

DELFT | NO. 2 | JULY | YEAR 38 |
OUTLOOK | TU Delft

Karin Slois
Alumnus
of the year

ON THE ROAD
TO TOKYO
Students prepare
for the Olympics

Delft in
space
A closer look
at satellites

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Drought





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 At the Faculty of Architecture, René
 van de Velde and René Hoonhout
 research the cooling effect of trees in
 the city. With trees in pots the water
 supply is important. They are testing
 the Aquabag, with which the water
 can seep slowly towards the roots.
 (Photographer Sam Rentmeester)

Foreword
Tim van der Hagen

Drought

The Netherlands is a beautiful country, but it needs a roof, we used to joke. The joke has worn a little thin since the droughts of recent years. Even though not all the climate models indicate increasing drought in the Netherlands, it is clear that changes need to be made to our water management in order to combat drought-induced subsidence and flooding in the future. Meanwhile, scarcity of water threatens no less than a quarter of the world population, a threat that will only increase under the influence of climate change. The harsh reality is that Wall Street has recently started trading in water in addition to oil and other raw materials, making water 'the new gold'. Drought. The spectre of this century, and also the theme of this edition, because the knowledge and ingenuity of TU Delft engineers can certainly mitigate. For example, as Professor Rudy Negenborn explains, ships' hulls can be fitted with inflatable floats to adjust their draught to the water level. Satellite readings can in turn help predict the best moments for sowing crops in Africa. Alumnus Mandy Korff working at Deltares is also using satellite images, to study damage to

foundations. And did you know that this year sees the launch of the fifth TU Delft satellite into space? Oliver de Gruijter graduated cum laude in 2014 with a self-cleaning water filter that fits on a jerrycan. His Jerry has now passed the prototype stage: this summer, over 100 examples will be tested in refugee camps in Iraq and Gaza. And if there is one alumnus who has influenced Dutch water management, it is Alumnus of the Year Karin Sluis. Besides her work at Witteveen+Bos, she was a member of the 'Top Team' of the Water & Maritime Top Sector. All these people are interviewed in this edition. Meanwhile, for our TU Delft top athletes, the road to the Olympic Games is also often a watery one. We wish every success to all our athletes, whether in indoor, outdoor or water sports. It promises to be a great summer for sport. But whether we end up facing a hosepipe ban, or getting wet feet on the campsite, I wish you all a splendid summer!

*Prof. Tim van der Hagen,
 President Executive Board TU Delft*

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 Theme drought



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Alumnus of the Year

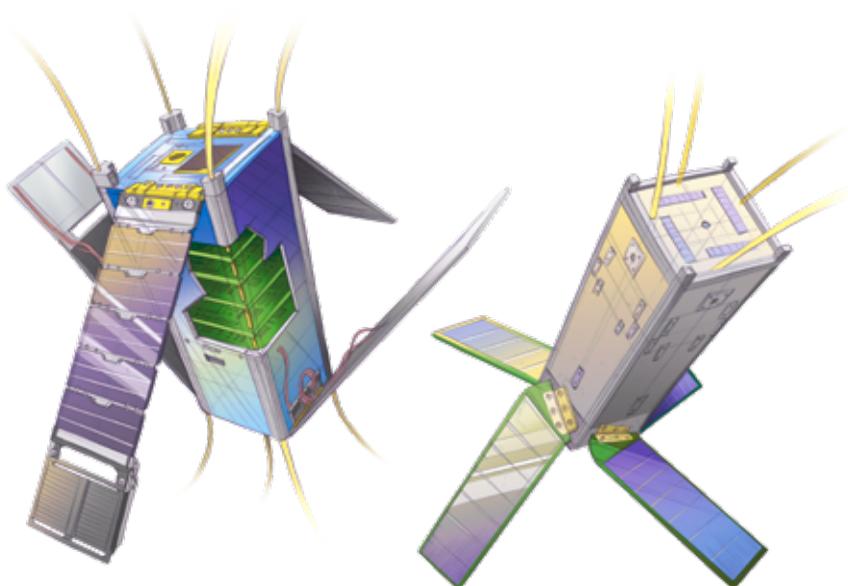
Karin Sluis, senior consultant and former director of Witteveen+Bos, has been voted TU Delft alumnus of the year 2021. What is her vision of talent development, the role of the engineer and the great challenges facing society?



