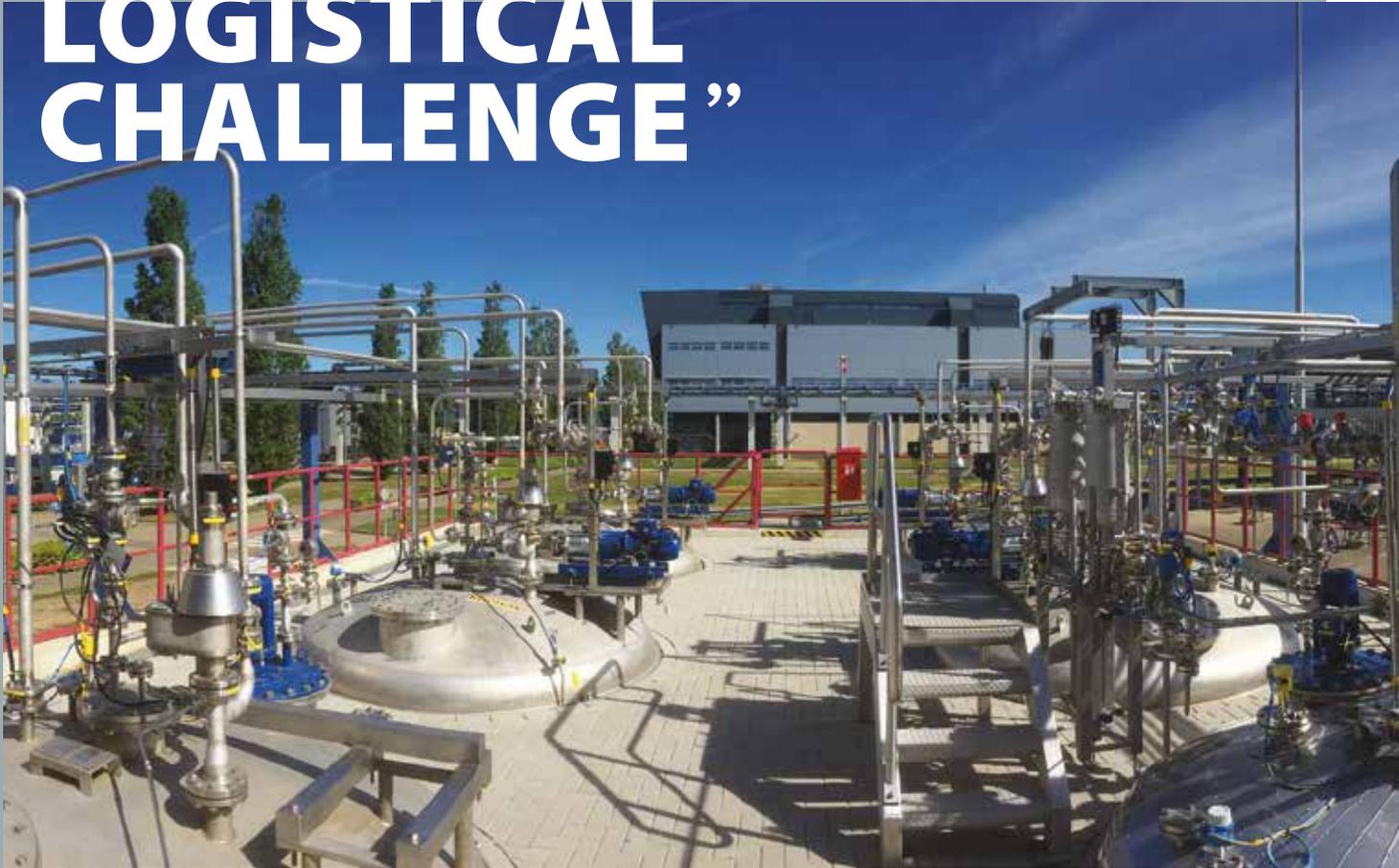
| A selection of our vacancies:

- ✓ Senior Mechanical & Marine Engineer
- ✓ Monodisciplinary Project Manager
- ✓ Workplanner Infrastructure
- ✓ Junior Climate & Energy Technology Engineer
- ✓ Electrical Engineer



See all vacancies on
jobsativ.com

“ ENORMOUS LOGISTICAL CHALLENGE ”



Performing work at a non-stop BRZO company



Getting on with it, in an environment where chemical substances are used. The integration of a regeneration installation within the existing tank farm and the construction of an additional tank farm for the storage of regenerated liquids such as ethanol, methanol, toluene, ether and THF. Christian Hospers from Iv-Industrie tells us about SHE specialists, LEL meters and a skid that he'll never get tired of talking about.

"That was the best part and the most challenging too. The placing of the skid at Aspen's new regeneration installation in Oss. Ten by four and twenty metres high", says Christian Hospers, Project Manager at Iv-Industrie.

I still feel proud whenever I walk past this huge tower. In a way, it's kind of 'my' tower.

"The steel structure is lifted, and you just have to hope that the foot plates will fit onto the anchor bolts and that all this preparation had not been for nothing. The bolts are tightened and then, yes, that's it. This was the first part, then the other part followed, and finally the stairwell, this really was an enormous challenge."

Proud

The skid was transported in parts - the process installation in two parts by boat. It was transported from Switzerland via the Maas and the Burgemeester Delen Canal and took four days to arrive in the port of Oss. The stairwell was transported by trailer from the Netherlands. "We managed to erect it in one day. I still feel proud whenever I walk past this huge tower. In a way, it's kind of 'my' tower, and yes, it's standing."

Active Pharmaceutical Ingredients

Aspen in Oss. They make Active Pharmaceutical Ingredients, APIs for short. These are active raw materials that determine the effect of medicine. Christian: "If your doctor or pharmacy gives you an ointment or cream against itching, it will contain an active, working substance (API) that ensures the itching will stop." Aspen has three locations in the Netherlands, two of which are in Oss. One is just outside the city in the modern business park; De Geer. The other is in the middle of the city, on the Moleneind industrial estate, surrounded by houses which were formerly inhabited by Organon employees. Aspen is more or less a continuation of Organon.

Reusing volatile liquids

"Various solvents are used for API production. Volatile liquids such as ethanol, methanol, toluene, ether and THF [tetrahydrofuran, a cyclic ether/ed.]", says Christian. These substances are not cheap, so reusing them is a favourable option, also from a sustainability perspective. And it is possible, but you first need to clean them thoroughly to at least achieve the same quality as when the solvent was purchased. "This cleaning takes place in a regeneration installation. Here, the polluted solvents are heated in a number of distillation columns. Following this process, the vapour produced from these volatile liquids is collected. The condensate can be used again as a solvent and the remaining chemical waste is destroyed. But it's much more complicated than this at Aspen."

