COLOPHON

coverphoto
Dryness in Namibia.
Photo: Nigel Dennis/ANP

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editorial staff
Frans Godfroy *(editor-in-chief)*,
Maarten Keulemans *(deputy editor-in-chief)*,
Jorinde Hanse & Katja Wijnands *(managing editors)*,
Saskia Bonger, Tomas van Dijk, Maaike Muller,
Joost Panhuysen, Sam Rentmeester *(image editor)*.

office
P.O. Box 139
NL 2600 AC Delft
The Netherlands
T +31 15 278 4848
F +31 15 278 1855
www.delftoutlook.tudelft.nl
e-mail delftoutlook@tudelft.nl

contributing writers
Samira Boon, Henk Makkink,
Hugo Priemus, Angèle Steentjes

subscriptions
Willy Abramsz-Witte
(015) 278 8598
w.m.s.abramsz-witte@tudelft.nl

translations
Margareth Clegg, Marcus de Geus, David McMullin

design & typesetting
Cok Francken – MultiMedia Services, TU Delft

printing
DeltaHage BV, The Hague

Concrete creatures

There is a lot of hard work being done in the experiments of microbiologist Dr. Henk Jonkers (Civil Engineering and Geosciences). But not only by the post-doc researcher: for the past two years billions of bacteria have been trying to prove that self-repairing concrete is a reality.

Construction bacteria still hard to feed

Illustration: Floris Wiegerinck

"A small crack in concrete doesn't significantly affect its overall strength. But water can seep in through that small crack and affect the metal reinforcements, causing them to rust." Concrete decay, as this is called, does weaken the concrete, however. Of course you can repair the cracks, but what could be better than having a billion bacteria do this work themselves? Jonkers has since found the appropriate bacteria. They leave spores – a kind of seed – that can survive for years in the inhospitably high acidic levels found in concrete. As soon as a crack appears, air and water ensure that the bacteria get to work closing the crack. The bacteria, which are found in every common backyard, do this work with limestone that they produce themselves. But first these bacterial builders want to eat. Jonkers has found a food source that satisfactorily hardens the concrete. Experiments will now be conducted to determine if the bacteria can also work well with it.

More information: Dr. Henk Jonkers, H.M.Jonkers@tudelft.nl.

Floating igloos

If the dikes are breached, residents of this futuristic city have nothing to fear. A research group led by Rutger de Graaf of the Faculty of Civil Engineering and Geosciences has won first prize in the Delta competition for their innovative plan to build a floating city on the IJmeer. The Delta competition was organised by Royal Haskoning engineering bureau. The 'igloflats' were not only designed to survive floods; their unique shape also allows for maximum energy use from solar rays.

More information: Rutger de Graaf, tel. (015)2784673, r.e.degraaf@tudelft.nl.

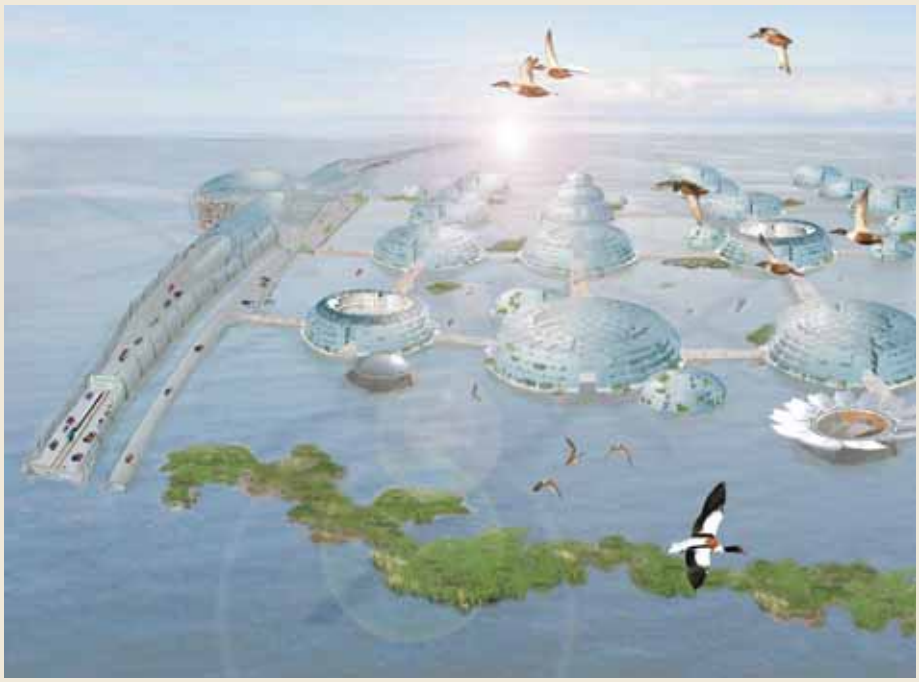

Illustration: Deltasync4

Axe Bow cuts through its first wave

A new ship's bow designed in Delft set sail on its maiden voyage on the deep blue sea. "A brilliant design," the shipbuilder declared.