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Delft satellites

If all goes well, two new TU Delft satellites will be launched into space this year. That brings the total to five. This is how they look like.



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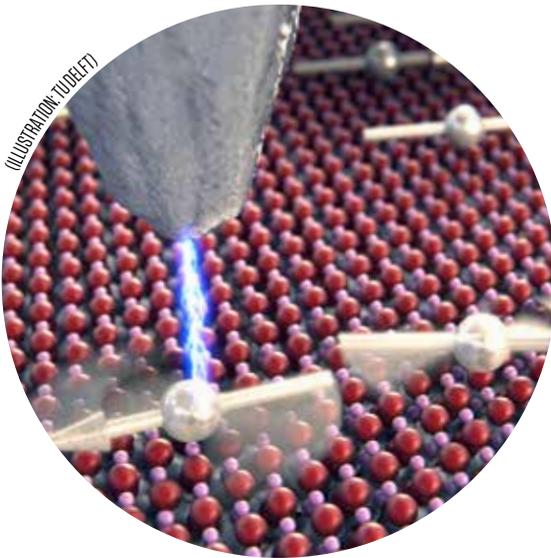
On the road to Tokyo

There are quite a few top athletes studying at the TU Delft. A number of them are preparing for the Olympics at the end of July. What motivates them and how do they combine with their studies?



DELFT IN BRIEF

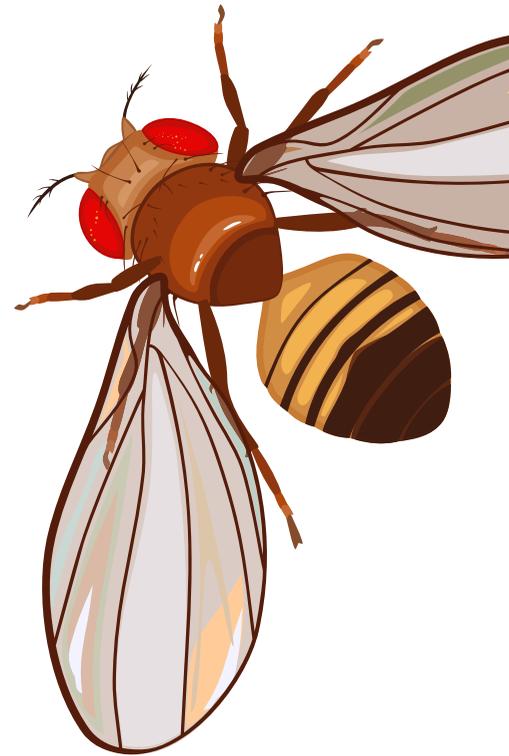
The QR codes refer to the longer articles.
 More science news on tudelft.nl
 and delta.tudelft.nl.



Atoms together

Material properties such as electrical conductivity, magnetism and superconductivity result from reactions between atoms. You could compare it with a choir: one person may be a good singer, but put 100 singers together and you get Giuseppe Verdi's compelling Chorus of the Hebrew Slaves. How macroscopic material properties arise from atomic

interactions is a fundamental question in physics. Prof. Sander Otte (Applied Sciences) and his research group recently shed new light on this phenomenon in their report of a remarkable experiment. Their experimental evidence of the mutual influence of atoms warranted publication in the authoritative journal *Science*.