These mobile tanks had a nickname, Christian reveals. Jumbo's for the clean vapour and Martians for the dirty solvents.

Jumbo's and Martians

The API production took place at Aspen's De Geer site and the regeneration at the Moleneind site. A bit awkward, because this caused a lot of going back and forth with trucks full of solvents, via public roads. At Moleneind, the solvents are stored in storage tanks, with each volatile liquid having its own tank, after which they were transferred to the regeneration installation via smaller mobile tanks. These mobile tanks had a nickname, Christian reveals. Jumbo's for the clean vapour

and Martians for the dirty solvents. "Both had to be connected with hoses to the connection panel of the regeneration installation. This required a lot of manual work and increased the chance of leakage and wastage. In addition: the regeneration installation at Moleneind was quite old. After decades of use, it was in urgent need of replacement."

After all, you are working in an environment with chemical substances. Safety was the highest priority in everything, and yes, this made the work a little more complex.

Logistics and safety

The assignment for Iv-Industrie is clear. Integrate the skid within the existing tank farm and design and realise a new storage facility for regenerated solvents at the De Geer location. Christian: "We had to link the new installation to the existing systems. For this, we had to realise around fifty tie-ins on existing solvent pipelines. While the production at Aspen continued as usual." Logistically, this was an enormous challenge at a plant that doesn't stop. "The tank farm remained in use. Trucks continued to load and unload which had to be taken into consideration when planning. After all, you are working in an environment with chemical substances. Safety was the highest priority in everything, and yes, this made the work a little more complex."



SHE specialists and LEL meters

Along with 400 other companies in the Netherlands, Aspen is a BRZO company. It is covered by the Seveso-III-Directive, a directive that aims at the prevention of major accidents involving dangerous substances. "That means that everything you do is carefully examined with a magnifying glass, so to speak. The advantage of this is that it keeps you incredibly sharp", says Christian, who with his men was intensively supervised by internal SHE specialists who pay close attention to the Safety, Health, Environment (SHE) regulations. These contain all the safety standards for every supplier and sub-suppliers of Aspen. "During the welding activities that took place in



the tank farm for several weeks, we placed a LEL (Lower Explosion Level) meter with 16 gas detectors situated at the highest point, this to provide a continuous measurement. Based on the location where we were operative, these were assessed every day in combination with, for example, the wind direction. The LEL meters keep a close eye on these risks.”

Christian compares it to building a house. First the walls are erected, then the floor is constructed and finally, the kitchen is placed.

Realistic schedule

“Start at the beginning. What needs to happen? Who’s going to do what, and who is going to supervise it? This means finding the right contractors and continuously aligning their progress with our schedule”, says Christian. “The mechanical, electronic and software deliveries: everything is interconnected.” Christian compares it to building a house. First the walls are erected, then the floor is constructed and finally, the kitchen is placed. This is based on a schedule whereby there is no room for mistakes to be made with the different components and phases, otherwise, the whole thing will end up in a mess. In terms of planning, everything went smoothly. “It was because we worked with a tight but realistic schedule. We had already accounted for delays because we are, of course, working on special terrain.”

To prevent a significant loss of time, everything needed to be shifted by a metre and luckily it was possible.

Data cables and groundwater level

“Sometimes it was very exhilarating”, says Christian. “Once during excavation work, we encountered some data cables in the ground next to the footpath, not under the footpath as according to the drawing. The cables were responsible for the entire data provisions at the location, so we couldn’t just cut through them. To prevent a significant loss of time, everything needed to be shifted by a metre and luckily it was possible.” We have also experienced difficulties when installing six recycled ground tanks to be used as storage for the ‘cleaned’ liquids. “These needed to be placed six metres deep in the ground, but the groundwater level was too high and impossible to drain. We, therefore, decided to install the tanks at a depth of 2.5 metres, with a concrete container above which consisted of a partial above-ground setup.”

Long-term cooperation partner

“From nothing to an end result.” This is what made the project extra special for Christian. “We have done everything within a time slot of two years. Always nice; such large projects. You take on more ownership too because you’re right in the middle of it. You know everything about the project.” For six months, he himself was nearly always present at the De Geer location. Christian: “The size of the project really suited me and all disciplines from civil and groundwork to process and piping were united in it. Everything was just small enough to be closely involved in all that was happening.” He still visits Aspen every week as quickly after, numerous assignments followed. From the smaller sibling of the regeneration installation situated at the Moleneind, project management for the upgrade



of the company sewer and the placing of a construction manager to the installation of a seventy-metre pipeline bridge between two production buildings. And yes, this involvement is clearly visible in the office of Iv-Industrie. A full width and height photo of the regeneration installation at the De Geer site dominates the whole wall and another one too on the other side of the room. Christian will be able to admire it for a long time to come. Aspen is a partner with which Iv-Industrie enjoys continuous, long-term cooperation. ●







The urgency for Crystallisers in China

The Chinese economy is still growing rapidly and the need for raw materials is great. Shenhong Refinery Petrochemical Corporation in Lianyungang, Eastern China, has ordered 24 Crystallisers from Escher Process Modules, a subsidiary of Iv-Groep. Para-xylene, the raw material for the manufacture of PET bottles no longer needs to be imported later on. The Chinese client wishes to have the installations ready by September 2020. This will put construction under a huge amount of (much needed) pressure.

Scraping crystals

The Crystallisers will be part of a new, gigantic petrochemical complex in China. How it works: The Crystalliser tank is filled to the brim with 250,000 litres of xylene, with some residues of toluene and benzene which is covered by a 'blanket' of nitrogen to ensure toxic vapours cannot escape.

The revolving rotor with scrapers is driven via a gearbox powered by an electric motor of 110 kW and revolves twenty times per minute.

Ethylene, a gas that varies in temperature (between -35 and -84 degrees Celsius) during the process and cools the contents of the tank, is introduced through

the double wall on the underside of the tank and approximately halfway up. Para-xylene crystallises at a temperature of 13 degrees above zero. A layer of crystals form on the inner wall of the tank and are removed by revolving scrapers. The crystals then sink to the bottom, where a sort of slush puppy forms. The liquid and the ice are discharged via the underside. At the same time, new liquid is fed via the topside of the tank to maintain a constant level. The ice is separated from the liquid in three stages via a centrifuge. Each stage increases the purity of the product. Eventually, para-xylene is produced. Once the installation is underway, it will run continuously, month in, month out.

The revolving rotor with scrapers is driven via a gearbox powered by an electric motor of 110 kW and revolves twenty times per minute. The revolutions can be varied from 10 percent to 100 percent. If more revolutions are required, this will depend on the production conditions.