The three ships that are nearing completion feature a so-called 'Axe Bow': a high, straight bow shaped like an axe, which was designed by maritime engineer Dr. Lex Keuning in the 1990s. The bow provides the vessel with superior seaworthiness. Vessels with axe bows pitch less heavily, their noses do not come out of the water and therefore they do not slam into the waves. The result: less seasickness and damage, and higher speeds. "Waves do not hurl this ship upwards; the ship just carries on cutting through such waves. Consequently, the captain can cut back on the throttle less quickly," says Jaap Gelling, product director for *High Speed & Naval Craft* at Damen Shipyards, in Gorinchem.

Photo: PR Damen Shipyards

The first axe bow vessels will be used for quickly transporting personnel and equipment to and from offshore oil rigs. "I envision them as the courier vehicles of the sea," Gelling says. The first two axe bow vessels are expected to be put into service in Mexico. The third vessel, which is a fast, 35-meter long transport ship, is currently being built for the Croatian offshore industry. In the coming years, another two longer axe bow vessels will be built. And there are also two designs for axe-bowed patrol boats currently on the drawing board.

It became clear during the first sea trial that the axe bow vessel performed exceptionally well. "It's a strange experience. You see a huge wave coming at you, but the bow just gradually rises, without extreme up and down accelerations." The vessels also proved to be easy to steer. Experts had initially feared that the axe bow might negatively affect the vessel's manoeuvrability and the ability to steer a fixed course. "But the captain complimented us on the vessel's ability to be tightly steered at all speeds."

More information: Damen Shipyards, www.damen.nl; Dr. Lex Keuning, 015-2781897, j.a.keuning@tudelft.nl

The Wad bogs down

Sand is disappearing from Texel and North Holland beaches and accumulating in the Wadden Sea. Experts theorise that this process will cease by itself, but TU Delft research undermines this theory.

"Five to six million cubic meters of sand per year has been added to the Wadden Sea over the past decades," says PhD candidate Edwin Elias, of TU Delft's Faculty of Civil Engineering and Geosciences. The culprit: the construction of the Helderse Zeewering, which already began around 1750, and the construction of the Afsluitdijk. The government must apply sand-water slurries to Texel's beaches and other North Holland beaches to prevent the land from disappearing into the sea.

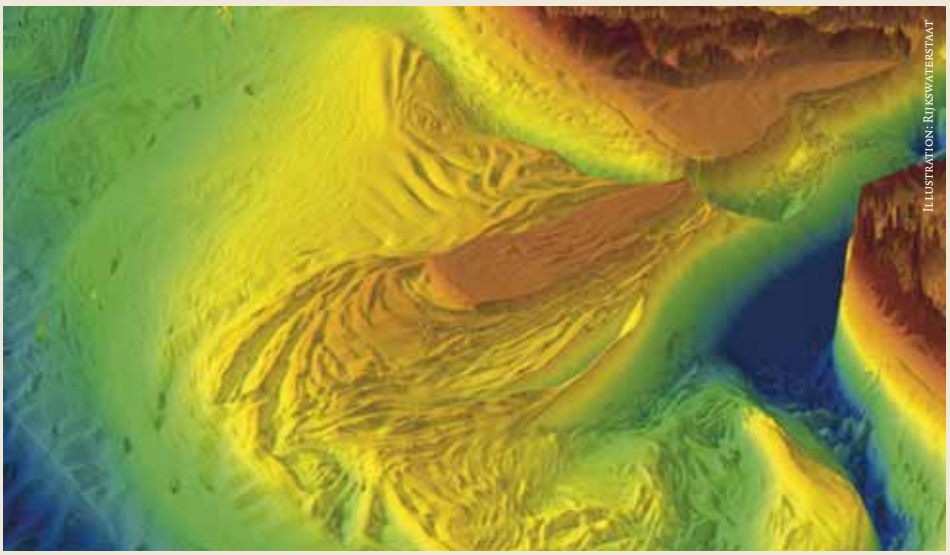

Illustration: Rijkswaterstaat

3D Computer images of the Razende Bol sandbar (centre) lying off the coast of Texel (upper right) and North Holland (centre right).