Car park = power station

The renovated town hall of Dronten is heated by two heat pumps, however the roof is too small to generate all the energy required with solar panels. The roof of the adjacent car park supplies most of the energy (400 kWp). Electric cars can also top up their batteries with solar power. Researchers of Prof. Ad van Wijk's research group (3mE) developed a strategy to harmonise solar power and charging behaviour. PhD student Rishabh Ghotge is involved in this Solar Car Park, which is one of the few places in the Netherlands where solar power and electric cars have been combined at such a scale.





Smart fruit flies

Despite their tiny brains, fruit flies have a steep learning curve, discovered researchers of TU Delft's Smart Optics Lab and colleagues from Oxford University. They used a technique that may one day shed light on the origins of brain diseases in humans. Using advanced microscopy techniques, the researchers revealed how and where specific proteins are made that are used to record memories. The researchers described their findings this spring in the journal *Elife*.



Carbon tax

The corona crisis has made many of us experts in remote working. It may also help us to achieve a CO₂ neutral campus, says Professor of Climate Design & Sustainability (Architecture and the Built Environment) Andy van den Dobbelsteen. TU Delft aims to be CO₂ neutral by 2030. Van den Dobbelsteen is developing a roadmap to achieve this goal. The professor advocates the implementation of carbon taxes. "We have to put a price on our environmental footprint; €130 per tonne of CO₂ is realistic. You can fly to a conference in a faraway country, but only at a price. The money set aside as compensation can be used to fund projects to reduce the environmental footprint."



Delft knowledge to China



ILLUSTRATION: LIAM VANDIJK

This spring, platform Delta, revealed that knowledge developed at TU Delft may have found its way to the Chinese military. TU Delft researchers have been cooperating with the so-called Seven Sons of National Defence, a group of leading Chinese universities that have close ties with the military and specialise in themes such as aerospace and armaments, or so say Australian and American researchers. TU Delft has even signed cooperation agreements at the faculty or university level with four of the Seven Sons. In addition, at least 29 PhD students and guest researchers from the National University of Defence Technology (NUDT) have conducted research at TU Delft in recent years.





Did Van Leeuwenhoek cheat?

Antoni van Leeuwenhoek (1632-1723) is also known as the 'father of microbiology'. But he was not solely responsible for the breakthrough in microbiology. Tiemen Cocquyt, curator at National Museum Boerhaave, and scientists of the Reactor Institute Delft (members of the Dr Lambert van Eijck's Neutron & Positron Methods for Materials research group) used a neutron beam on a microscope to examine the lens more closely. The research revealed that Van Leeuwenhoek probably refined an existing manufacturing technique to make his lens, which he copied from a colleague, the British lens maker Robert Hooke. The results of the research appeared this spring in the journal Science Advances.



TU Delft researcher guides Olympic sailors



Dr Sukanta Basu (CEG) was previously responsible for producing detailed wind charts with hourly updates that TeamNL sailors used for training near Scheveningen. Making such wind charts for the Olympic sailing competition in Tokyo is challenging because of the geography: Mount Fuji, deep water and a 700-metre-high island. Basu uses the open-source forecasting programme WRF, which he has adapted to Sagami Bay, and he has the SurfSara supercomputer calculate predictions using weather data from the previous day. The computer makes a new calculation every ten minutes.



From apartment building to paradise



Team SUM (Symbiotic Urban Movement) has redesigned the 'walk-up' apartments in The Hague's De Dreef district for the Solar Decathlon 2022 university building competition. The neighbourhood is described by residents as noisy, prone to mould and dilapidated. Communal areas have now been created on the ground floor and the streets are free of cars. Galleries encourage social contact and the lack of internal stairwells means there is more space in the homes. The buildings also have two extra floors and solar panels on the roof. In October, the students will build a prototype in The Hague in preparation for the final in Wuppertal next summer.