From crude oil to PET bottle

Crude oil contains approximately 0.5 to 1 percent xylene or dimethylbenzene, which is extracted via catalytic reforming. This is a clear, colourless liquid from which the Crystalliser produces para-xylene (PX). The installations that Escher supplies are part of a larger whole. The para-xylene is later converted by oxidation into purified terephthalic acid (PTA) to produce polyethylene

terephthalate (PET), from which, among other things, PET bottles can be made. An appealing feature of PET is that this plastic is highly recyclable.

Escher can supply the Crystallisers to licensees based on the specifications supplied by BP.

'Installed base'

Escher has been active in process technology since 1925 and has built up an excellent reputation. Already in 1998, five Crystallisers of this type were delivered to BP in Geel, Belgium. The Crystallisers have been running successfully there for the past twenty years. This is an 'installed base' and is very important for scoring follow-up assignments.

The process was cleverly devised by chemical technologists at BP. While the molecular structure differs marginally from ortho-xylene and meta-xylene, they have been able to trace para-xylene as the raw material of a PET bottle. It is BP's desire to market this in-house developed process. Escher can supply the Crystallisers to licensees based on the specifications supplied by BP. If this assignment is executed properly, Escher's position can be strengthened by taking on even more of this type of work.

Our strength is that we have many kinds of divisions within Iv-Groep, each possessing specific expertise. These divisions all work in close collaboration for the Crystallisers. "Additionally, we found the best suppliers for the construction of the Crystallisers. They are also our partners because we needed more from this

collaboration. The pressing of time due to the tight deadline is enormous. Every project brings challenges," laughs Hugo Keemink, Technical Coordinator of the project.

Reversed engineering

Escher was already supplying Crystallisers twenty years ago, but because there are no longer personnel within the organisation who previously worked on this, the new Crystallisers must be designed based on the old data. Moreover, the specifications have intensified. We have travelled several times to China to first convince the customer that Escher's solution was the best and



safest option. And especially, to take on board the wishes of the customer.

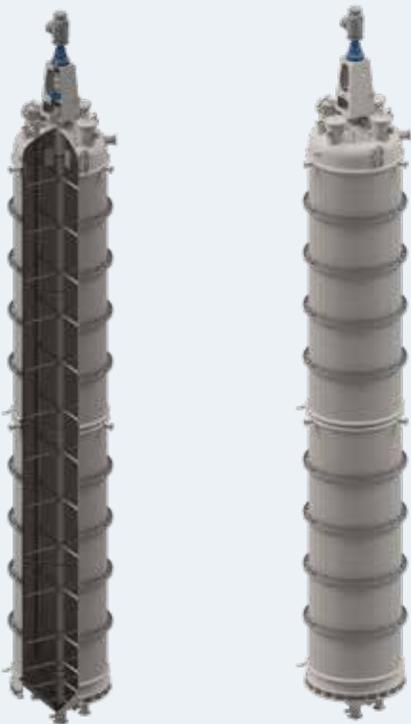
One of the requirements is an extra safety feature, a torque limiter, developed for the gearbox and with planetary gears in three stages. In the exceptional case that the motor jams or a tooth breaks off a sprocket, the liquid will take the rotor with it and the forces will become ten times greater than the forces delivered by the motor. Should this happen, the torque limiter will intervene and disconnect the rotor from the motor.

It all seems fairly simple for outsiders, but just to fix corrugated sheet on the outside of the tank requires 2.2 kilometres of certified welding.

Compared to the old design, further improvements have been made, such as a dry gas mechanical seal and a direct drive mechanism. The construction is calculated at the higher speed at which this installation will run at twenty revolutions per minute, compared to eleven revolutions with the former design.

Certified welding

A Crystalliser is a thirty-metre-high tank, made of stainless steel, type 304 alloy composition and has a double wall. Relatively speaking, it all seems fairly simple for outsiders, but just to fix corrugated sheet on the outside of the tank requires 2.2 kilometres of certified welding. The tank must be as round as possible from the mid-point because the pressure of the scrapers on the tank-wall must be constant. The inside of the tank is completely polished,



which is extremely labour-intensive and precise work. These are all critical points.

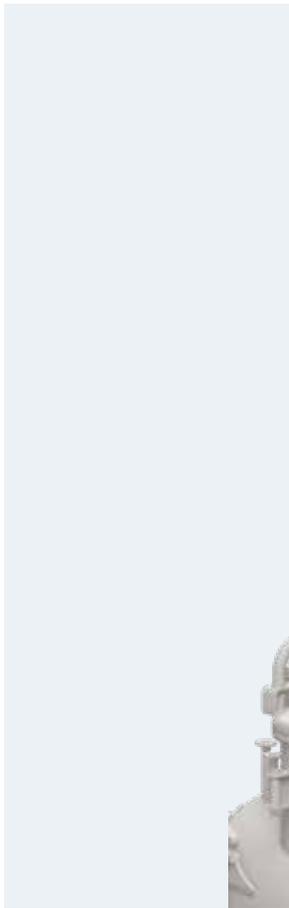
By delving deep into the technical details, a whole wealth of knowledge has recently been gained within Iv-Groep.

You would expect that this type of installation could be built in Asia. However, the client has insisted that this takes place in Europe; for the customer, this guarantees quality.

Hugo emphasises that this is a team performance of several divisions of Iv-Groep: "Escher takes care of the sales process, Iv-Offshore & Energy does the coordination, procurement, testing and installation supervision - and the specialists of Iv-Consult are the technical brains of the project."

You would expect that this type of installation could be built in Asia. However, the client has insisted that this takes place in Europe; for the customer, this guarantees quality.

As a supplier, Escher is the bearer of product knowledge. Making a product is very different from carrying out a project, Hugo emphasises. "The people who work on it must therefore fully understand how the installation is put together and how it works. All material used is certified. The installation must comply with the U-stamp of the American Society of Mechanical Engineers. We have set up an inspection organisation ourselves because the geometric tolerances in the design are very small and this project is so big that nothing can be left to chance. All components are to be monitored." ●



**“THE PRESSURE IS ON
FOR ESCHER”**





Working together on scrubber projects

“Projects run very smoothly because our core businesses complement each other so well”, says Rick de Jong, Sector Manager at Iv-Consult, regarding the collaboration with VDL for the scrubber projects program.