It may seem that the Wadden Sea is absorbing less sand, but Elias has discovered that the sand is in fact accumulating more eastwards, in a section of the Wadden Sea that until now was not included in the analyses. His doomsday scenario: "We must consider rises in sea levels and seabed subsidence due to natural gas extraction. The Wad will try to neutralise these changes, and this is likely to lead to even more displacement of sand."

Elias however is unconcerned. "The Netherlands has an enormous reserve of sand in the North Sea," he says. His research moreover has shown that this sand can be unloaded at the Razende Bol, a large sandbar located in front of Texel. The sand that is dumped there will flow straight back into the Wadden Sea. "The great advantage of this is that you will rarely need to use sand dredging vessels."

More information: Edwin Elias, eelias@usgs.gov

Photo: Sam Rentmeester/fMAX

Top story

Gloves are required for this top story. In the atlas of cartographer and merchant Georg Braun that dates from 1575, Rotterdam strangely enough is pictured as lying on a peninsula. This atlas can be admired in the new Map Room, where all the maps acquired by TU Delft since 1850 are collected under one roof. From Jacob van Deventer's impressive Atlas of Cities dating from the 16th century, to sparkling new digital aerial maps.

Computer coach

Photo: Jeroen Arendsen

The computer as a coach. The computer is an extremely helpful tool for children aged between three and five years old who are learning sign language. Two cameras film the children as they make a sign that has appeared in an image on the computer screen. The computer then 'judges' if they have made the correct sign. Three TU Delft PhD candidates will devise the best way for the computer to recognise and evaluate the signs.

More information: Gineke ten Holt, g.a.tenholt@tudelft.nl; Jeroen Lichtenauer, j.f.lichtenauer@tudelft.nl; Jeroen Arendsen, j.arendsen@tudelft.nl.

IN·BRIEF

Rococo under the x-ray

A great mystery has long surrounded the yellow flowers of rococo painter, Jan van Huysum (1682-1749). Some of the flowers Van Huysum painted have faded, while others have continued to shine down the centuries. Materials scientist Dr. Joris Dik has solved the mystery.

Last summer Dik (Faculty of Mechanical, Maritime & Materials Engineering) placed a yellow flake of paint from a Van Huysum flower under an x-ray diffractometer. This machine emits x-rays and, based on the reflections on the underlying object, determines the crystal structure. Dik concluded that Van Huysem used orpiment (arsenic sulphide). This pigment consists of strongly reflecting crystals. The only problem is that this pigment degrades when fully exposed to sunlight for too long. Oxidation occurs, creating a colourless arsenic oxide and corrosive sulphur dioxide. During his research, Dik also discovered small bits of plaster and chalk in the less effected sections of the paintings. From this, Dik surmised that Van Huysum, like many of his contemporaries, diluted his paint with chalk. There is less corrosive sulphur dioxide in such mixtures. The sulphur reacts with the chalk to create plaster.

Gaining insights into the stability of the orpiment's various compositions can be beneficial for restoration works, Dik believes: "If the paint only has a little chalk in it, the varnish should perhaps be removed more carefully." In order to be absolutely certain of his theory, Dik will begin conducting additional x-ray research next year, when he will place an entire painting in the diffractometer.

More information: Dr. Joris Dik, tel (015)2789571, j.dik@tudelft.nl.

Before (left) and after the restoration (centre and right).

The dream of every surfer

Surfers Paradise is regarded as heaven by Australian surfers. But the Gold Coast 'Down Under' now has a formidable competitor in Delft.