Deborah Nas publishes book



Professor of Strategic Design and columnist Deborah Nas has written a book called *Design Things That Make Sense*, the first comprehensive guide to designing technology-based products and

services. The book answers questions like: Why do so many new technical products fail? What can accelerate the acceptance of technology? How can you design logical products? Nas has translated the knowledge she gained in her 25 years of experience as a designer, professor and thought leader in the field of technology-based innovation into practical design strategies. Alumni can get a discounted copy of the book at bispublishers.com/design-things-that-make-sense.html?id=230887966 o.v.v. TUDelft15

THEME

Drought

While the editors were discussing the theme for this July issue in the pouring rain, we received the news that after three years, the drought in the Netherlands is officially over. Good news, but we can't cheer too soon. A recent climate simulation by the Dutch meteorological institute KNMI shows that more evaporation and less precipitation will occur in the future. TU Delft is therefore continuing to work on solutions to the drought problem. Knowledge platform Deltalinks, for example, advocates more accurate indicators for measuring drought. And shipping professor Rudy Negenborn is preparing the inland navigation sector with a plan for innovations. Groundwater expert Mark Bakker, for his part, is trying to find out how subsidence can be stopped. Several researchers and alumni are also involved in initiatives to combat drought in the city. In the picture, an underground water storage facility in the Cromvliet Park in The Hague, a project by Field Factors.



And now for the weather forecast: more sunshine and evaporation

Forest fires, crop failures, inland shipping blocked, salt intrusion and soil compaction: these were some of the consequences of the extremely dry summers of the past three years.

The summer of 2018 took the crown and was placed among the top 5% of driest years on record by the KNMI, the Dutch meteorological institute. The summers of 2019 and 2020 were also drier than average. After years of drought, groundwater levels finally recovered this spring. All that rain was bad news for café owners; even after the corona measures were relaxed, they still had to contend with empty terraces for part of the spring. It was a blessing for the environment though.

CAUGHT IN THE MIDDLE

But we cannot afford to breathe a sigh of relief. Weather patterns are becoming more erratic due to climate change. A recent study by the the Dutch weather institute KNMI shows that we will need to prepare for more frequent and more severe periods of drought, although researchers say their prediction is tentative: while southern Europe is almost certain to become drier and northern Europe wetter in the

coming decades, the Netherlands is caught in the middle where it could go either way. However, the research points slightly more towards drought.

INITIAL PROGNOSIS

The KNMI's climate simulation indicates that, by the end of the century, we can expect an increase in air pressure over north-western

Europe every spring. That will lead to more sunshine and more evaporation, but also less precipitation. There are many uncertainties in these results, as the calculations have been based on only a single model, but they do give an initial prognosis. This prognosis is currently the subject of ongoing research while the scientists await the new climate scenarios that



National Park Loonse en Drunense Duinen, one of the largest shifting sand areas in Western Europe.

the KNMI expects to publish later this year.

The situation could become even more critical if less water flows into the Netherlands through the Rhine and Meuse rivers, the result of less rainfall and higher evaporation in the countries where these rivers originate. In combination with rising sea levels, this could lead to the salinisation of groundwater near the river estuaries. We will therefore have to use the available water much more carefully.

ECONOMICAL DAMAGE

The climate damage caused by recurring droughts costs the countries of the European Union about €9 billion a year on average, revealed a study by the European Joint Research Centre (JRC) published in May in the journal Nature Climate Change. By the

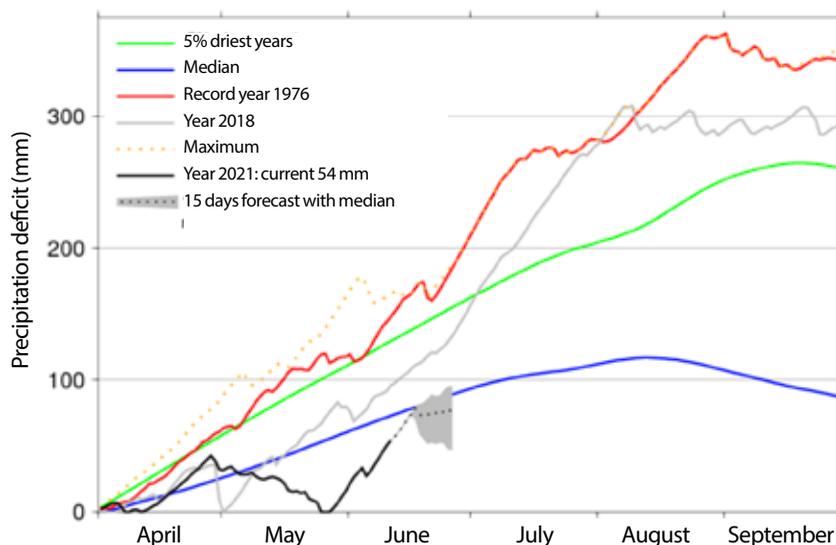
We will need to prepare for more frequent and more severe periods of drought

