Delft Outlook
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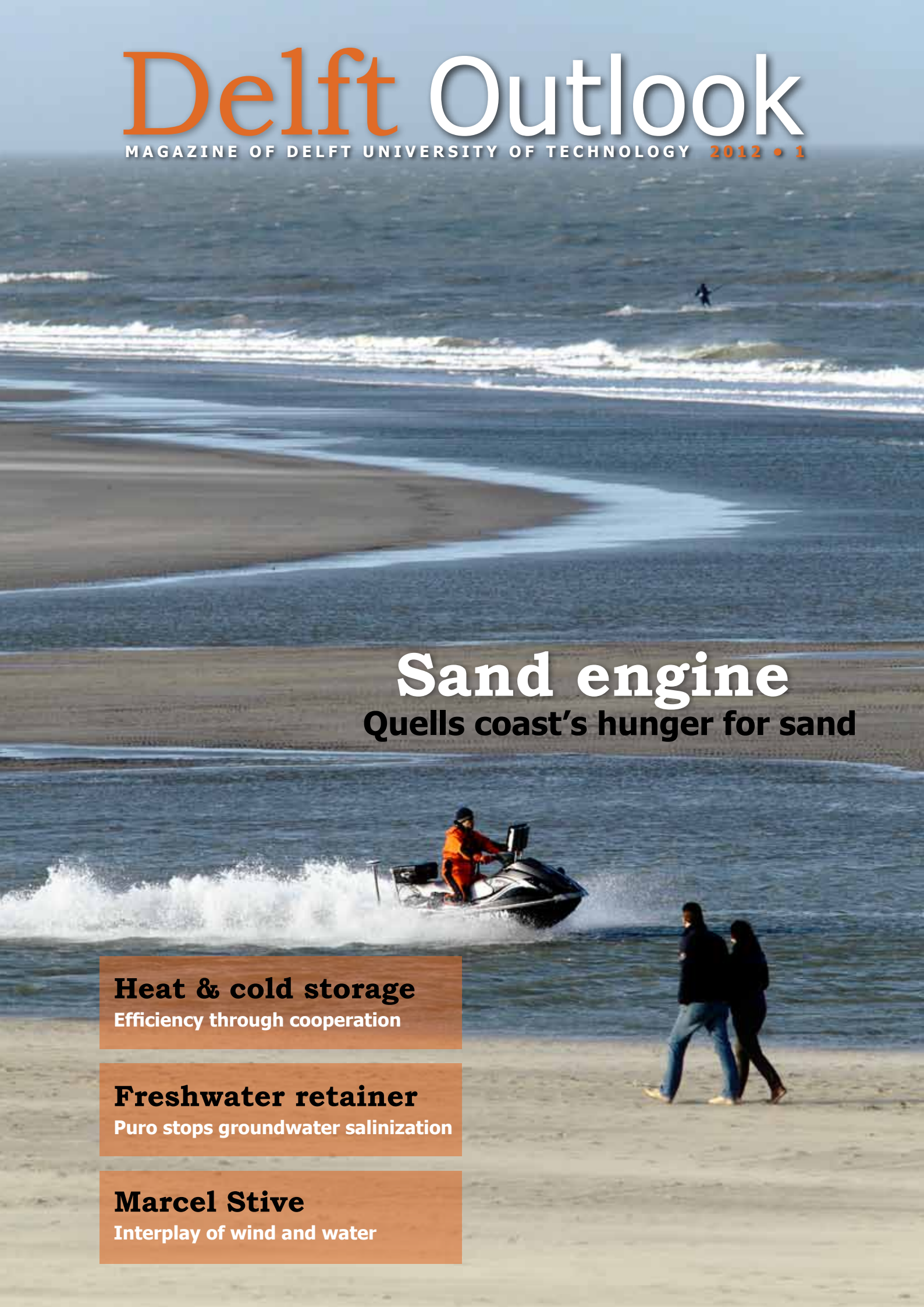
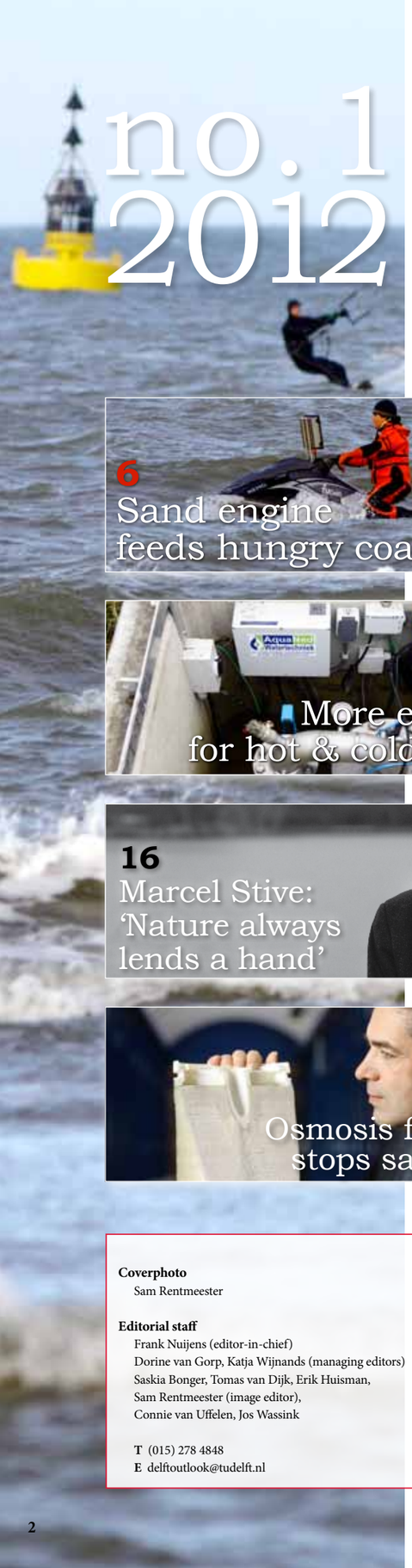


Sand engine
Quells coast's hunger for sand

Heat & cold storage
Efficiency through cooperation

Freshwater retainer
Puro stops groundwater salinization

Marcel Stive
Interplay of wind and water



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Water

During his *Dies Natalis* address, rector magnificus Karel Luyben spoke of the 'harsh anti-academic wind' blowing in the Netherlands. He aims to use this 'spell of heavy weather' to highlight the scientific contribution we make to society and to bring it to everyone's attention. (www.delta.tudelft.nl/24398). As TU Delft celebrates its 170th anniversary, it will come as no surprise to you that the theme is 'water'. So, in this edition of *Delft Outlook*, we take a look at the sand engine at Ter Heijde and the brains behind it, Marcel Stive; energy-efficient water desalination; improving the performance of thermal energy storage systems; a rescue boat with an axe bow, and Deltasync's mission to create the world's first self-sufficient floating city. We talk to the manager of the storm surge defences, Derckjan Smaling, and hear about Tonie Mudde's fear of water, as well as Han Vrijling's vision for water in 2030. Another rich selection of scientific achievements of TU Delft, highlighted as ever for you in Delft Outlook. Since this year is bound to come with its fair share of nautical and aquatic references, I hereby wish you favourable winds and hope that technological ingenuity will lead you to safer waters as you navigate the narrow waterways of innovation – with the water rising around us, thanks to or despite the efforts of the government.

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Coverphoto
Sam Rentmeester

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Delft in Brief

Chatting with André

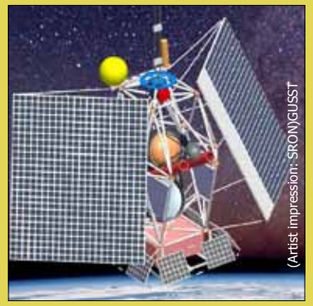
"ISS, this is TU Delft for a voice check. How do you read?" The students in a completely full hall at Aerospace Engineering waited in silence for an answer from the Dutch astronaut, André Kuipers, to the question asked by ESA astronaut Frank De Winne. Kuipers floats in front of the camera and fiddles with his microphone. "Reading you loud and clear. I'm ready", is heard a few seconds later via the live connection. The students cheered loudly.
For 13 minutes, the students were able to chat with Kuipers, who was circling the Earth in the International Space Station at a height of 400 km. Prime Minister Mark Rutte and astronaut Frank De Winne presented the show. "When did you celebrate New Year?" asked one student. The connection is not stable, however. The hall waited tensely and heard: "And then we went on…" static… "and…" beep... long silence... "and then the New Year in Europe" … "and the night owls could wish Houston a happy new year at 6 o'clock."

Photo: Tomas van Dijk

Balloon mission

Together with Sron, researchers from the Kavli Institute for Nanosciences are developing terahertz sensors for Nasa's Gussto (Galactic/Xgalactic Ultra long duration balloon Spectroscopic Stratospheric THz Observatory) mission. The mission – planned for 2017 – involves using a balloon to carry a one-metre diameter telescope to an altitude of 36 km. Gussto is intended to improve understanding of cosmic dust and the creation of stars and planets. Prof. Teun Klapwijk's research group at TU Delft has previously worked on the terahertz sensors used in the Herschel satellite and the Alma telescope in Chile.

More information:
www.delta.tudelft.nl/24107


(Artist impression: SRON/GUSST

My first edu-game

It was the first time that Electrical Engineering students developed computer games for external parties, but as far as Dr Rafael Bidarra (EEMC) is concerned, it is a "magic formula" for the 'Building Serious Games' project, in which teams of six students are given six weeks to develop a game. At the presentation last November: 'My Eco-House' about energy saving measures, 'Teeth Defender' to distract nervous patients in the dentist's chair, and 'Clash of the Penguins' about Newton's laws of mechanics in a friction-free environment. Yoohoo…


Photo: EWI

Universal DNA architecture

Humans and mice are separated by no less than 75 million years of evolution, but it seems that we closely resemble the small animal in the way our chromosomes are ordered. Dr Wouter Meuleman reaches this conclusion in his PhD thesis Computation Biology in Clinical Proteomics and Chromatin Genomics (EEMC). Meuleman built on the cell biology theory that DNA on the edge of the cell nucleus is less active than DNA at the centre of the nucleus. Meuleman, who looked at both human and mouse cells, found that almost all the types of cells he investigated were organised in a largely similar way. He attributes this to a kind of 'basic chromosome architecture' in the animal kingdom.

More information: www.delta.tudelft.nl/24389

Catching bullets


Photo: Tomas van Dijk

It is possible to make bullet-proof vests that are significantly lighter thanks to new insights into the behaviour of bullet-proof materials upon impact. Dr. Béate Heru Utomo, who obtained a PhD at 3mE, reached this conclusion in her thesis High-speed Impact Modelling and Testing of Dyneema Composite. Dr Heru Utomo fired small bullets at the Dyneema fibres used in a bullet-proof vest and used a high-speed camera to record how the fibres reacted. One of her conclusions is that the fibres are able to move more freely than had been previously assumed and, as it were, slide past each other when the vest is penetrated by a bullet.

Best TU Delft invention

A technique to make radioactive 99molybdenum from non-radioactive 98molybdenum has been named the "best TU Delft invention in 2011". Researchers Prof. Bert Wolterbeek and Dr. Peter Bode (Applied Sciences) were awarded 20,000 euros to bring their idea to market. 99Mo is an important chemical for conducting medical diagnoses. It is usually made through the fission of highly-enriched uranium and is produced at only five locations in the world. This new production method will ensure that much more 99Mo is available for hospitals in the future.