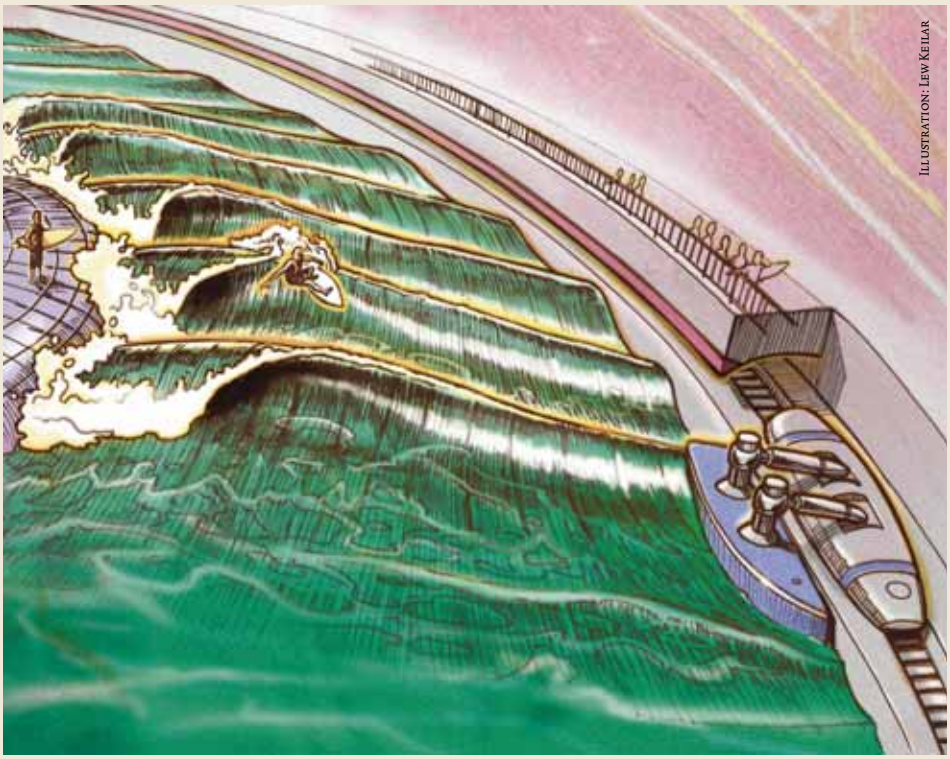

Illustration: Lew Keilar

Coastal engineering and fluid mechanics students Matthieu de Schipper (23) and Sierd de Vries (24) have designed a mobile surf pool that can be used anywhere – even in the barren outback, 4,000 km from the Australian coast. Their 'Liquid Time Wavepool' is a round, 200 meter in diameter swimming pool that has an island in the middle of it. A ship's hull rotates along the outer edge of the pool, leaving a series of 2-meter high waves in its wake. The waves 'break' – as they say in surfer speak – at the island, becoming uniform, curling masses of water. The dream of every surfer. The two students are planning to graduate this summer based on this research subject. They are currently using a numerical model to determine the ideal shape of the hull, which they will then test as a scale model in the Faculty of Mechanical, Maritime and Materials Engineering's tow tank. The original idea for this wave pool came from Australian surfboard designer Greg Webber, who patented the idea a few years ago. Webber was introduced to the two TU Delft students by fellow Australian, Andrew West, who had previously studied at TU Delft.

More information: Sierd de Vries: sierddevries@gmail.com; tel. (06)55808345 and Matthieu de Schipper: madeschipper@hotmail.com; tel. (06)44818331.

IN·BRIEF

Randstad to become 'Medical Delta'

In ten years time, anyone who needs to undergo a complex operation will come from far and wide to the medical facilities in South-Holland.

There will be lots of good business and employment opportunities in the region for companies directly or indirectly involved in the medical sector, like, for example, providing hotels for people visiting patients. This is the ambitious goal of the Health Science and Technology (HST) research institute, which was founded at the end of October. TU Delft has joined this venture in partnership with Rotterdam's Erasmus University and Erasmus Medical Centre, and the University of Leiden and Leiden University Medical Centre. The various doctors, technologists and researchers will pool their knowledge, in order to improve the health care service. This will involve everything from diagnosing, treating and recovering from illnesses, to caring for the chronically ill. Ultimately transforming the southern Randstad into a 'Medical Delta' is an ambitious project, but not too ambitious, according to Professor Ted Young, chairman of the HST taskforce. "We have a unique concentration of expertise within an 20-kilometer radius. Having the various disciplines working together means we can achieve a lot." Many TU Delft faculties develop interesting technologies for the medial sector. The Faculty of Applied Sciences has developed methods to help chemotherapy treatments focus more effectively on the 'sick', cancerous cells. The fluid dynamics developed at the Faculty of Mechanical, Maritime and Materials Engineering can also be applied to blood streams. And Industrial Design Engineering can design more efficient and ergonomic operating rooms.

More information:
Professor Ted Young, i.t.young@tudelft.nl;
www.hstresearch.nl.