Going back several years prior to the cooperation between Iv and VDL, we came up against each other as competitors in 2008 for a defence project for RUAG, a project that VDL eventually won. This encounter then led to a successful collaboration in 2009 in domains such as helicopter landing grids, the turn-key delivery of the indentation resistance testing machine for Forbo Flooring and the mechanical engineering of two bioreactors for DONG Energy. At the end of 2017, VDL purchased AEC Maritime to increase the construction of scrubbers at VDL-KTI and to be able to supply the scrubber concept themselves. Scrubbers, also known as gas scrubbers, are widely used in the industry to remove sulfur dioxide and particulate matter (PM) from exhaust streams. Scrubbers are becoming increasingly common on sea-going vessels as a requirement of still be allowed to sail. This is due to stricter emission requirements from the European Union and IMO (International Maritime Organization), which shipowners must meet in the coming years. VDL performed the engineering of the

scrubbers themselves but needed another party to take care of mechanical engineering. This is where Iv came into the picture again. Currently, 16 new scrubber systems have been designed and successfully developed.

Seawater is used to clean the exhaust gases in the gas cleaning installation. An aggressive corrosive environment is created by combining saltwater with the high temperatures produced from exhaust gases. These are two important challenges in the design of the installation.

Saltwater, heat and limited space

Rick explains the challenges that are presented when designing scrubbers: “On a ship, there is an exhaust pipe or funnel (chimney). A scrubber installation is approximately eleven metres high and variable in diameter from two to six metres. It is placed in the exhaust pipe or funnel or, if it cannot be fitted here, the installation will be placed on the back of the ship as a ‘backpack’. Exhaust gas rises through the outlet and passes through a kind of shower of pumped-up seawater. This misting, dispersed via spray nozzles,



causes the saltwater to sag downwards as a blanket of spray and bind with the sulfur particles. The sulfur-containing water is then discharged below the waterline. Scrubbers remove around 99 percent of sulfur dioxide and particulate matter from the exhaust gases.”

A scrubber system can be supplied as an open-loop system or as a closed-loop system.

Seawater is used to clean the exhaust gases in the gas cleaning installation. An aggressive corrosive environment is created by combining saltwater with the high temperatures produced from exhaust gases. There are two important challenges in the design of the installation. The exhaust pipe or funnel needs to be made of Alloy 254 SMO, a highly resistant stainless steel and therefore also resistant to corrosive seawater. “Rubber mounts are used for mounting the scrubber as the heat causes the pipe or funnel to expand by several centimetres and, of course, vibrations and ship motions may also occur”, says Rick. “Adjusting the resistance of the ship’s engine is also a very precise job, as it must be exactly right.” A scrubber system can be supplied as an open-loop system or as a closed-loop system. With an open-loop system, the sulfur-containing water is discharged into the sea that breaks down the sulfur. For gas scrubbers with a closed-loop system, the contamination is stored in a tank. The wash water is hereby cleaned in a centrifuge. Ozone is added to retain the remaining waste.

In addition to saltwater and heat, another very important challenge is the available space. Frans Nieuwkoop, Mechanical Engineer at Iv-Consult, has seen the significance of this challenge on a number of ships around the world: “I have conducted several surveys on ships where we needed to install scrubbers. What was especially noticeable was the number of different piping systems crammed into a small space such as the funnel (chimney) of the ship. It was, therefore, quite a challenge for us to identify available space to install our system components and connect the pipework.”





3D-scan

To make the fitting and measuring easier, especially in the funnel, engine room and the areas surrounding existing pipework, Iv-Consult, in collaboration with Iv-Infra, developed an innovative working method for the 3D scanning of sea-going vessels, cruise ships, oil tankers, bulk carriers and container ships. This method allows both the supplier VDL-AEC and shipowners to select the appropriate scrubber for the ship in question. Various CAD packages are combined with the 3D scan data which allows a 3D model to be generated very quickly.

Sixteen scrubbers in nine months

“The scrubber program is a great example of good collaboration”, says Rick. “Iv first prepares the P&ID and the GA (general arrangement) during the concept phase. VDL then visits the site or yard and consults the project there. Iv performs a survey and/or a 3D scan on board the ship and begins work on the basic engineering phase. Following consultation with the customer, we begin work on the detail engineering. VDL then builds the scrubber. Since September 2018, we have taken on two projects each month. To date that are 16 systems that have been designed and developed. Designing a scrubber takes a few months. Time can be saved in the design phase by creating a smart P&ID. It is not possible to replicate the previous design again and again. Every scrubber is unique and complex in its own way, but we certainly use our acquired knowledge and experience which is what makes us increasingly efficient in implementation.”

The team consists of employees from Iv-Consult, Iv-Industrie, Iv-Infra, Iv-Offshore & Energy, Iv-Water and Nevesbu.

Beyond the conventional markets

“What actually makes this project program even more special is that about 15 to 18 employees of Iv are involved in each project and these are not just people from Iv-Consult. The team consists of employees from Iv-Consult, Iv-Industrie, Iv-Infra, Iv-Offshore & Energy, Iv-Water and Nevesbu. Having a diverse team means we can go beyond the conventional markets in which we normally operate. We tackle every project falling under the program and one person is assigned responsibility for each yard. Even though they are not physically sitting next to each other, there is a lot of contact among the teams. In addition to the weekly consultation, there is an app group in which a whole wealth of information is shared. Some employees also regularly travel abroad to perform measurement and scan activities on board ships.” Frans adds: “In addition to the technical challenges in the projects, this work has also proved to be particularly unpredictable. It happened to me once, for example, that after conducting a survey in China, I flew on to Japan to scan another boat. Shortly after arrival, it appeared that the boat I needed to scan was actually going to arrive in the port a week later due to ‘congestion’ in the port. The quay was full of ships which meant there was no