More information: Prof. Bert Wolterbeek, h.t.wolterbeek@tudelft.nl


Photo: Tomas van Dijk

Into space

The countdown has started for the launching of the next TU Delft nanosatellite, Delfi-n3Xt. In September this year, a Russian Dnepr rocket will carry the successor to the successful Delfi-C3 satellite to an orbit around the Earth along with a few dozen other miniature satellites. The most important purpose of the mission is to give students the opportunity to work on a space mission. The progress of the project can be followed on the website. Last December, the (dual) on-board computers were presented there.

More information: www.delfispace.nl

Bacteria to produce plastic

Only a few bacteria survive in the cold conditions in Leonie Marang's reactors. By growing bacteria in varying conditions, from an excess of nutrients to a lack of nutrients, the PhD student at the Environmental Biotechnology research group (Applied Sciences) has bred very useful bacteria. Marang's micro-organisms efficiently convert many substances that occur in waste streams, such as acetate and lactate, into polyhydroxybutyrate, also known as bioplastic. The young researcher's work was rewarded with the Unilever Research Prize last autumn.

More information: www.delta.tudelft.nl/ 24154


Photo: Tomas van Dijk

Sparking superatoms


Photo: Tomas van Dijk

At the end of the 1980s, Prof. Andreas Schmidt-Ott (Delft Chemtech) invented the method. Today, almost a quarter century later, he has been given a large amount of money by the EU to further develop his 'spark generator' – a device that can produce nanoparticles of the same size very precisely. The research consortium of about 20 European research centres and companies that Prof. Schmidt-Ott works with received 8 million euros in January.
There are two electrodes in the device. When a spark jumps between them – due to the high voltage – a small vapour cloud of electrode material is formed. As this cloud cools off, the atoms cluster together to form nanoparticles. Prof. Schmidt-Ott wants to try and increase the frequency of the sparks. The objective is to create stable inorganic clusters of atoms, so-called superatoms, which behave in the same way as individual atoms because their electrons occupy orbitals around the entire cluster of atoms.

More information: prof.dr. Andreas Schmidt-Ott, a.schmidt-ott@tudelft.nl www.delta.tudelft.nl/24443


Photo: Tomas van Dijk

Calculating battery life

Worries about remaining range are not only a problem in electric vehicles; it's also difficult to estimate the remaining life of Li-ion battery cells in electrical racing cars. Long Lam has devised a solution. For his graduation project, Dr Pavol Bauer of the Electrical Power Conversion section (EEMC) developed a mathematical model allowing remaining battery life to be calculated. Many parameters can be entered into the model, including age, number of kilometres and number of charging and discharging cycles. On National Sustainability Day, the young engineer received a 10,000 euro E-mobility thesis prize from Urgenda, an organisation that stimulates sustainable development.

TU Delft's anniversary

This year, TU Delft is celebrating its 170th anniversary. In a speech at the Dies Natalis, Rector Magnificus, Karel Luyben, expressed his concern about the "strong anti-academic winds" blowing in the Netherlands. The rector wishes to create greater awareness of the "contribution science makes to society". According to Luyben, the general public is too quick to forget that the high level of prosperity in the Netherlands is also due to the creative efforts of our scientists. "Over the past 170 years, TU Delft has always been at the forefront when it comes to the development of knowledge, leading to safety and prosperity." Luyben defended fundamental research: "It is the task of science to look beyond the short term."

More information: www.delta.tudelft.nl/24398


Photo: Sam Rentmeester

Second life


Photo: Kennis in beeld

The Reactor Institute Delft is to receive 38 million euros from the Ministry of Education, Culture and Science to modernise its research reactor. The reactor is to be fitted with a Cold Neutron Source which will enable the RID researchers to examine materials even more closely. In the new Cold Source the neutrons are cooled using liquid hydrogen. "What we will actually be doing is slowing down the neutrons," explains RID director, Professor Tim van der Hagen. "This will enable us to manipulate them better, to bundle them and to get them to go round corners. It will make our instruments a hundred times better, and we will be able to develop new instruments for research into cancer and materials for sustainable energy technology among other things."

More information: www.delta.tudelft.nl/24478

Clean flying

When PhD student Tim Snijders circled TU Delft and the National Aerospace Laboratory in a test plane, he left the air almost completely clean. Snijders was flying on a fuel mixture of 95 % synthetic kerosene made from natural gas and 5% normal kerosene. Synthetic kerosene is very clean. It is actually so clean that the aviation industry believed it could not be used for flying. This is because some impurities, such as sulphates and aromatic compounds, help to lubricate engines. For this reason, aviation fuel must contain at least 50% standard (unclean) kerosene. In his research, however, Snijders showed that 5% is enough and it is thus possible to fly much more cleanly.

More information: Tim Snijders: t.a.snijders@tudelft.nl


Photo: TU Delft

The human measure

Together with their cultural professor, photographer Vincent Mentzel, 25 TU Delft students tried to discover what the human measure is. They travelled to Paris with their cameras to observe Parisians and each other. "Each student interpreted the human measure in a different way," says Mentzel. For example, Bart Ruigrok (19, first-year Aerospace Engineering) wanted his photographs to highlight how people relate to their surroundings. In his photograph, the people on the large concrete-paved plaza in La Défense look like miniature figurines. "One realizes how small human beings are." Mentzel had not taught before and was quite excited. "It was nice to see how open they were to each other's ideas. I found that quite inspiring."

More information: www.delta.tudelft.nl/24195


Photo: Bart Ruigrok

The sand engine let nature do its work.

Sand engine

quells the coast's hunger for sand

An artificial peninsula at Ter Heijde is designed to feed the coast with sediment. Scientists are investigating whether this kind of sand engine could be the Netherlands' answer to rising sea levels.

Tomas van Dijk

At the foot of the dunes in the coastal resort of Ter Heijde, Matthieu de Schipper and Sierd de Vries carefully cross the sand in their four-wheel drive vehicle. The dunes here have recently been reinforced. Neat lines of beach grass protrude from the sand at intervals of some 30 cm.

"Pretty different to what you get with the sand engine," says De Schipper. Through the other window he points to where we are heading: a massive hook-shaped expanse of sand extending 1 km out to sea. "The waves, sea current and wind are creating all kinds of gullies and bays around the sand engine. It's wonderful to let nature do her work."

"Building with nature" has now become the watchword for hydraulic engineering. It's also the theme of the PhD research that De Schipper and his colleague, De Vries, are working on. The two researchers from the faculty of Civil Engineering and Geosciences (CEG) are regular visitors to this peninsula. "We come to count the grains of sand," De Schipper jokes.

This sand engine provides the hydraulic engineers with a superb testing ground. Last year, dredging companies Van Oord and Boskalis used trailer suction hopper dredgers to deposit 21.5 million cubic metres of sand here. In the coming years, the sand will be carried by currents and waves in a primarily northerly direction, compensating for the loss of sand along the coast up to Scheveningen. Some of the sand will be blown into the dunes, reinforcing the coastline. Using GPS equipment on board the vehicle, the researchers measure the sand engine's movements on a monthly basis. A staff member from the Delft spin-off company Shore Monitoring also uses a jet ski equipped with sonar technology to investigate the soil morphology up to the edge of the coastline. The researchers share their findings with Deltares and Imares Wageningen UR. These two research institutes have been commissioned by the Directorate-General for Public Works and Water Management (Rijkswaterstaat or RWS) to closely monitor the sand engine and the currents and ecology around it over the next ten years.

'There are already clear signs of changes'

The peninsula will gradually disappear. Just a few months after its completion, there are already signs of changes. Sand deposits have increased the size of the bay, a kind of lagoon on the inside of the hook. Already an ideal site for kite surfing, it will eventually form a suitable habitat for rare plants, such as salicornia and searocket. The sand engine will gradually transform into something completely different - most likely a system of sandbanks.

Experiment

"It's part of a major experiment that RWS is conducting into alternative methods of sand replenishment," says De Vries. Since 1990, RWS has been commissioning the annual replenishment of 12 million cubic metres of sand along the whole of the Dutch coast, alongside the beach, on the beach itself or in the dunes. The aim is to counteract coastal erosion – or to quell the coast's hunger for sand, in a manner of speaking. Before the project started, the Netherlands had been gradually eroding for centuries, a result of rising sea levels and soil subsidence.

"The problem is that these sand replenishments from deeper parts of the North Sea are expensive and disrupt the marine ecology," continues De Vries. "We're using the sand engine to see if it's possible to use a single large-scale replenishment in one location in order to protect an entire section of the coastline over a much longer period."

A preliminary study conducted by Deltares suggests that the sand engine will have been completely reabsorbed into its surroundings in about 20 years' time. At a cost of € 50 million, the sand engine works out to be much cheaper than the series of smaller replenishments that would have been necessary over that same period.

According to hydraulic engineer, Professor Marcel Stive (CEG), who played a major role in the realisation of the sand engine, the project offers valuable prospects for research. He believes there will need to be a significant increase in sand replenishment in the coming years, making it extremely important to gain experience of new, larger-scale techniques.

The Delta Commission 2008, of which Prof. Stive was a member, recommended that the annual volume of sand replenishment be increased to 20 million cubic metres in order to stifle the Dutch coast's hunger for sand. A proactive approach, enabling the coast to grow in the next century, might even require 85 million cubic metres of sand.
There may even soon be a series of sand engines along the coast. In an interview in this edition of Delft Outlook ('Nature always lends a hand', page 16) Prof. Stive explores that possibility.

Fine sand

Deltares and Imares have their work cut out for the next few years. In three years' time, the institutes must publish an interim report. "Before then, we'll be conducting a huge number of measurements," says Arjen Luijendijk of Deltares.
The predictions included in the environmental impact report (EIR) involve a number of uncertain factors.
"The EIR was based on a theoretical situation in which the sand has a uniform grain size," says Luijendijk. "In reality, these sizes vary. The effect of these variations has yet to be seen."
The fact that the sand engine also contains fine sand could explain why it seems to be working more quickly than expected.
At the northern tip of the sand engine, new sandbars have formed very rapidly, suspended like drips from a nose. Every minor storm has led to the formation of a new 'drip'. Luijendijk believes that the explanation for this is that, during the initial phase, all the fine sand is in motion.
Another major uncertainty affecting the models is the effect of dune formation on the sand engine. "The vegetation could prevent the sand from moving about, leaving the sand engine in place for longer than planned," says Luijendijk.
Could severe storms perhaps also have a major impact on the sand engine?
The recently graduated hydraulic engineer, Timon Pekkeriet, is using models to predict the effect of the kinds of storms that only occur once every 20, 100 or even 1000 years.
There is little likelihood of a storm of the latter type hitting the sand engine in the next 20 years, but even if it does happen, the expected consequences would appear to be slight. "The combined effect of small storms is much more important than that of a single heavy storm," says Pekkeriet, who completed his research at Deltares.
So this leaves the effect of all the small storms combined. "In one year, you may have ten storms and in another as many as 50," says Pekkeriet. "This will certainly affect the way in which the sand engine works and the models should take greater account of these fluctuations."
However, Luijendijk has few concerns about this. "If you look at things over the longer term, the effects of all the storms average out," he says.


Photo: Sam Rentmeester

Matthieu de Schipper: "The waves, sea current and wind create all kinds of bays."


Photo: Sam Rentmeester

Sierd de Vries: "Sand replenishments from deeper parts disrupt the marine ecology."