end of this century, the economic damage could amount to €65 billion a year. That is the outcome of a scenario in which we do nothing to reduce our greenhouse gas emissions and the temperature rises by four degrees by 2100.

If we manage to limit warming to two degrees, in line with the Paris Agreement, the damage will be limited to €25 billion a year. Of course, these too are rough estimates. The damage will mainly affect agriculture, but drinking water supplies will also suffer and houses will start to sink due to soil desiccation, for example.

Precipitation deficit in the Netherlands

Nationwide average over 13 stations



Precipitation deficit in the Netherlands

The black line in the graph above depicts the development of the precipitation deficit over time (in mm), averaged over 13 stations throughout the Netherlands.

A precipitation deficit applies when there is negative net precipitation. The green line (5% of the years) shows the course of the precipitation deficit that is exceeded in this period. The blue line (median) shows the deficit that is exceeded in 50% of the years. The red line shows the precipitation deficit during the extremely dry summer of 1976. In this graph, the calculation stops when the continuous deficit reaches zero and resumes as soon as a new deficit occurs. In principle, the calculation runs from 1 April (provided that there is a deficit) and in any case stops on 1 October. The curve will show a downward trend if the amount of precipitation exceeds the evaporation calculated during a given period. The quantities are rounded off to whole millimetres. The precipitation is measured once a day at 10:00 local time.

The following KNMI rain gauges were used in the calculations for the above graph: De Bilt, De Kooy, Groningen, Heerde, Hoofddorp, Hoorn, Kerkwerpe, Oudenbosch, Roermond, Ter Apel, West-Terschelling, Westdorpe and Winterswijk. (Source: KNMI)

The best way to measure drought

Following the dry summer of 2018, the Ministry of Infrastructure and Water Management established a 'Drought Policy Consultation'. Researchers recommended making better use of drought indicators in the future.



PHOTO: SAM BENTWEESTER

Rutger Weijers investigated the usability of drought gauges for his graduation research at Rijkswaterstaat.

Not all droughts are the same. Not only does the location matter, but also the duration and the extent to which the rainfall deviates from historical levels. In the

Netherlands, drought is expressed as precipitation deficit: the difference between precipitation (from April) and potential evaporation. However, this theoretical concept appears to be due for replacement; researchers point

out that it is precisely in periods of drought that evaporation drops below the potential level, because crops cannot get enough water. Drought comes in degrees. A shortage of rainfall is the primary cause, which

SPI, a universal drought index

The European Drought Observatory (EDO) uses the Standardised Precipitation Index to indicate the measure of drought. The SPI measures deviations in rainfall over a given period (1, 3, 12 or 24 months) compared to the long-term average over the same period. The SPI describes the deviation from the mean for a certain area, expressed as a standard deviation. Severe precipitation deficits result in an SPI below -1, while excessive rainfall results in an SPI above +1.