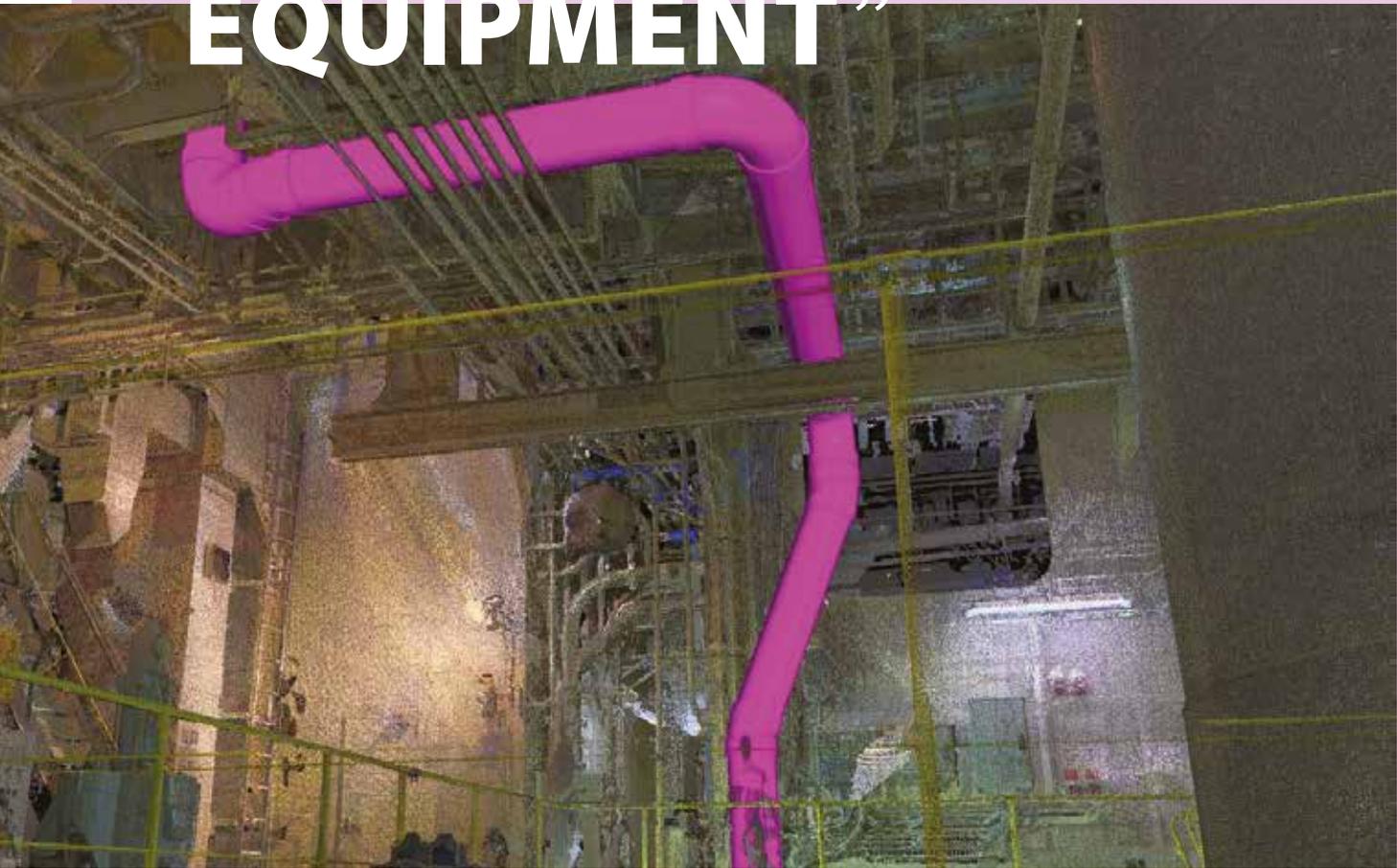
available space for unloading. After a pleasant leisurely day in Tokyo, I flew back to the Netherlands. I’m not the only one who has experienced this. Other colleagues have also flown around the world for nothing and returned home without a survey or scan data.”

Tijmen de Haan, Engineer at Iv-Industrie, shares his experiences: “The thing I remember the most are our adventures in Singapore and Panama. We sailed with small boats to visit large sea-going vessels. To sail among huge ships was such an amazing experience! When our work was done, we still had time to explore the cities and these beautiful countries. In Panama, we also saw the new lock gates of the expanded Panama Canal which were designed by Iv.”

“It’s great to see how closely the team works together and how we all develop further under the leadership of Caspar Breman, Project Manager of the structural department”, Rick continues. “This is how young people with potential continue to grow. Within projects like this, you have to work together a lot and working hard is also a must. In combination with the desire to be working ever smarter, you gain a lot of knowledge and experience within a short period of time, which is well worth it! Therefore, we are always on the lookout for new people who are eager to learn. In short: technicians with a broad knowledge of technology who can operate at a high level. Talents that can be developed further!” ●



“PUZZLING OUT THE FITTING OF EQUIPMENT”







'De Passie' school building: from 4,300 m² to 6,300 m²

"You can plan it all out, but you will gain much better insight into what is possible when on location. For example, whether that duct will fit in that area or will it perhaps obstruct passage. Moreover, I now indicate on location exactly where the new energy supply needs to be placed and where it needs to be disconnected. It's very precise where certain installations or pipes are placed, so I always examine this on location." Han Engel, Project Manager at Iv-Bouw, talks about the project 'De Passie'. An existing school building for secondary education that is to be renovated and expanded from 4,300 m² to 6,300 m².

The building will be renovated and expanded in phases while remaining open. The radical changes will improve the sustainability of the building to a level exceeding the current statutory criteria for newbuilds by 30 percent. Significant improvements to the building shell, the removal of the gas connection and an All-Electric building with an air source heat pump will ensure this sustainable result.

The project 'De Passie' has been accepted in the form of a DBMO contract, whereby Iv-Bouw, as the contractor, is responsible for the design (from sketch to implementation design), building (construction),

maintenance and operations. Iv-Bouw has carried out a number of projects in this way in recent years, but then in the form of an EPC construction within a UAV-GC contract. There were, therefore, no responsibilities with regard to management and maintenance. A DBMO contract is not something you immediately expect to encounter with an engineering and consultancy company that specialises in installation technology.

It's not just about the drawings, but also about understanding exactly what you are doing. You need to smell, feel and taste it!

Han explains: "Previously, we only provided the design in projects; the design of the installations. It was then put out to tender and a contractor began work without us having any influence anymore on our design or what would happen with it. The tendering process takes a lot of time and contractors also often outsource activities to subcontractors. A few years ago, we thought 'we can do that', then we have a direct influence on what is being built as well as on customer satisfaction. In the meantime, we have begun to do more and more ourselves in projects, and now, we not only design the

installations, but we also take care of the procurement and we work with fixed self-employed professionals who execute the work for us.”

Professionals with an Iv heart

The self-employed professionals who implement the work have been selected and trained in what we at Iv find important. “They are people with an Iv heart!” says Han. “They are present at the construction on behalf of Iv and are an important point of contact for other parties. We, therefore, consider it to be very important that they learn exactly how Iv wants something to be built and the standard of safety and quality that we strive for. They really have to think and act as we do.” That’s why Han is often present at the construction site. Not only to supervise the construction and to carry out the engineering but also to reinforce that Iv heart to the subcontractors.

In each of the three phases the existing installations must be adapted to the new temporary situation.

He adds: “By walking around, you notice more, and this is better for the design. It’s not just about the drawings, but also about understanding exactly what you are doing. You need to smell, feel and taste it! When you walk around, some things are suddenly noticeable. It’s all very well thinking that large installations need to be placed in a room, but can you actually get these things inside? Is there room for that? These are the things that we can prepare well and ultimately apply guidance.”