Photo: Sam Rentmeester

The sand engine will have been completely reabsorbed into its surroundings in about 20 years' time.

Not ideal

Of course, the researchers will also need to monitor how much sand is actually distributed along the coast. They calculate that around 10 to 20 percent will flow away to greater depths.
This is why the renowned hydraulic engineer, Dr Ronald Waterman, a former Liberal member of the Provincial Council of Zuid-Holland and a TU Delft alumnus, has his doubts about the use of sand engines.
Waterman would prefer to recreate a 17th-century coastline ("by way of approximation"). For Zuid-Holland, this would be a hollow curved coastline running from the northern breakwater of Hook of Holland to the extended southern breakwater of Scheveningen.
"In terms of land reclamation in Zuid-Holland, we aim to achieve a flexible, dynamic, hollow coastline that is in balance," says Waterman. "In the long run, sand engines will achieve that, but it's not what they're designed for. They do not have the ideal shape for that purpose."
Together with Czech engineer Honzo Svašek, Waterman pioneered the principle of 'Building with Nature'. The fact that he has such doubts about the use of sand engines may therefore come as a surprise.


Photo's: Rijkswaterstaat/Joop van Houdt

The sand engine after construction on August 9, 2011 (left) and the condition on January 10, 2012.

Indeed, in a report dating from 1980, he already mentioned the need to extend the coastal strip. In his plans, dams and dikes largely make way for beaches and dunes.
Waterman has had a hand in a whole series of coastal extensions between the Slufterdam and Maasvlakte 2 in the south and Seaport Marina IJmuiden in the north. A family of coastal extensions that have all resulted in a boost for nature, according to Waterman.
Waterman does admit that the sand engine is an "interesting member of the family. It's interesting, because as well as increasing safety and boosting nature and recreation, it also offers numerous possibilities for research. And it could be put in place relatively cheaply because the trailer suction hopper dredgers were already in the area, working on Maasvlakte 2. It's for those reasons that I gave it my support. But in certain cases, I'd prefer to deposit the sand directly where it's needed, for example if port extensions are required."
In Waterman's view, if 85 million cubic metres of sand need to be replenished every year, this does not necessarily call for a whole series of sand engines along the coastline.
Ecologist Dr Martin Baptist, from Imares, does believe this would be a good idea. If the volume of sand replenishment required in the future increases significantly, sand engines will need to be used, or else it will prove disastrous for marine life, he argues.

Marine animals

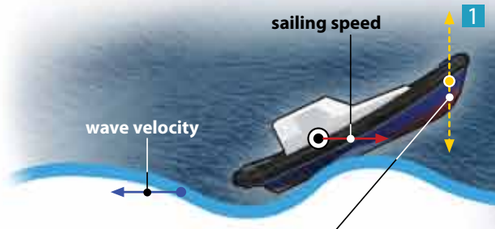
"Although a sand engine has a major effect locally, the advantage is that it leaves the natural world in the wider environment undisturbed for 20 years," Baptist says. "If, on the other hand, you regularly replenish sand at numerous points along the coast, marine life doesn't have time to recover. It takes between four to six years for the soil community to recover in places where sand is disrupted.
"Another disadvantage of sand replenishment done in the traditional way is that it makes the coast steeper. This reduces the habitat for marine life in shallow waters."
Baptist is leading Imares's research into the marine ecology around the sand engine. At late 2011 his institute took more than 200 samples of sand from around the peninsula. The marine life taken from these samples (including countless worms, shellfish and crustaceans) is being preserved and will be counted over the course of this year. This process will then be repeated annually.
The key question is whether the animals can cope with the flow of sand originating from the sand engine. "As long as they're not covered by too much sand, they can still crawl up to the surface," Baptist explains. "If the sand moves as the models predict, it shouldn't be a problem."
There is another reason for Baptist's enthusiasm for sand engines: "Possibly these will serve as nurseries for flatfish. The lagoons are particularly interesting in this respect. We're researching the ideal conditions for flatfish fry, such as the sediment content, depth and grain size of the sand, and how we can shape the sand engines to create these conditions."

'We're using the sand engine to see if it's possible to use a single large-scale replenishment to protect a section of the coast over a much longer period'

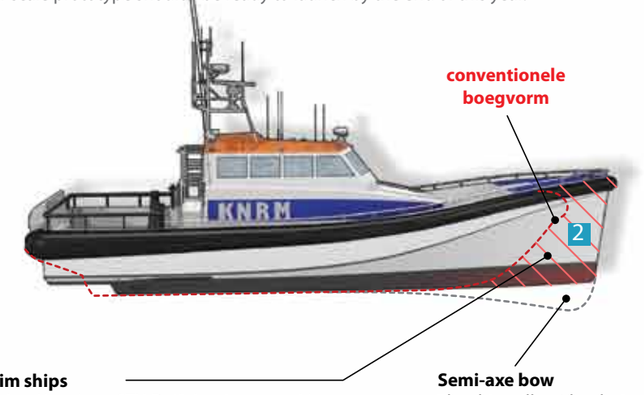
On the sand engine, the small expedition from TU Delft is now being subjected to a thorough sandblasting. Barely audible in the howling wind, De Vries draws the others' attention to a boat full of ecologists about 100 metres out from the beach. "We're working on this project with a lot of different disciplines," says De Vries. "That's the great thing about it."

Sailing comfort through axe bow

Every year, the Royal Netherlands Sea Rescue Institution (KNRM) heads out to sea 2000 times to rescue people. In conditions with high waves, the lifeboats hit the water so hard that the crew have difficulty keeping upright in the pilot house. Sailing slowly is therefore the only option. But the boats also make so much noise that the crew have to wear hearing protection gear and can only communicate with each other by means of headphones. Together with TU Delft, Damen Shipyards and De Vries Lentsch, the KNRM has developed a new lifeboat which should put an end to these disadvantages. The new design is based on the axe-shaped bow concept created by the Ship Hydromechanics section of the department of Marine and Transport Technology of the 3mE Faculty. A full-scale prototype should be ready to launch by the end of this year.

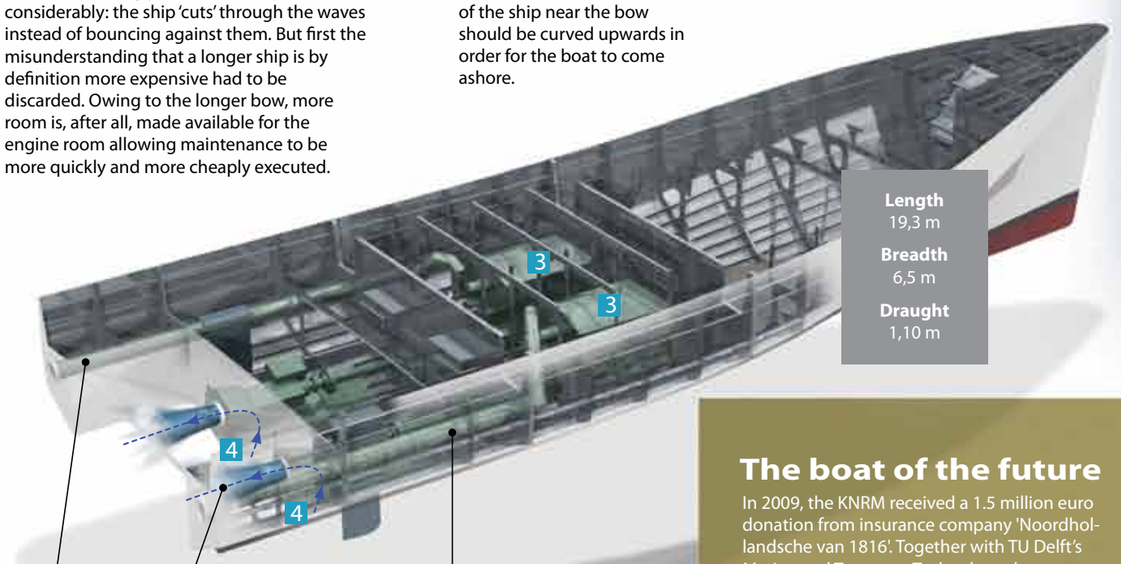


Extremely high speeds
It is predominantly under rough weather conditions that the KNRM lifeboats are launched. If a boat sails straight or at a slant through high waves (five metres high), the broad round bow crashes heavily against the water. The crew reduce sailing speed if waves are higher than two metres as the accelerations in the bow 1 and the pilot house become too high. At extreme wave heights of nine metres, the accelerations in the bow can increase to 8 g. At the time the KNRM's largest existing lifeboats ('Arie Visser' type) were built, the emphasis was on high sailing speeds, good manoeuvrability and shallow draught – the crew's comfort took less priority in 1999. Although occupational health and safety demands do not apply to the more than 800 volunteer crew members, the KNRM wants to replace the 15 existing 'Arie Visser' boats in the coming 10 years by a new type of ship where comfort on board meets the minimum demands that can be expected in this day and age.



Slim ships
Dr Lex Keuning of TU Delft has been working for 15 years on the 'Enlarged Ship' concept. While retaining the same width and making these ships slimmer (for example 25% longer 2 as well as shaping the bow in the form of an axe, the sailing performance improves considerably: the ship 'cuts' through the waves instead of bouncing against them. But first the misunderstanding that a longer ship is by definition more expensive had to be discarded. Owing to the longer bow, more room is, after all, made available for the engine room allowing maintenance to be more quickly and more cheaply executed.

Semi-axe bow
The ship will not be designed with a complete axe bow in which the axe also fans out in a downward direction. As lifeboats often operate in shallow waters, the bottom of the ship near the bow should be curved upwards in order for the boat to come ashore.



Length
19,3 m
Breadth
6,5 m
Draught
1,10 m

Powering
The ships are powered by means of two engines 3 and two water jets. Via an inlet nozzle 4 in the flat bottom, water is sucked in through each pump. The pressure of the water is increased and is then forced out at great speed through the jet pipe.

The boat of the future

In 2009, the KNRM received a 1.5 million euro donation from insurance company 'Noordhollandsche van 1816'. Together with TU Delft's Marine and Transport Technology department, Damen Shipyards and De Vries Lentsch Yachts, the KNRM initiated a project to design an improved lifeboat. This new boat should experience less vertical acceleration at high sailing speeds and less vibrations and noise (a maximum of 75 compared to the current 90 decibels).

DESIGN REQUIREMENT: BETTER SEAFARING PERFORMANCE IN WAVES AT HIGH SPEED

Sleeptanktests tegen de golven in

Scale models of the 'Arie Visser' and of the two new designs (scale of 1:10) were towed at high speeds against the waves in the towing tank in Delft. The experiments confirm the results of computer simulations: less vertical movements arise in the axe bow and less high vertical accelerations in the bow and pilot house occur than is the case in the other two ships.

DESIGN REQUIREMENT: COMPARABLE PERFORMANCE WHERE BOWDIVING IS CONCERNED

Self-sailing models in successive waves

Captains of the current lifeboats were concerned that the axe bow would plough more quickly into the preceding wave than the wide round bow of the 'Arie Visser'. Experiments at Marin showed that none of the ships exhibited any tendency to bow-dive.

Two parallel designs
The design team got started with two designs: an improvement of the existing lifeboats with a slim bow and a new design based on the axe bow. Due to the test results, it was decided to go ahead with the further development of the axe bow concept.