The number behind the SPI indicates the length of the period measured (in months) and also the consequences. SPI-1 to SPI-3 cover the 1-3 month period and concern soil moisture content, snow thickness and the drainage volume. SPI-3 to SPI-12 mainly reflect the amount of water discharged from the rivers and water levels in the reservoirs. SPI-12 to SPI-48 concern the longer term and mainly describe the effects on the major reservoir lakes and groundwater replenishment.

over time can lead to soil desiccation and damage to crops and nature. This is followed by a phase of ground and surface water depletion, also known as the hydrological drought. Hydrological drought can lead to damage to nature and infrastructure, for example in the form of soil compaction and stresses in gas pipelines. This is the prelude to the next phase of drought: the socio-economic drought that manifests in diverse human inconveniences and economic damage.

After the drought of 2018, hydrologists suggested various alternatives to the precipitation deficit as a measure of drought. They proposed using the Standardised Precipitation Index (SPI, see box), the groundwater level, river discharges and soil moisture content. Rutger Weijers tested the usefulness of these indicators for his graduation project at the Ministry of Infrastructure and Water Management. He reconstructed a dry summer from historical precipitation data and set two working groups to work on it. They had to decide what measures to take in response to the data that came in. One group had access to the new indicators, while the other did not. Weijers' research (conducted at the Faculty of Civil Engineering and Geosciences) revealed that the group using the new indicators was quicker to implement measures and maintained them for longer than the control group. TU Delft's DeltaLinks knowledge platform (flowsplatform.nl) sees opportunities for 'proactive drought management' using the new drought indicators, but more research needs to be conducted first. For example, more data is required on parameters such as soil moisture content. DeltaLinks also advocates using the SPI in the Netherlands, whereby it could potentially replace the theoretical precipitation deficit as an indicator for drought. 

Catch-22 in the Netherlands Antilles



PHOTO: GETTY IMAGES/VALENTINA CALATRAVA

Biodiversity on Curaçao and Bonaire is suffering severely from drought. The islands have never had a lot of water, and pressure on the scarce water resources has increased hugely in recent decades as tourism has increased. The countless goats that have grazed there since time immemorial have only made the situation worse. They eat all the vegetation, which leads to erosion. After a heavy downpour, the rainwater can barely penetrate the soil and much flows straight into the ocean. This summer, Dr Boris van Breukelen of the Water Management department (part of Civil Engineering and Geosciences) will lead a research project into the hydrology of the islands. The project is called SEALINK and nine PhD

students are working on it. The researchers want to find out where the groundwater seeps into the sea, how effluent from leaky septic tanks merges with that groundwater and so also reaches the sea and how this impacts the coral.

Measures to combat drought, such as reducing the number of goats, may actually aggravate the effect on the coral reefs, fears Van Breukelen; if the groundwater level rises, more pollution could flow into the sea. The islands face a potential catch-22 situation between drought and marine pollution. Hopefully, this study will identify possible avenues for solutions. 

sealinkcaribbean.net

When is the best time to sow wheat or maize? In Ghana and other countries in West Africa, this question used to be easy to answer: sometime in May, shortly after the second rain shower. Then you could be sure that the rainy season had begun and your plants would mature. But climate change means rainfall patterns are becoming erratic and unpredictable. “There is still 900

to 1,200 millimetres of rainfall annually, but it comes in heavier showers mixed with longer periods of drought,” explains Sehouevi Mawuton David Agoungbome, who is researching drought and agricultural techniques in West Africa as part of the research group of Nick van de Giesen, professor of Water Management (CEG). The best time to sow is now some weeks later, says the researcher, who is trying to understand the climate

using satellite measurements and weather stations. He uses models to simulate how the yields of various crops can be optimised. The research project is part of Twiga, an EU Horizon2020 project that is collecting geoinformation on weather, water and climate in Sub-Saharan Africa. The ultimate goal is that both farmers and the financial institutions that provide the loans can benefit from this information.