Building and education at the same time

The renovation and expansion of the school building will take around two years altogether. In the meantime, education at the school will continue. In the first phase of the project, the school was prepared for the major renovations. Hereby the existing technical space was dismantled which is where, among other things, the boilers, control technology and air treatment were situated. For this, temporary provisions first had to be made including the diversion of the central infrastructure. Subsequently, the demolition of part of the school commenced and temporary classrooms were placed. Iv-Bouw was also responsible for preparing the site terrain for construction and the installation and connection of the temporary classrooms. The building will be renovated in three phases. For each phase, a third of the students will be moved into the temporary classrooms and the existing installations must also be adapted to each new temporary situation. The project is now ready for implementation and is scheduled to be completed by the end of 2020. The implementation design drawings still need to be converted into working drawings during the implementation phase.

Both quality and economic attractiveness have already been thoroughly undertaken in the technical design.

Challenges in cost-saving and quality

This approach whereby Iv-Bouw not only takes care of the design but is also responsible for the procurement and implementation, creates other challenges. As a





consultancy company, choices that normally do not have to be taken must now be made. Such as, which products are technically the best option, but also economically attractive? Han explains: "Iv has accepted this project for a fixed amount, which ensures that we critically examine the choices that we make. As an engineer, you want to make the building as beautiful as possible, but it must also be feasible within the agreed budget. This may mean, for example, that we choose for the cheaper option for the toilets, but not when it comes to purchasing the sustainable energy installations! It requires good technical knowledge to make these choices and to make cut-backs on some elements, but certainly not on others." Because the project team at Iv is responsible for the entire project, both quality and economic attractiveness have already been thoroughly undertaken in the technical design. Designing as 'simple' as possible was an important goal with this project.

Engineering on location?

The added value of Iv in such a project is in the complete technical concept. Where the contractor, as a specialist, knows how to do the work and how safely they can do it, Iv is still able to examine the design during construction and adjust it if necessary. This is what makes us a flexible 'total-package' consultant. Should the engineering always be carried out at the location? Han answers: "No, certainly not. It is very important to often be present at the construction site for bonding, visibility and on-site assessment of what is and isn't possible. But the engineering certainly does not have to be done on site. The bonding and exchanging of knowledge with other Iv colleagues are far too important for that!" ●

70 YEARS PEOPLE PROJECTS STORIES



Work hard, play hard!

Besides working on the most beautiful projects, we also have a lot of fun together; from summer barbecues and gypsy parties to fun trips to places such as Verona and unique New Year's gatherings.



Malaysia

In 1996, we laid the foundations of our successful office in Malaysia.



A man, a plan, a canal. Panama!

Rightly our project of the century: the renewed Panama Canal with 16 lock gates designed by Iv was opened in 2016.



70 years of innovation

The latest technologies are implemented daily in the most diverse and challenging projects. Through our special collaboration with technical universities and knowledge institutions, we keep abreast of the latest developments and know exactly how to help young engineers of the Netherlands find their way to Iv.

“ASSET MANAGEMENT IN PRACTICE”



Significant and sustainable renovation of Sluisjesdijk sludge processing company



It's not just any project, the replacement and modification of the control cabinets, sludge dewatering (centrifuges), pre-thickeners and chemical storage at the Sluisjesdijk sludge processing company. Nineteen control cabinets (with 53 panels in total) must be replaced. The scale of this is huge and it must all be achieved in 2.5 years, while the processes at the sludge processing plant must continue undisturbed. Paul Kloet (EIA Department Head) and Ruud Hekman (Senior Project Leader) tell us about the greatest challenges within this project, which is part of a large-scale renovation project for which approximately a total of 25 million euros has been allocated.

One of the main goals of this large-scale renovation is to future-proof the Sluisjesdijk sludge processing company. To be able to make strategic choices for the coming ten years, an analysis was carried out according to the method of Life Cycle Asset Management. This led to a number of fixed measures that will guarantee sustainable and target driven business operations for the coming ten years. Several projects have been combined into one project of which Iv-Water identifies the various

solutions, evaluates choices, designs, prepares the contract and ultimately supervises the implementation.

Back in time

Let's go back in time; because what exactly happens at the sludge processing plant in Sluisjesdijk and why is this major renovation necessary? The headline of a Dutch newspaper on 27 October 1987 was '*Queen Beatrix opens underground water treatment plant*'. A few days later, on 3 November, wastewater treatment plant (WWTP) Dokhaven was officially put into service. WWTP Dokhaven was the first underground biological treatment plant in the Netherlands.

The aim of this large-scale renovation of the sludge processing company is to generate 8 million kWh of renewable energy annually which is to be used directly by the water board.

The sludge processing plant is situated around 600 metres away on the Sluisjesdijk in the Rotterdam Waalhaven area. Here, the sludge from the Dokhaven

WWTP is fermented. The biogas produced during the fermentation process is converted into electricity and heat. This heat is used for, among other things, maintaining the temperature (33 to 35 degrees Celsius) of the sludge fermentation tanks. The electricity is stored and provides emergency power in the event of a power failure.

We are now 32 years further and the sludge processing installations are approaching the end of their technical life. Partly due to ensuring safe and reliable operational management, it's necessary to renovate or replace components. The aim of this large-scale renovation of the sludge processing company is to generate 8 million kWh of renewable energy annually which is to be used directly by the water board.

Hollandse Delta Water Board is aiming to fully perform its core tasks in a circular fashion by 2050. The sub-target is to be 50 percent circular by 2030.

Paul: "In the coming years, various renovation projects will be carried out that will contribute to this. The project that Iv-Water is currently working on is one of these. It's a technically challenging project that involves many disciplines such as electrical engineering, process automation, mechanical engineering and civil engineering, as well as specialities such as ATEX, RAMS and functional safety. I myself have been involved in engineering projects for the water board since 1998. The great thing about this collaboration is that we know the water board very well. We have a great deal of

knowledge of the applied technical standards, but also of project management within the organisation. And because we have been working together intensively for years, we were already familiar with the initiation of this project for quite some time. We participated in the market consultation and it soon became clear to us that this was a challenging project that we really wanted to be a part of. Not only because of the scale, but also because of the limited space where the conversion needs to take place and the assurance of continuing business operations during conversion. This is what makes it even more valuable to me to be able to contribute to this project."

Energy neutral ambitions

Hollandse Delta Water Board (HDWB) is aiming to fully perform its core tasks in a circular fashion by 2050. The sub-target is to be 50 percent circular by 2030. Presently, these ambitions have been inventoried, but the environmental guide at organisational level still needs to be covered and the sustainability goals still have to be determined. The Aanpak Duurzaam GWW (Sustainable Approach for Ground, Road and Hydraulic Engineering) is helping with this. Ruud: "We are already familiar with this approach at Iv-Water, but because its application is new in the world of water treatment, we don't have any practical experience with it. That was quite a challenge with this project. Since this approach has been applied for some time in the infrastructure sector, we have involved our colleagues from Iv-Infra. When examining the twelve sustainability themes, it appeared that not all themes were equally relevant to the world of water treatment. The relevant themes are



energy, materials, water, well-being and investments. For these themes, an ambition level has been agreed with the water board and a project objective for each theme has been set.”