Tilting container 5
With the aid of a tilting container, persons in danger of drowning are taken on board. The boot has room for 120 saved persons.

Composite pilot house
By constructing the pilot house entirely from fibreglass hardened plastic (instead of aluminium), the design weight is reduced by 20%. The pilot house will be placed on dampers that should prevent it operating as a sound box and strengthening vibrations from the engine room.

Axe bow fund
Damen Shipyards has a licence to sell the axe bow. For each axe box sold, the company from Gorinchem will donate money to a Delft research fund with which the Marine and Transport Technology department can carry out follow-up research and can finance new PhD candidates.

Weight
35 tons
Maximum speed
35 knots
Crew
6 persons

DESIGN REQUIREMENT: BETTER COURSE STABILITY AND BETTER MANOEVRABILITY

Extendable fins

To eliminate the problem of the boat running off course in backward moving waves, it is equipped with special fins. But as the ship has to be extremely manoeuvrable at other times, the fins can be pulled in to carry out a manoeuvre.

Prototype
Calls for tender will take place later this year and the new lifeboat will be launched at the end of 2012. The captains of the current 'Arie Visser' boats can then experience in practice whether the new ship lives up to all its promises.

Monster waves

The extreme conditions in which ships have to operate cannot normally be reproduced with model tests: the maximum full-scale wave height reproduction is 4 m. By generating waves in the towing tank in a smart way, it nevertheless appears possible to test the model with monster waves 6 of 8 m high.

illustration & text : Eric Verdult, www.kennisinbeeld.nl © 2012

Thousands fighting over groundwater

Heat and cold storage systems are among the most popular ways to save energy, but they are not yet delivering the returns they promise. According to researchers from the faculty of Civil Engineering and Geosciences, it is time for this to change.

Desiree Hoving

Well near the YesDelft building in Delft.

Red and blue spots grow rhythmically larger and smaller on Martin Bloemendal's laptop screen. He is a PhD student in the area of geothermal energy, under the supervision of Theo Olsthoorn, professor of hydrogeology in the faculty of Civil Engineering and Geosciences. Together, they are looking at an underground map of Utrecht's inner-city area. Ninety sources of hot and cold water are located here, in the area of the train station, the Hoog Catharijne shopping mall and Jaarbeurs Utrecht. This is one of the highest densities in the Netherlands.

Photo's: Sam Rentmeester

Martin Bloemendal (left) and Theo Olsthoorn plead in favor of a more dynamic design of heat and cold storage systems.

"All of these underground sources are pumping water into and out of buildings in order to heat or cool them," explains Bloemendal, with regard to the growing and shrinking of the spots. "As you can see, each source grows larger over the years, and the red colour – representing the hot water –becomes dominant. Once that happens, that source can no longer be used for cooling. This is likely to happen within the next 75 years if we fail to take each other's energy usage into account. We are currently not doing this."

As for the cause of this problem, Bloemendal and Prof. Olsthoorn point to the design of heat and cold storage (HCS) systems that have been increasingly constructed under large buildings since 1985. "Each of the current HCS systems is designed based on static conditions," the professor states. "As soon as people open a window in the summer, it starts to go wrong. Then more hot air enters the building, making the HCS system cool more than had originally been planned. As more cold water is pumped upward, more and more water is returning to the hot-water source after cooling, causing it to expand so far that it pollutes the cold-water source. This messes up the sources for the rest of the time."

Sand layer

The HCS systems utilise groundwater stored in a layer of sand under the ground. The fundamental idea is that there are always two sources: one source contains water that is 5 °C colder than the groundwater (between 11 and 12 °C), and the other source contains water that is 5 °C warmer. Storage is a relative term, however, as groundwater flows continuously through the sand layer as well. But it does not flow very quickly: in Utrecht's inner city, this occurs at a speed of about ten metres per year. By way of comparison, an above-ground river moves at a speed of one metre per second.

Since groundwater flows, the various sources can influence each other. This applies not only to two sources of the same system, but also to two HCS systems in close proximity to each other, as is the case in large inner-city areas.

The TU Delft scientists are convinced that this should change, given the great significance that companies currently attach to energy saving. They simply can no longer put up a new office building without utilising sustainable energy. For this reason, the building code (a set of requirements that any new building must meet) contains increasingly stringent requirements in terms of energy saving.

The most important reason why companies opt to use HCS systems is that they offer the most attractive way to save energy. The system pays for itself within five or six years, whereas solar panels and wind energy require 20 to 30 years.

The number of HCS systems will thus continue to increase in the coming years. Nearly 2,000 systems currently exist, but the government is calling for around 20,000 systems by 2020.

Efficiency

"No one knows what would happen if we all were to start rooting around in the soil," says Prof. Olsthoorn. He mentions another problem as well: HCS systems promise energy savings of 50%, with most of the gains involved in the cooling process. This is because the stored cold water (6-7 °C) can be used immediately for cooling, while the warm water (16-17 °C) must still be heated with a heat pump to approximately 45 °C. The promised return of 50% is thus rarely achieved.

During his doctoral studies, Bloemendal would like to investigate how to improve the efficiency of HCS systems and subsequently call for a more dynamic design for these systems. Only then can they be constantly adjusted to the actual demand for cooling and heating within a building and its surrounding buildings. This would prevent the system from being thermally polluted 100 years from now.

His PhD supervisor, Prof. Olsthoorn, adds: "We think that HCS systems should learn to act cooperatively, like an orchestra, because you will be a nuisance to your neighbours if they are unable take you into consideration.

'As soon as people open a window in summer, it starts to go wrong'

We therefore want to find out how to arrive at a system that automatically adjusts to your energy consumption and that of your neighbours."

This seems very simple. "At the very least, each installation should measure how much water it pumps and heats," asserts Bloemendal, "so in theory, it doesn't cost anything." First, however, it's necessary to link the details from all of the HCS systems. "We're working on a type of smart-grid infrastructure that would receive all of the data from all of the pumps. This would make it possible to calculate the groundwater situation at any time and at any location, such that the HCS system can automatically take them into consideration (for example, by cooling more or pumping less). This type of centralised system could yield considerable savings."

This type of system was originally planned for all of the buildings in the Delft Science Park. "Because of the economic crisis, however, land allocations and new construction are proceeding so slowly that each company will have to fall back on its own system instead of working together to design a solution," says Prof. Olsthoorn. "For this reason, the YesDelft and Exact buildings now have their own separate HCS systems. There are thus four sources in the Science Park – two hot and two cold – which do not work together. This is the case, even though having more sources in an area would allow more direction and compensation - for example, by distributing the groundwater across multiple reservoirs."

The professor concludes: "It seems as if thousands of us here in the Netherlands are fighting over groundwater, even though it's no longer possible to monitor it, let alone to gain an overview of it. We are in urgent need of a smart system."

A 600 bar waterjet drills in a pig's bone at 3mE's Biomechanics lab. PhD-student Steven den Dunnen MSc. has worked on bones of goats, sheep, pigs and human to determine the pressure needed for the resulting hole dimensions. Den Dunnen is working on a dynamic control over the powerful waterjet, as it should drill blind holes in knee bones during orthopedic surgery, but not drill through the entire bone. His PhD supervisor, Dr. Gabrielle Tuijthof, who leads the 'Healing Water Project', also supervises medical researcher Aimee Kok MD at the AMC who studies the therapeutic effect of these holes on the recovery of knee cartilage.

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Photo: Sam Rentmeester

‘Nature always lends a hand’

Professor Marcel Stive’s voice is heard and respected in many a delta. As a scientist, consultant and creator of the sand engine, he is putting his stamp on the Dutch coast of the future. Other countries – including Vietnam – are eager to draw on his expertise. “You can’t pull any tricks.”

Joost Panhuijsen

In 2008, you served on the Delta Committee as professor of coastal engineering. Are you satisfied with the way in which the Delta Committee’s recommendations were received?

“A few weeks after the report was published, the Balkenende government had already expressed its support, and the House of Representatives accepted it in 2011. So there were no problems at all in political terms. We can expect heavy discussions in future, however, when push comes to shove and the government must make hundreds of millions available.”

Because of the current cutbacks?

“That certainly doesn’t make the debate any easier. The conclusion is likely to be to go ahead with the plan, but at a slower pace. Our recommendations were actually never meant to be converted directly into concrete policy. ‘Improve the safety of the dike rings by a factor of ten’ - I still think it’s good advice, but something like that is easier said than done. Our report was not a blueprint, but rather a discussion. We wanted to show the topics on which politicians need to take decisions.”

At any rate, the Delta Committee’s report has already led to the appointment of a Delta Commissioner in 2010.

“Wim Kuijken, yes, he’s well suited to take the lead, because he is intimately familiar with the politics in The Hague. In 2014, the Delta Commissioner will issue proposals to the government regarding several issues that the Delta Committee has already highlighted. For example, tightening safety standards: how can you minimize the chances that the Netherlands will be hit by another flood? It’s a complicated subject, and a political hot potato. The more you want to reduce the risk, the more it will cost.

Kuijken is also looking at how, in future, we can continue to provide agriculture and industry with fresh water throughout the year – the concept of providing nearly free water for everyone may cease to be a given.”

Speaking of fresh-water reservoirs: the Delta Committee recommended allowing the IJsselmeer to rise along with the Wadden Sea in the decades to come. It’s a controversial idea, as it would involve increasing the height of the dikes, which would come at the expense of nature and the beautiful views.

“Kuijken would like the politicians to take a decision in principle on this in 2015. The same applies to the idea of making the Rijnmond area an open system that can be closed when needed. This is a possible solution to a pressing problem: should a very violent storm occur in the North Sea at the same time as a large volume of meltwater is flowing through the rivers, cities like Rotterdam would be threatened from two sides. Movable dams would allow us to close open river mouths and estuaries temporarily under such extreme conditions. Civil engineering and architecture have already investigated the possibilities of this type of ‘open/closed’ Rijnmond. If you walk along the Merwede in Dordrecht or the Nieuwe Maas in Rotterdam, you can see how vulnerable it is there. A little extra water can present major problems. We don’t have to build the new dams tomorrow, but it’s a huge project, involving work for the next 50 to 100 years.”

In September 2011, State Secretary Joop Atsma (Infrastructure and the Environment) stated, “Large-scale coastal expansion for 2050 isn’t really necessary”. Is that bad news for coastal protection?

“At the time, the Delta Committee said that if you wanted to do something extra, you could use additional coast expansion to stimulate spatial development. That has nothing to do with safety. Atsma has a point; nevertheless, he’ll probably be opening the second sand engine soon, near the Hondsbossche Dam. So he is working on additional coastal expansion after all. The second sand engine will also contribute to coastal protection, as the Hondsbossche Dam is a weak link in our coastline.”

You are the creator of the original sand engine, the sand island between Ter Heijde and Kijkduin, which is intended to broaden the coastline in a natural way. How does it feel to see your own idea take shape?

“It’s incredible to see how this island attracts people like a magnet. It’s … dynamic, constantly changing. It adds another dimension to the coastal system.”

And wind and water will eventually reduce the island to about a third of its current size?

“No. In theory, it should disappear completely. In 20 or 30 years, it should be completely absorbed into the ecosystem – if we don’t do anything. But … (he laughs) I’ll bet my hat that there will be discussion about that.”

Save the island!