Greatest challenges in the project

“The greatest challenge in this project was making an inventory of the existing installations. We used a multi-criteria analysis to determine which existing functionalities needed to be adjusted and to what extent it was necessary,” says Ruud. Other challenges were the lead time and the scale of the conversion of the control cabinets, but also in the fact that business operations must continue during the conversion. The control cabinets are central to the plant. They manage all the



equipment which means replacing these, therefore, has an impact on the entire business operations. Ruud: "The new control cabinets are housed in a new control room so, for example, the installation of the new cabinets and the laying and connecting of new cable paths can take place independently of other activities. The routing of cable paths is set up in such a way that the continuation of processes will experience minimal inconvenience and the contractor will also be unhindered by operational continuation. By making thorough preparations, the cabling need only be connected on the site-side, to begin with testing. This way, the conversion work can be planned to take place consecutively."

The existing control cabinets are mainly controlled via relay technology and are equipped with modern automation equipment. Iv-Water is to provide the functional designs for automation.

When taking chemicals into consideration, it emerged there was a problem at the site with the formation of struvite.

Replace or renovate?

Adjusting the dewatering of sludge should lead to a higher dewatering capacity, and will allow optimal usage of the sludge fermentation capacity.. To achieve this, various components of the sludge dewatering system will be replaced and/or radically overhauled, modernised, automated where possible and controlled

remotely by the Remote Monitor & Control System. What we are now investigating is: should the sludge dewatering centrifuges be renovated or replaced with new ones? And, how to incorporate the centrifuge adjustments into the overall planning as efficiently as possible? The choice between replacing or renovating can only be made properly if a comparative test is performed with centrifuges available on the market. The steering committee of HDWB still needs to decide if these tests can be performed in the fourth quarter of this year.

Preventing the formation of struvite

When taking chemicals into consideration, it emerged there was a problem at the site with the formation of struvite. This causes an obstruction in pipes and would lead to installations having to be taken out of operation. Further analysis showed that the formation of struvite can be prevented by mixing the sludge flows in an alternative way and in combination with quantities of iron chloride for the binding of Phosphate. Together with a number of specialists from WSHD, Iv-Water has considered a number of variants that will prevent the forming of struvite in the future. The basis of the solutions is the mixing of the external sludge and the A-stage sludge from WWTP Dokhaven, resulting in a sufficient liquid mixture in which iron chloride can be dosed and mixed thoroughly. Various alternatives of this have been worked out. It is not yet known which alternative will be chosen. A Design Risk Inventory and Evaluation (RI&E) will also be prepared for the parts to be renovated and newly installed. Hereby the safety will





be tested against the requirements of the machinery directive. Input provided by an ATEX specialist is a precondition due to parts of the installation being in the ATEX zone.

Safeguarding of various interests

The project has many stakeholders and all with various interests. All these stakeholders must ultimately support the chosen solution, which means gaining support is very important. Stakeholders are, therefore, closely involved in the project and in the technical choices, whereby the voice of the directors and process managers are of great importance. Among others, introductory meetings and interactive sessions have been organised to jointly draw up the Customer Requirements Specification (CRS) and to identify risks.

Choice of contract

The contract is to be marketed as a UAV contract or a UAV-GC contract. The choice between these is still open and will ultimately be made based on the development of scope (design freedom and complexity), planning (lead times per contract form), risks (to what extent are the risks manageable for the water board), information (the condition and quantity of available information) and the extent to which the water board wishes to be involved in the implementation of the project. ●





A new method for hydro-structural ship analysis

“Coupling between hydrodynamics and structural analysis is what makes this method so unique”, says Ana Maria Tocu, Lead Naval Architect at Nevesbu. “We have developed a method for mapping the response of ships and offshore structures with direct link to the FE (Finite Element) analysis, in order to accurately account for specific environmental conditions. It goes without saying, that once a marine structure is at sea, it should remain intact and be able to properly and safely operate over its entire life time.”

Nevesbu is currently among the first engineering companies in the Netherlands that performs hydro-structural analyses.

Our goal is to ensure that global structural strength, as well as local structural details, are capable of withstanding operational and environmental loads, whilst balancing these requirements against economic and environmental emission-driven demands calling for lighter and more efficient structures and structural arrangements.

Current practice, risks and limitations

Currently, it is more of a common practice to separately perform hydrodynamic calculations and FE analyses. Wave-induced loads, like accelerations and wave bending moments, are commonly determined by linear seakeeping analyses. Thereafter, the load combination approach is typically used to load the structural FE model. This is an example of a rule-based approach in which the FE model is loaded by a combination of extreme wave-induced loads, which will not necessarily give a representative design load condition for the structure. Practice learns that in case of non-compliant results, this can lead to time-consuming discussions with classification societies and sometimes to extreme structural design modifications. Additionally, modern engineering practice implies that in those cases where rules are not deemed sufficient, direct calculation procedures are to be applied.

Therefore, Nevesbu has chosen to invest in further developing their hydro-structural calculation methodology, since it will lead to more consistent and realistic FE loading and results. These results will help to early identify where and how the design should be adjusted.

Hydro-structural link

“When a few years ago the opportunity arose and we had adequate in-house knowledge and experience, we set up a core team of specialists to develop the methodology for performing the hydro-structural analyses more efficiently”, says Ana Maria. “These calculations are by no means simple. They are extremely complex and require specific knowledge of both hydrodynamics and structural aspects. Our main goal was to make use of an integrated software package that covers all relevant hydro-structural aspects, and we succeeded.”