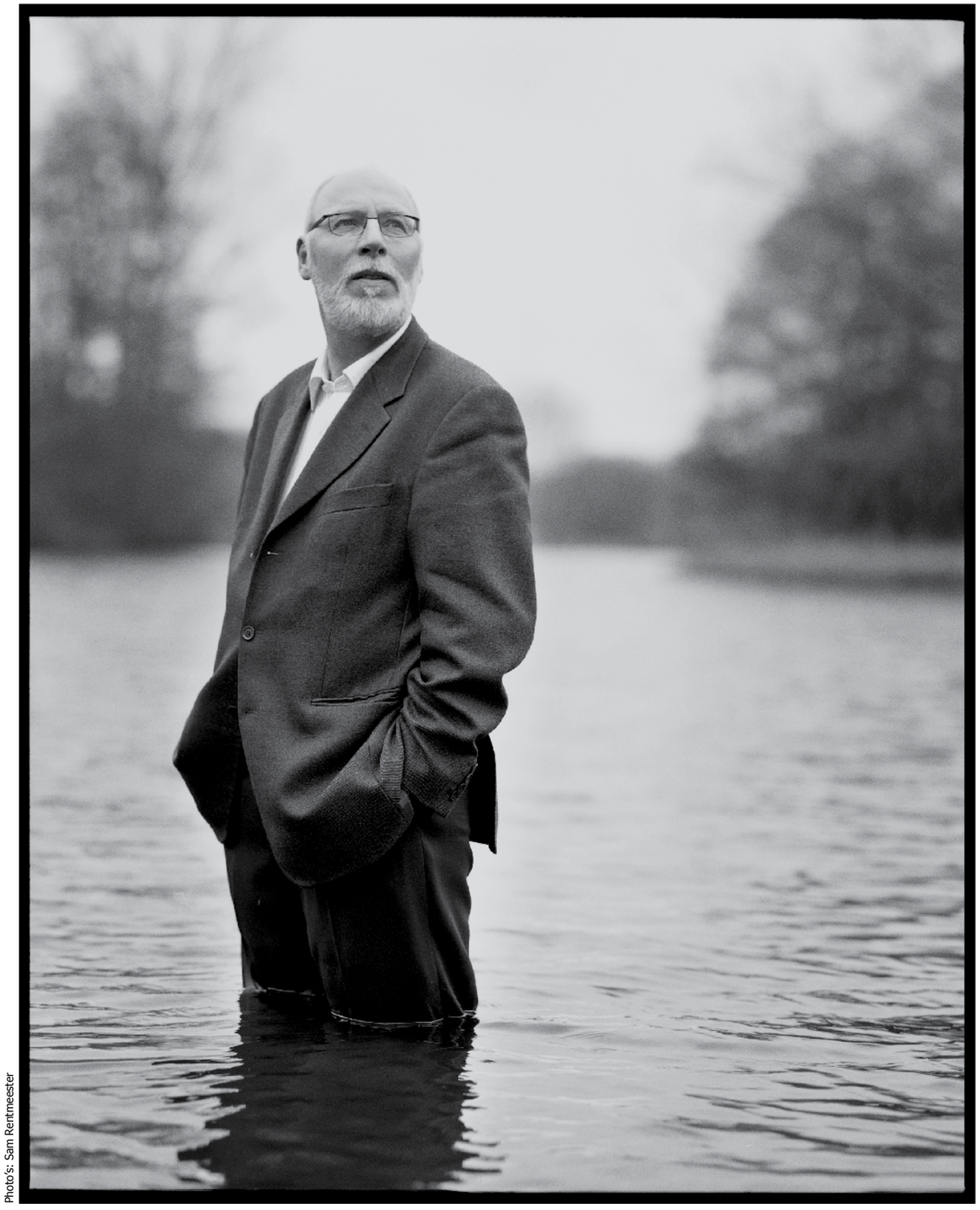
“Exactly.”

And that would be possible?

“It could be.”

Will there be more examples of this kind of ‘building with nature’ in order to expand and protect the coast?

“I think there will be. We’re already carrying out minor explorations, for example in the Oosterschelde. And then there’s the



Photo’s: Sam Rentmeester

‘You can’t pull any tricks’

Marsdiep, where the sediment is reaching a dangerously low volume."

What would happen if the sediment were to disappear?

"Then the whole thing would slip out of control. It would require tremendous effort to hold onto the coastline, as our entire coastal system depends on the Marsdiep. I'm already telling The Hague: 'You should be worrying about this.'"

You'll be using the research grant that you were awarded by the European Research Council (ERC) in 2011 to map the development of coast near The Hague over the next five years.

"In order to maintain the coastal system as well as possible, you have to intervene from time to time. It's important to know whether these interventions occur economically and ecologically. You can watch how the coast is developing, and adjust your approach, if necessary. It's a sort of feedback."

In June 2012, a conference will be held at TU Delft on the topic of 'Water and the City', with a special focus on Asia. Are the problems of mega-cities in Asian deltas so huge that they've not yet reached the point at which they can start determining 'acceptable risk'?

'No, they haven't got that far yet, but they will. They are catching up. You can see it everywhere. Jakarta is considering the possibility of constructing a polder. Ho Chi Minh City is exploring how to protect the city from flooding without stifling nature. And in Shanghai, they've been working for some time on a stunning multi-functional barrier for the Huangpu River that runs through the inner city."

Is TU Delft playing a role in the design and construction of the barrier?

"Not at all. We get to come and watch! The Chinese have built a four-layer multifunctional barrier, in three years! It would have taken us 15 years."

Would you say that the greatest challenges for coastal engineering today are in Asia?

"Absolutely. Vietnam is inundated by consultants. What's more, Prime Minister Rutte has established a new Delta Committee, at the request of his Vietnamese colleague, Nguyen Tang Dong. Cees Veerman is the chair once again and Louise Fresco is also serving on it, with Paval Kabat, myself … and several new members, including scientist and water board council chairman, Stefan Kuks, and my colleague, Professor Han Vrijling. We're returning to Vietnam in March 2012. We're trying to support the Vietnamese in creating a plan for the Greater Mekong Delta, which is close to Ho Chi Minh City (formerly Saigon). At spring tide, the water flows upstream from the East China Sea, causing flooding in Ho Chi Minh City every 14 days."

Since time immemorial?

"No, only in recent years, because Ho Chi Minh City is sinking a few centimetres each year. Just like Jakarta. In Vietnam, we're cooperating with a Deputy Minister. His original plan was to build a 32km-wide enclosure dam to prevent further flooding in Ho Chi Minh City. It's basically a clever idea, but we pointed out one major drawback: the dike would be located right in front of a large mangrove forest, which also acts as a spawning ground for fish and as a buffer for tsunamis. The dike would cut off this nature reserve from the sea and the tides, and this would have many consequences. We devised a variant that would leave the wetland untouched. The Deputy Minister has now accepted this idea."

How did you convince him?

"You can't play any tricks – you can't have a hidden agenda. You also need to understand how the Vietnamese look at the issue. Dutch people tend to think, 'We'll just go there and tell them how it ought to be done'. That's not how it works. We still have to convince the Deputy Minister that he shouldn't be too quick to push the revised plan through the system (he'll be retiring soon, and he's in a hurry) and that he should consider the big picture first: the plan for the entire Mekong Delta. Cees Veerman loves this diplomatic game. He has a good feel for the nuances."

Why are cities like Ho Chi Minh City and Jakarta sinking at such an alarming pace? As you have already established, it's occurring much more rapidly than the rise in sea level.

"Using groundwater - for industrial and domestic use, and sometimes for agriculture - is usually the main reason. That's hardly surprising: Jakarta is a city of nearly nine million inhabitants, and industrial development is proceeding at an incredible pace. Settling due to drainage also plays a role."

In a word, progress. What can you do about it?

"You could try to wean the area off the use of groundwater. They have plenty of water there, thanks to the Mekong. There are major problems, but there are also practical, affordable solutions."

Are you optimistic?

"Yes, because nature always lends a hand. At some point, the problem will become so urgent that people will understand that something must be done. You just hope that no disasters occur before we get to that point."

Who is Marcel Stive

What impact will the rising sea level have on the coastline in the coming years? The honorary degree that the University of Lund, Sweden, awarded to Dr Marcel Stive, professor of coastal engineering, in 2011 clearly highlighted the importance of his work in the search for an accurate answer to this question. Prof. Stive (born Amsterdam, 1951) has shown how observations and calculations can be used to predict how a piece of coastline will develop in the longer term.
He is fascinated by the ever-changing coastline, the interplay of wind and water. It was no coincidence that Prof. Stive returned to the faculty of Civil Engineering and Geosciences in the mid-1990s as a part-time professor of coastal morphodynamics, as he had graduated there in 1977. He acquired much of his experience in the Delft Hydraulics Laboratory, which is now part of Deltares. Prof. Stive obtained his doctorate in 1988 and has been professor of coastal engineering since 2001. He is also the scientific director of the Water Research Centre.

Fear of water

Tonie Mudde Tonie Mudde is ais a science editor and columnist for De Volkskrant. Previously, he wrote for the monthly magazine Quest. Mudde is qualified as an engineer in Aerospace Engineering and studied at TU Delft from 1996 to 2002. Further information: www.toniemudde.nl

Who is afraid of water these days? The last truly major flood – not a burst dike near a village, but a really serious one – was more than half a century ago. For Dutch people today, a flood disaster is like a war on home territory: an obscure phenomenon from one's grandparents' times, a threat that has lost its relevance.
Volcanic eruptions, nuclear disasters, killer storms: their existence is forgotten until they return with a vengeance. This is then followed by the usual excuses. The focus on safety had gradually waned, funding was gradually reduced: after all, things had been going well for such a long time…

Photo: Sam Rentmeester

At hoogtetool.ahn.nl, you can check how many metres you are above or below N.A.P (Amsterdam Ordnance Datum). In my case (Amsterdam), it is + 60 cm. Pretty negligible.
What would I do if a gigantic storm was heading my way and the newsreader announced that I had one day to make my escape?
Finding shelter locally would seem the most reasonable option. But where? There is no sign outside my door with an evacuation plan or details of the highest and safest location in my district. The only government advice on disasters I've ever heard is: 'Go indoors, close all doors and windows and turn on the radio.' But what's the use of that, if the water could come flooding through my letterbox at any moment?
So, it's a case of looking after oneself. I'd have to take the car to the Utrecht Hill Ridge, where I have somewhere I can stay. A brilliant plan. That is, if I'm the only one who comes up with it. But in the event of a mass evacuation, everyone in Amsterdam would be heading eastwards in their cars. The roads would become completely gridlocked and we'd would all drown as we inched our way forward on the A10 ring road.
Time to call in some advice. I email a PhD in civil engineering, who also enlisteds the advice of several colleagues. The answer arrives a few days later.
When faced with a traditionally Dutch peril, I must resort to an equally traditional source of salvation: the bicycle. If I peddle hard, I can be high and dry in the hills beyond Utrecht within four hours. If it's a westerly storm, I can get there even quicker.
Floating past the traffic jams at wind force 12 on an old-fashioned Dutch bike: that's my idea of a pleasant evacuation.
But don't spread the word: the bicycle lanes aren't that wide, after all.

Photo: Sam Rentmeester

Rocket engineers in the rain: students of the Dawn project of the Dare (Delft Aerospace Rocket Engineering) dream team tested various concepts for the ignition of a new hybrid rocket motor, which is intended to compete with solid fuel propulsion as currently used in Dare's Stratos II rocket. A major launching campaign will begin in May.

Holding back salinisation

A vertical underground osmosis filter for drinking water not only reduces energy consumption by 40% but could also prove to be a powerful means of preventing saltwater intrusion.

Jos Wassink

Jeroen Posthumus (left) and Bas Heijman holding the Puro filter.

It's a problem horticulturists in the Westland area know only too well: groundwater often contains too much salt. Many have already taken action to prevent this saltwater intrusion, which results from a combination of a relatively low volume of discharge from the rivers and high seawater levels. This means that the salty seawater intrudes far inland beyond Rotterdam and also penetrates the soil because of low water levels in the adjacent polders. "It's currently happening once or twice a year," says Harrie Timmer, hydrologist at drinking water company Oasen in Gouda. "But if it becomes a structural problem, as some climate scenarios predict, the intruding brackish water will cause salinisation in our pumping stations. Oasen has groundwater wells in such places as Ridderkerk and Hendrik Ido Ambacht, at depths of 20 to 100 m. The water sourced from these wells was flowing through the river five years back. By law, drinking water may contain up to 150 mg of salt per litre. Studies suggest that this limit will be exceeded in certain places if climate change turns out to be significant (a temperature increase of 2 °C and dry summers). This is why some drinking water companies are experimenting with special filtration methods.

There is really only one way of filtering salt from water on a large scale: by using reverse osmosis. This technique has been used for large-scale seawater desalination for the past 20 to 30 years. The basic principle is simple: high pressure is used to push salt water up against a semi-permeable membrane that allows water to penetrate yet holds back salt ions (and other constituents). To purify seawater, a pressure of 40 to 80 bar is required, and the purification of just one cubic metre of drinking water consumes 6 kWh of energy. Brine is produced as a by-product: it amounts to 20% of the original inflow, with five times the salt content.

> 'Energy consumption can be almost halved by not pumping the brine to the surface'

The conditions for purifying groundwater are less extreme. The brackish groundwater contains around 500 mg per litre. In this case, the reverse osmosis installation works under a pressure of 8 bar to produce a flow with a double salt concentration (1 g per litre) and an equal flow of fresh water.

This is the same system used by market gardeners and by two water purification plants in Zevenbergen (West-Brabant) and Noordbergum (Friesland). The brine is then discharged into the sea or pumped back underground. The energy consumption is approximately 1 kWh/m3.

A few years ago, membrane specialist Dr Bas Heijman (sanitary engineering section of the faculty of Civil Engineering and Geosciences) came up with a smart idea to make the process more energy efficient. He has just returned from Somalia, where he was working on making brackish water drinkable. Initially, he says, the water companies showed little interest in his energy-saving design - only Oasen in Gouda saw the potential.

"It's a great purification technique," Timmer explains. "It may provide a remedy for salinisation and gives us an opportunity to explore the regulations governing the discharge of brine."

This is because the key to saving energy lies in the underground discharge of concentrated groundwater. The underground system consists of an inflow pipe, two pumps, and six filter tubes stacked on top of each other. The brackish water is pumped down through the filter tubes. The filters consist of a concentric tube for the freshwater, wrapped in a membrane filter and surrounded by a sealed cover. A big pump is used to suck the freshwater to the surface. The brackish water is left underground, separated from the inflow point – preferably by a layer of clay. Energy consumption can be almost halved by not pumping the brine to the surface. Almost halved, but not quite, because a small pump is required to propel the brackish water through the filters. Calculations show that the Puro system requires 0.6 kWh/m3 to produce 25 m3 of freshwater per hour.

The entire structure, built by water treatment manufacturer Logisticon and well-drilling company Haitjema, is 10 m in length and weighs around one tonne.

TU Delft is supervising the installation by way of two PhD research projects. Geohydrologist and chemical engineer, Jeroen Posthumus (CEG), is researching unwanted brine crystallisation. Normally, anti-scalants are added to prevent deposits from forming on membranes and their immediate surroundings. However, additives are out of the question, as it is not permitted or desirable to introduce foreign chemicals into the subsoil. This increases the risk of scale deposits, leading to a decision to limit the concentration ratio to a factor of two. It may however be possible to increase production.

Frank Smits is conducting research into the effect of the Puro on salinisation in the local area for Waternet and TU Delft. Simulations carried out by his supervisor, Professor Theo Olsthoorn, have shown that freshwater wells eventually draw up the underlying, saline groundwater. With Puro, however, the concentrate penetrates more deeply into the soil, thereby pushing back the creeping effects of salinisation, and keeping freshwater fresh. Measurements will reveal whether there is actually a significant effect.

They are currently awaiting a permit from the province of Zuid-Holland. The researchers understand the need for careful consideration, but also point to the hundreds of horticulturalists' wells that are more or less tolerated. In any case, says Timmer, all that is required is a research permit for a limited time. The results of the research will provide greater clarity regarding saltwater intrusion, as well as potential remedies.

Frank Smits is conducting research into the effect of the Puro on salinization.

Harrie Timmer of water company Oasen.

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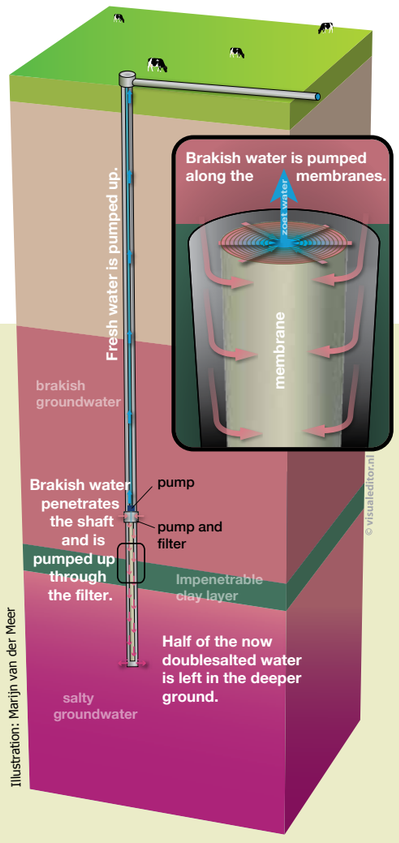
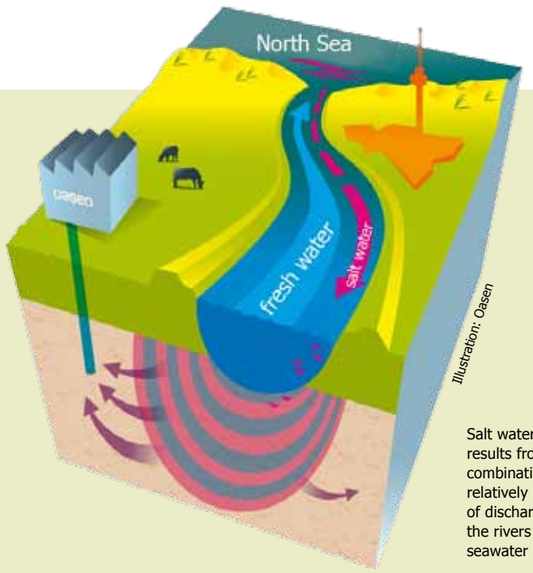
View the animation on combating salinisation: http://youtu.be/HCKpg-EJr-8





Salt water intrusion results from a combination of a relatively low volume of discharge from the rivers ad high seawater levels.

Floating construction

Creating the world's first self-sufficient floating city: that is the mission of Deltasync.


Photo: Sam Rentmeester

In 2006, when Rutger de Graaf had been working for a year on his PhD research on how cities can use water in order to become more sustainable and less vulnerable, he saw an advertisement for Royal Haskoning's delta competition. The engineering firm invited students and PhD candidates to develop innovative solutions for delta areas around the world.
Together with his team of students, De Graaf immediately won first prize with a design and development strategy for a floating city in the IJmeer. "It was very futuristic: floating apartment complexes that could adapt to rising sea levels," explains De Graaf.
After that, he was busier than ever. The father of one of his team members asked if they wanted to prepare a presentation, as he was scheduled to speak with the head of environmental planning during a business trip to Shanghai. De Graaf: "He truly enjoyed the presentation and invited us to organise an exhibition."
The team was eventually asked to give a presentation to the committee of World Expo 2010 Shanghai. "We had to be there within two weeks, and with the support of a major Dutch city, preferably signed by the mayor." It worked: one of the cases in De Graaf's PhD thesis involved Rotterdam.
His plans to start a company were thus shifted into overdrive. "When you suddenly appear before the World Expo committee, you need to have a professional organisation very quickly," recalls De Graaf. And so Deltasync was established at an accelerated pace in October 2007.
Once in Shanghai, the Chinese felt that the funding should come from the Netherlands. That did not work out. The city of Rotterdam, however, wanted to realise a project in the Netherlands. The result is now bobbing in the Rotterdam Rijnhaven: a floating pavilion for conferences, lectures and exhibitions.
Six floating homes in the Delft Harnaschpolder are on this year's schedule. "We're not developing the design for this project," De Graaf says, "but we are helping the residents to realise their homes. We provide technical expertise and advice."
Consulting is one of Deltasync's focal activities, in addition to creating designs and conducting research. De Graaf: "Everything is focused on floating architecture. My favourite projects involve a combination of all three."
In addition to municipalities, Deltasync works for project developers and water boards. "We're conducting a project for the European Union: FloodProBE. We're exploring new concepts and techniques for making cities water-resistant. We're doing this in collaboration with Dura Vermeer, Deltares and other parties, in addition to international partners."
The company has four employees and regularly hosts interns or graduates, but that could change at any time. "We're now trying to go international, and that could really take off if we should suddenly have the opportunity to start designing a floating city." (CvU)
www.deltasync.nl

Hydraulic engineering goes underground

Anyone expecting hydraulic engineer Prof. Han Vrijling to make a plea to raise sea dykes is bound to be disappointed. According to him, hydraulic engineers will be working more and more underground in the not too distant future.

"In urban environments I think we will be seeing major developments in building underground infrastructure: parking garages, subways and stations. That leaves free space to live in and move around the city while infrastructure and constructions are under the ground. They have already realised that in Düsseldorf where, if you walk across the square from the old centre to the river, you are unaware of the fact that beneath your feet lies a motorway. The Grote Marktstraat in The Hague hit the headlines on more than one occasion owing to leaking tunnels but the end result is fantastic: bus lanes, parking garage and a glass fissure at the exit to the square. For me, this is an example of what can be achieved when constructive hydraulic engineers and architects put their heads together.
The underground station in Amsterdam is another example. Under the square in front of Central Station is a huge station for the Noord-Zuid subway line. That is also a hydraulic engineering construction. It wasn't so much the drilling I was afraid of; it was the feat involved in sinking a tunnel under Central Station that took my breath away. A canal was first dug out with sheet piling through which a sluice was piloted that was then dammed up and sunk ten metres under street level below the station as part of the tunnel. The consequences of leakage there do not bear thinking about. That process drew far less attention than the drilling itself, but I see it as the future of underground hydraulic engineering.
Another development in hydraulic engineering is the emergence of multifunctional water defence systems. Raising the dyke on the Maasboulevard in Rotterdam by a metre is a complex enterprise but it becomes more attractive if you can combine it with housing construction. Water defence systems will be installed to the height of the parking deck and above that houses and restaurants will be located. To do that, however, you have to take the water level into account when renovating the city. That doesn't just apply to Rotterdam, incidentally, but to all cities that are constructed close to water and where people want to put it to attractive use.
I have few concerns about the sea dykes until 2030. The sea level is predicted to rise but the measurements remain stable at + 18 centimetres. I am far more worried about the state of the inner dykes of which, at the last inspections, 33 per cent did not meet the requisite demands. Everyone is in a state about the rise in sea level but the real danger lies elsewhere. The political debate on this issue didn't even make the papers." (JW)


Photo: Sam Rentmeester

Prof. **Tiedo Vellinga** says that an environmentally friendly harbour can also be efficient. He held his inaugural address as 'harbour professor' at TU Delft in December. Prof. Vellinga, who also works for the Port of Rotterdam Authority, now occupies the Chair of Ports and Waterways.