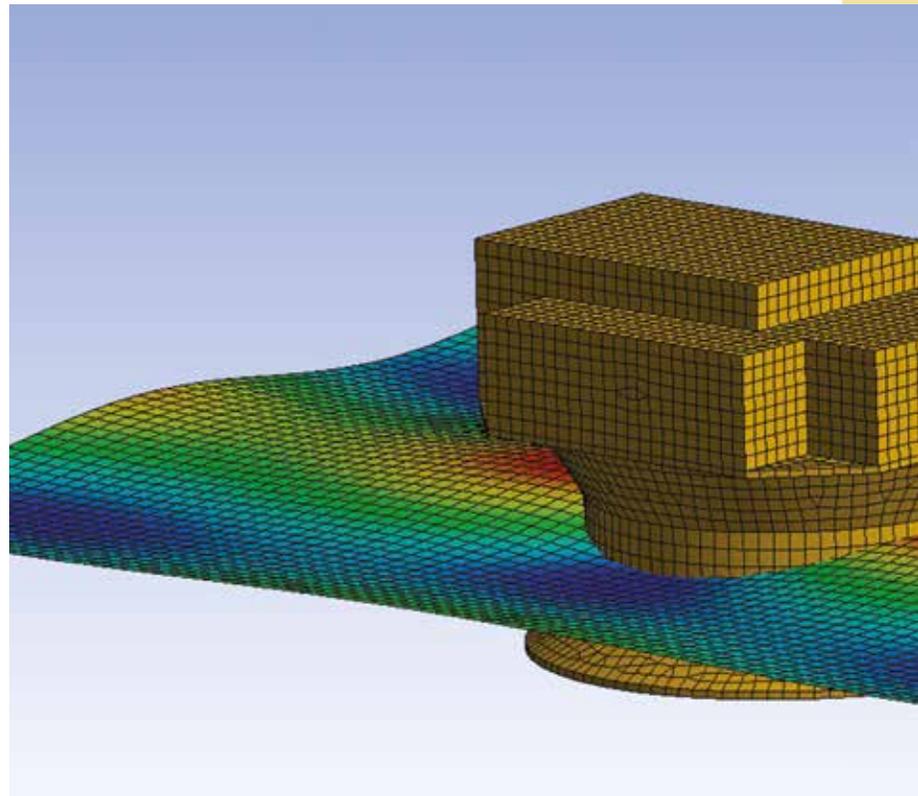
More complex issues such as fatigue behaviour, non-linear excitation of waves and hydro-elasticity can also be simulated.

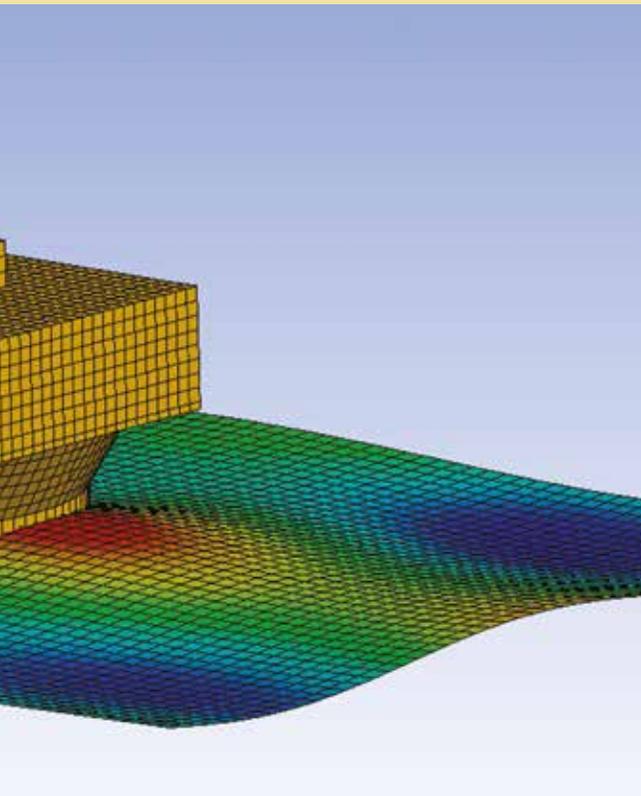
With the new software package, a direct connection is made between the hydrodynamic mesh and the finite element mesh. The pressures exerted by the waves on the wetted surface of the ship can, therefore, be directly linked to the FE model. Consequently, this means that working with (sometimes) unrealistic wave loads is cancelled out. More complex issues such as fatigue behaviour, non-linear excitation of waves and hydro-elasticity can also be simulated. Usually, various software packages are used by different disciplines, but ultimately, everything is integrated in one model, with direct link to the structural FE model. This is of great advantage for Nevesbu as a wealth of knowledge, experience and tools can be reused.

We have conducted various benchmark studies to test the hydrodynamic calculations, and to refine these where necessary.

Status in the market

Hydro-structural analyses are often conducted by classification societies. Nevesbu is currently among the first engineering companies in the Netherlands that perform this type of analyses. Preceding this are years of knowledge development, research, discussions with software suppliers and benchmarking.





When classification societies carry out hydro-structural analyses, it often takes place at a later stage during the design process. But what if the analyses show that modifications should be made to, for example, the main frame, topside supports or the bilge keel, as they will not be able to withstand the extreme and/or fatigue loads that will be experienced at sea? This may cause a considerable steel increase, which can have consequences for all parties involved in the ship design. In such a case, how can we ensure that the design is adjusted within the given time frame and budget, without compromising on quality? We recommend to perform the hydro-structural analyses during the early design stages. By doing this, above mentioned risks can be avoided, and if necessary, the design can be timely adjusted, which will benefit our Clients.

Main focus

The main focus for Nevesbu is to increase the consistency and representativeness of the FE results of marine structures, for both extreme load cases as for fatigue loading. "We use for example a non-linear seakeeping model to calculate extreme wave-induced loads," says Lennart, Naval Architect at Nevesbu and member of the core team of specialists. "This is necessary to determine realistic wave loads in extreme environments. It is unique that the software package is not only capable of performing this calculation, but can also link this information to the structural FE model. Particularly in extreme wave conditions, it is observed that a non-linear model provides a significantly higher response than a linear model."

Nevesbu will continue investigating the identified challenges, how we can tackle these, where further improvements can be made and how we can make the communication between disciplines even more efficient.

Continuous optimisation

After years of knowledge development and research, the moment finally arrives that the methodology is mature enough. Everything has been thought out and calculated in detail and the required software has been purchased. But does it work in practice as intended? Lennart: "We have conducted various benchmark studies to test the hydrodynamic calculations, and to refine these where necessary. For one of the benchmarks, we have used the available data from a FPSO project. We compared our results with those of the classification society and the outcome was good. The results matched." Ana Maria: "Our method works! Nevertheless, both research and further development remain an ongoing process. Developments are still in full swing and we strive to deliver the best quality possible."

Nevesbu will continue investigating the identified challenges, how we can tackle these, where further improvements can be made and how we can make the communication between disciplines even more efficient. For this, we are currently benchmarking hydro-structural results with a Dutch offshore contractor. ●



**“OUR METHOD
WORKS!”**



Engineers with Passion for Technology

Iv-Groep is a globally operating multidisciplinary engineering company. Since 1949, Iv has been devising technical solutions for projects of any size and complexity within the following sectors: Building & Installations, Industry, Infrastructure & Traffic, Handling, Maritime, Offshore & Energy and Water. No challenge is too complicated for us. We are a team of specialists with a genuine passion for our specialisms, and if necessary, we'll jump straight in the car to help our client on location.