Professor of Petroleum Engineering **Bill Rossen** was "pleasantly surprised" at being chosen as the best lecturer at TU Delft in 2011. Rossen does not yet know how he will use the 5,000 euros prize that can be spent on improving education. With regard to his own lectures, Prof. Rossen picked up an idea from his fellow nominee, Peter Naaijen: reward students who find the most mistakes in his lectures.

Prof. **Geert-Jan Witkamp** (3mE) won the DOW Energy Prize for his important contribution to the development of energy efficient technologies in the field of separation processes, such as, for example, the recovery of salts dissolved in water using Eutectic Freeze Crystallization (EFC). EFC is used in the mining and chemical industries and for treating manure.

"We want to record motor brain activity very precisely: with a resolution of 2 mm for each microsecond." Prof. **Frans van der Helm** (3ME) has received an ERC grant worth 3.5 million to develop a 4D brain scanning method – a new method of recording brain activity. He will do this in cooperation with Prof. Gert Kwakkel of the VU University Medical Centre.

Prof. **Marco Waas** has resigned his position as Dean at 3mE with immediate effect. There were negative reports about him in the media related to high expense claims. The former Dean, Louis de Quelerij, will take over his position on a temporary basis. Among other things, Waas was involved in the setting up YesDelft and Science Port Holland.

Prof. **Andrezej Stankiewicz** has been appointed Director of the new TU Delft Institute for Process Technology. Prof. Stankiewicz describes the institute as an "umbrella organisation of three departments within two faculties: Chemical Engineering and Biotechnology of Applied Sciences and Process & Energy of the 3mE faculty.

The comedian **Youp van 't Hek** will become TU Delft's second cultural professor. Twenty students will participate in his master classes with the theme of 'Los van Alles'. On 8 March, Van 't Hek will hold a public lecture. His departing lecture, with 'something tangible' from the students, will be on 11 May.

The Dean of Industrial Design Engineering, Prof. **Cees de Bont**, left TU Delft on 1 February. His new position will be Dean and Chair-Professor of the School of Design at the Hong Kong Polytechnic University. Prof. De Bont will continue to play a role in the FES programme for the Creative Industry. Prof.ir Daan van Eijk will act as his replacement until the Executive Board appoints a new dean.

Electron microscope expert Prof. **Pieter Kruit** (Faculty of Applied Sciences) received the FOM Valorisation prize on 17 January. He received the 250,000 euros prize for his research on electron and ion optics and his active role in the valorisation of this knowledge in an industrial context. Prof. Kruit has been leader of the Charged Particle Optics research group since 1989. Within FOM, he is the leader of the programme 'Microscopy and modification of nanostructures with focused electron and ion beams'.
I did not so much receive the prize for developing the technology but for setting up a company so other scientists can work with it as well", explains Kruit. "At first I started knocking company doors with my invention (a microscope that combines light and electron microscopy), but they wished to see if it would actually work first. Then we decided to found our company Delmic. Kruit plans to use his prize for 'as many as possible minor researches with a high failure-probability'. Experiments which he would otherwise never receive funds for. "Because when you apply for grants you have to indicate that you are a 100% certain of tremendous results."

Propositions

A programming language shoud have a benevolent dictator who decides on the evolution of the language; committees should be avoided.
Zef Hemel, electrotechnical engineer

Research is a never ending activity.
Liliang Wang, materials engineer

If people would give each other more space, they would definitely get closer together.
Louise Heerema, phisycs engineer

Life is meaningless without stress.
Gregory Andrew Georgalli, materials engineer

The most frequently form of discrimination in neither gender nor even race, but language.
Yue Chen, mechanical engineer

One that requires a manifesto to explain what he has just designed, should take to writing literature in the future, and devote himself to dog houses as an architect.
Peter Wellens, naval engineer

Proposition

Health insurers should also be required to take the Hippocratic Oath.
Blagoy P. Iliev, electrotechnical engineer

Defence

"It appears that health insurance companies could influence the selection of treatment or medicine when several "equal" options exist, by putting an emphasis on the one that results in a shorter (and cheaper) hospital stay. Naturally, this is imposed by selecting the treatments and medicines that will be covered by insurance. Without even debating whether a shorter/cheaper hospital stay may result in a worst outcome or not, I would like to hear that everyone involved in this selection process has sworn upon the Hippocratic Oath."

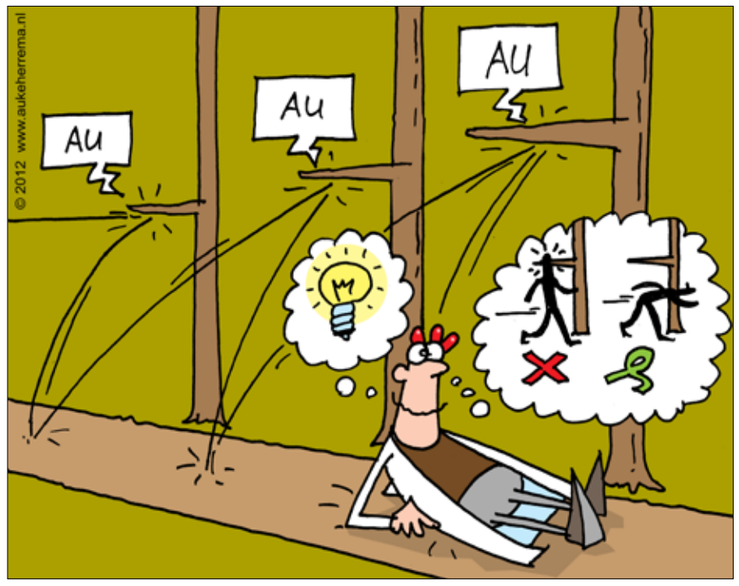
Sound Bites

"It's possible that depth sounders will have to look further to the front and to the side of a vessel. Look, it is obvious that the captain deviated from the usual route: The rocks have been there for a long time. But a cruise ship is not an oil tanker. Cruise ships have propellers at the stern and on both sides making them much more manoeuvrable. They can almost turn on their own axis."
Prof. Hans Hopman, professor of Ship Design in Trouw.

"It's easier to manage things with pumping stations than with washlands. Several areas in Friesland have been allowed to flood. The resulting drop in water level was just 1 cm, which is not much. Additional pumping stations must be built. When the wind is blowing from the wrong direction, the pumping stations are sometimes pumping from a dry ditch."
Prof. Han Vrijling, professor of Hydraulic Engineering in NRC Handelsblad.

"We changed the course programme recently, but the lecturers were so enthusiastic that the courses were sometimes too full. So we had to slim the courses down again."
Aldert Kamp, Director of Education for Aerospace Engineering in De Volkskrant.

"A robot we taught to dribble a ball accidentally pushed the ball backwards into the opponents' goal. In this way the robot learned that it could backheel the ball. Other robots only learned this much later. The other robots turned around first. This particular robot became an expert at backheeling."
Prof. Pieter Jonker, professor of Vision-based Robotics in De Volkskrant.



'The greatest glory in living lies not in never falling, but in rising every time we fall.'

George Lutterodt, civil engineer

'I've earned my closing badge'

It is rare that the wind is so strong and water levels so high that the floodgates must be closed. When such a situation is approaching, however, some hearts will start to beat faster. One would be that of flood-barrier manager Derckjan Smaling.


Photo: Sam Rentmeester

No wind, grey skies and a relatively moderate water level. That's the situation as Derckjan Smaling (40) sits down for an interview at the Maeslantkering, the most important storm-surge barrier, for which, in his capacity as manager, he has been responsible for since July 2009. Not the most exciting of weather conditions. An atmosphere of calm prevails in the large trailer where the barrier's employees convene.
The situation had been different a few weeks earlier. At that time, 25 pagers went off, causing their owners to throw their sleeping bags into the trunks of their cars and rush to the barrier situated in Hook van Holland's Nieuwe Waterweg, in order to monitor water levels, test the systems and ensure that even simpler matters, like walkie-talkies, were in working order. Smaling explains: "At times like that, we act as if there actually will be a closure. Especially in the beginning, you have a lot of adrenaline, but even after that, you have to stay alert. The closing of the barrier is computerised, but you have to watch constantly to make sure the data in the computer are accurate. Moreover, we aren't accustomed to such situations."
The design of the Maeslantkering was based on projections that it would have to close once every ten years. Not every employee experiences an actual closure, and this can lead to considerable frustration.
Smaling came to work at the barrier in the spring of 2007, beginning as a failure-probability manager. In this current position, he is responsible for ensuring that the barrier's most prominent objective – working 99 out of 100 times – is always achieved. Eight months after Smaling had assumed

"The immediate value of my work is clear to everyone"

the tasks of his predecessor, he had the experience of which every barrier employee dreams: the Maeslantkering closed because of a storm, marking the first time this had occurred since its completion in 1997.
"At any rate, I've earned my closing badge," says Smaling, cheerfully. "The best situation for the Netherlands, of course, would be if we could dismantle and clear away the barrier after a century of it not being used. For us as employees, however, there's nothing more frustrating than investing so much energy in maintenance without anything ever happening. That truly puts a damper on things."
His studies in civil engineering at TU Delft ended with a graduation internship at a small engineering firm that was acquired by Arcadis engineering firm. He was offered a job there as a consultant. "How to organise ports, especially abroad: that was my job," he recalls. "After only a month, I found myself all alone on the Black Sea."
Smaling subsequently went to work at DHV engineering firm: "I was working on the HSL-South, in the safety department. But I kept wondering why I was doing it; I didn't know what was actually done with my recommendations. I needed something more concrete. I needed to know that people would benefit from my work." Smaling has now found what he longed for. (SB)

Pride on the rocks

The ultra-modern cruise ship Costa Concordia sank owing to human error. Is it still worth making improvements in technology and procedures? Ship design professor, Hans Hopman (3mE), believes it is.

At around 10 pm on Friday, 13 January 2012, Captain Francesco Schettino, navigating by sight, made straight for the island of Giglio in order to give a little added lustre to a festival being held there. This was not an isolated event: the British shipping journal *Lloyd's List* reported that satellite data showed that the Costa Concordia came even closer to the shore last August. A YouTube video plotted the course of the ship, showing how the ship headed towards the coast at high speed and turned away too late. This caused the stern of the ship to swerve out and hit a rock. With this, the Concordia's fate was sealed.
Professor Hans Hopman believes that although the Costa Concordia disaster was caused by human error, safety can still be improved by, for example, improving procedures. Prof. Hopman: "One of the safety procedures proscribes that an emergency drill should be held within 24 hours of leaving the harbour, so that everyone knows where to go. But this accident occurred on the first day. You could therefore argue that the existing procedure is not safe enough and that it would be better to hold a drill before the ship leaves the harbour."
Technology also plays a role. The stability of a ship that is taking on water is based on the statistical probabilities of particular types of damage occurring. These probabilities are primarily based on damage resulting from collisions with other ships or damage to the bottom of the hull from running aground. This is why double bottoms are a compulsory feature of cruise ships. But the same type of construction is not required for the sides of the hull, because far fewer incidents of damage of this magnitude occur there. This means that a 50 metre tear and hole could develop in Concordia's hull, resulting in several compartments filling with water. "Perhaps we should consider making passenger ships entirely double-hulled, as tankers are," says Prof. Hopman.
The way information is communicated while a ship is sinking could also be improved. The current generation of cruise ships often seem to capsize during sinking because they lose stability rapidly. Prof. Hopman: "This is why it's important to have an overview of the damage as soon as possible. If you have sensors measuring the water level in each compartment, you can use a computer You can then take a decision to abandon ship at an earlier stage if the predictions indicate this is necessary."

According to some reports, one hour after running aground Captain Schettino had still not issued the command to evacuate the vessel, at which point the crew felt impelled to disregard his authority and take the initiative themselves.

Watch the last minutes of the Costa Concordia at:
http://bit.ly/AIS-Concordia
(JW)

Best Graduate

Jerôme Schalwijk was chosen Best Graduate 2010/2011.

Since 24 November 2011, Jerôme Schalkwijk, from the faculty of Applied Sciences (AS), has been able to pride himself on being the Best Graduate for the academic year 2010-2011. He fended off competition from the best graduates of the university's other faculties. Schalkwijk graduated with a thesis on the subject of 'clouds', whose interaction with the phenomenon of climate change is as yet unclear. In a climate subject to rising temperatures, will there be fewer clouds, possibly making it even warmer? Or will the reverse effect occur? In order to shed more light on the issue, the AS faculty is conducting fundamental research on clouds by means of detailed simulations on supercomputers. According to the faculty's recommendation, Schalkwijk made two remarkable advances in his research. "Working with colleagues from the faculty of Electrical Engineering, Mathematics and Computer Science, he succeeded in modifying the simulation program to enable it to run on the GPU of a desktop PC. This allowed him to conduct fast cloud simulations at a local workstation. He also developed an abstract conceptual model for the cumulus cloud type, reducing the complexity of the calculation while still retaining the essential information. This type of cloud is important in relation to the study of climate change. Schalkwijk was awarded a prize of € 2000. The best graduates from the other faculties were each awarded € 1000.

Giving something back to TU Delft

Alumni who wish to support talented TU Delft students and academics and strengthen their professional and personal ties with the university can become a Friend of the University Fund (UfD). The Friends of TU Delft began recruiting alumni in early 2011. Nienke Maas from the Friends' Fund: "We started by approaching the 7000 former members of the Alumni Association, before moving on to the remaining 43,000 TU Delft alumni. In 2012, we intend to draw the attention of a number of generous donors to the Friends' Fund." According to Maas, many alumni received grants from the UfD for internships, educational trips or study abroad while they were at TU Delft. One such person is Ionica Smeets. She studied Applied Mathematics and, partly thanks to an UfD grant, was able to spend two months at Oregon State University in 2004. Smeets: "Those two months proved extremely valuable and gave me the impetus I needed to go on to take my PhD. I have never worked as hard as I did then. I was just about to graduate and received intensive coaching from Tom Schmidt during those two months. He took a look at my research, gave me useful books and taught me different techniques and a new perspective. It was an amazing learning experience, to lead such a different kind of life and work so intensively with someone."

Internships and educational trips

The UfD also approaches businesses for support. Together with the support provided by alumni, the Friends' Fund passes these funds on to the Implementation Committee (*Commissie van Uitvoering*), which then funds educational trips and internships abroad, for example. Maas: "Many alumni feel the same way as Ionica and are very grateful for their time at TU Delft: they feel it's time to give something back. We want to make that feeling more explicit, by asking alumni to become Friends of TU Delft." The donations are also spent in other ways. In 2011, the Friends' Fund sponsored the book *'Delft in de Tweede Wereldoorlog'* (Delft in the Second World War), in which alumni and former staff recounted their wartime experiences at TU Delft. The first Alumnus of the Year election was held in 2011, organised by and for alumni. All alumni can nominate candidates. "Next year, the Friends' Fund plans to launch a prize for the Best PhD Student. The winner will receive a sabbatical worth €5,000, increasing his or her chances of securing a Veni grant. The UfD already has the Leermeester Prize, the prize for the Best Graduates and the Bachelor Grants. The Best PhD Student prize will make the list complete. There are also plans for an annual contribution for the TU Delft Dream Teams. This would be targeted not at the team as a whole, but one outstanding individual. Every team can nominate a member because of their special contribution to the team. The winner secures eternal fame, a great addition to his or her CV and also wins € 1500 for the team."

Dreamteam members (on photo: NovaBike) might get an annual contribution.

Stay in touch

TU Delft is eager to keep in touch with its alumni. Do you want to stay up-to-date on what is happening at the university and developments in the field of education and research? Then register now with TU Delft's alumni portal. You can use it to manage your contact details and record your qualifications and work experience. You can also register for the digital newsletter for alumni, *Delft Outlook*, faculty newsletters and various events, such as the Coach Café and Alumni lectures. Visit alumniportal.tudelft.nl and click on *'Registreer hier'* (Register here) to activate your account.

Agenda

23 February 2012
Presentation of UfD Cofely Energy Efficiency Awards. Location: Senate room, Aula Congress Centre. Starts at 15:30.

8 March 2012
Presentation of UfD Strukton Master Awards Location: Committee room 3, Aula Congress Centre. Starts at 16:00.

26 March 2012
Presentation of UfD Imtech Bachelor Grants Location: 3mE faculty, Mekelweg 2, Delft. Starts at 15:30.

17 April 2012
Presentation of UfD EBN Geo Energy Master Awards. Location: CEG faculty, Stevinweg 1, Delft. Starts at 16:00.

TU Delft appoints top rowing coach John Parker

Rowing at TU Delft has a long and rich history, including participation in the Olympic Games. With some 1,100 rowers, 20 at the top of the sport, and 15 to 20 hours of training every week, it's already one of the biggest sports at TU Delft. The appointment of top coach John Parker and financial support for the Rowing Talent Center Zuid-Holland (RTC-ZH) are set to raise the standard of rowing at TU Delft to an even higher level. This is the first time ever that the University has participated in a project focusing on talent development, top sport and sports innovation. Students have proved particularly adept at developing rapidly in the discipline of rowing. Rower Ellen Hogerwerf, a student of civil engineering, has already taken part in three World Championships since arriving at Delft in 2008. "Outstanding achievement in terms of studies and sport reflects TU Delft's culture of performance and excellence," says Head of Sport & Culture Raymond Browne. TU Delft is participating in this project in order to contribute to the further development of rowing as a sport, for example by means of sporting innovations. The University sets high academic standards for students. In order to enable students to engage in sports at the highest levels, special support is available in the form of the Graduation Support Scheme (RAS). This provides added flexibility for study. In 2012, a top sport coordinator will be appointed at TU Delft in order to enable the university to provide the very best support.
Top coach John Parker was appointed in November on a six-month contract to lead the TU Delft rowing team, with the intention of continuing thereafter. He came fourth in the 1992 Olympics and was director and head coach of the highly successful American Talent Center in Oklahoma.

Rowing is one of the biggest sports at TU Delft.

No future without history

Histechnica was founded 40 years ago as an association of friends of the Techniek Museum Delft. The association aims 'to preserve the identity of engineers who work in design and construction and also conduct research of the highest calibre'.

Although the museum has now been transformed into a Science Centre, this key objective remains alive. Histechnica has strong connections with TU Delft because it is by far the oldest institution for technological research and teaching in the Netherlands. The association supports efforts to preserve the historic academic heritage collection. Lectures and educational trips are organised in order to provide members with knowledge of the historical context underlying modern developments. On 11 February, there was a lecture on the history and future of fossil fuels and on 10 March there will be a special event to mark the 125th anniversary of the journal 'De Ingenieur'. On the schedule for May is an educational trip to Cornwall, an area of the UK where interesting remains of early industrialisation have been preserved. Finally, the lecture in June will be about navigation at sea and the instruments used for it. All of the lectures will be held at the Science Centre Delft and admission is free for members of Histechnica. Annual membership is €30. If you would like to join, please contact the chairman Menno Tienstra, (+31) 015 21 41 293.

Histechnica organizes a lecture about navigation at sea.

who & where

Delft University of Technology has eight faculties, each of which is engaged in education and research in one or more disciplines. The University was founded in 1842 by King William II. With 13,000 students, 2,800 scientific staff members and 2,000 technical and administrative employees, it is the largest university of technology in The Netherlands.

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Disciplines

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Chemical Technology & Bioprocess Technology
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Computer Science
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Applied Mathematics
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Technology, Policy & Management
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Multidisciplinary Centres

Adhesion Institute
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Biotechnological Sciences Delft Leiden (bsdl)
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Telephone +31 15 278 5140/2342

Centre for International Co-operation and Appropriate Technology (cicat)
Mekelweg 2
nl-2628 CD Delft
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Centre for Transportation Engineering
Stevinweg 1
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Telephone +31 15 278 6634

Dutch Institute of Systems & Control (DISC)
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 7884

Koiter Institute Delft (Institute for Engineering Mechanics)
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Telephone +31 15 278 5460

Netherlands Institute for Metals Research (NIMR)
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Fax +31 15 278 2591

Wind Energy Research Group
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Reactor Institute Delft
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OTB Research Institute for Housing, Urban and Mobility Studies
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Open Building Working group (obom)
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Interduct Delft University Clean Technology Institute
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Netherlands Schools for Advanced Studies in Construction
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Advanced School for Computing & Imaging
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Trail Research School
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Central Library

Delft University of Technology Library (dutl) supplies information and provides services, particularly in the area of the technical sciences.
It comprises a central library and twelve sub-faculty libraries housed at the respective sub-faculties and institutes.
The dutl is intended for students and staff at the Delft University of Technology. However, as the task of the library is to provide scientific and technical information at a national level, its facilities are also available to the general public. As well as all areas of technology and natural sciences, the library also contains a general collection in the social sciences, economics etc.
This relates not only to books or periodicals, but also to standards, reports, reference works and congress proceedings.
Literature not in the collection or not on hand can be obtained through Delft University's Central Library from other libraries in the Netherlands or abroad.

For further information:
Delft University Central Library
Prometheusplein 1
p.o. box 98
nl-2600 MG Delft
Telephone +31 15 278 5678

Delft University Press
IOS Press
Nieuwe Hemweg 6B
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Fax +31 20 620 34 19
E-mail order@iospress.nl

Information

General information:
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Information on facilities for foreign students:
Student Advisory Office
Jaffalaan 9a
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Telephone +31 15 278 4670

Liaison between business and research:
Liaison Office
Mekelweg 2
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Information on research fellowships:
Mrs. M.Y.M. Spiekerman-Middelplaats
Stevinweg 1
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Telephone +31 15 278 3773

General information on university education in the Netherlands:
Min. of Education, Science & Culture
Central Information Dpt.
p.o. box 16375
nl-2500 BJ Den Haag
Telephone +31 70 412 3456

(Post Graduate) Courses

Delft TopTech
(vocational courses)
Mekelweg 2
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Fax +31 15 278 1009
www.delft-toptech.nl

Institute for Biotechnology Studies Delft Leiden (bsdl)
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For information on courses in the Dutch language:
Language Laboratory
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