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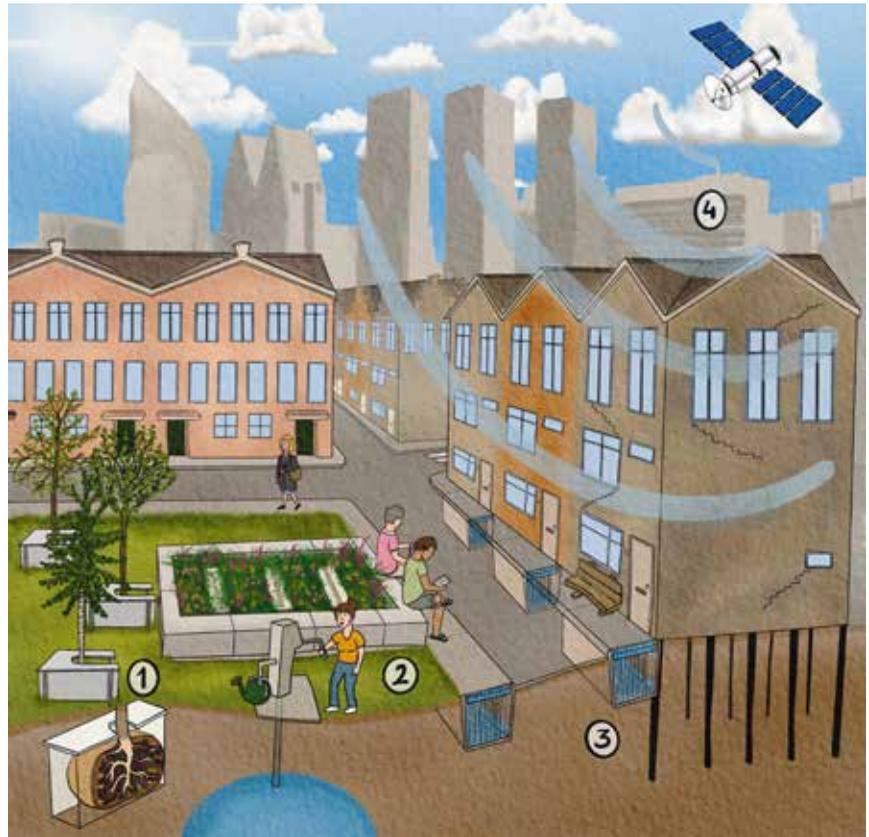
The best time to sow in Africa

Drought in the city

TU Delft researchers and alumni are involved in various initiatives and innovations to deal with the problem of drought in the city. Here are four examples:

1 Two climate arboretums in Delft and Almere have been established to find out how various tree models act to reduce heat stress. Each arboretum has 75 different trees equipped with sensors. “We measure parameters such as evaporation, air and radiation temperature and humidity,” says Professor René van der Velde. The trees in Almere are planted in the ground while those in front of TU Delft’s Faculty of Architecture are in special containers. “The containers are designed for easy assembly. They form a kind of sleeping bag that keeps the roots cool. A Spring Ring system (as used in the London Olympic park) uses an egg-box-like layer that prevents the roots from choking themselves.”

2 Alumna Mirthe Snoek works for Field Factors on Bluebloqs: green systems especially developed for urban areas that reduce both heat stress and flooding. Rainwater is collected, treated and reused. “The visible part is a biofilter: a compartment containing a special mix of plants and sand in which rainwater is treated. An underground water storage system makes the water available for reuse. The system has been installed in the Netherlands, Belgium and Spain, with each location having a different setup.” For example, the Urban Water Buffer in Spangen,



Rotterdam, stores rainwater that is used to water the football club Sparta’s sports fields. The rain garden at ground level reduces heat stress on hot days through the evaporation of rainwater, while local children can play in a special water feature.

3 Movares’ Rainroad is a reservoir for reducing heat stress and floods. The lower reservoir stores excess rainwater during heavy showers, while the water in a smaller reservoir directly under the paving evaporates in hot weather, so not all the sun’s energy is converted into heat. Any overflow of rainwater simply infiltrates into the soil. Alumna Rinze de Vries: “The process of capillary action, which you also see in trees, ensures the upper reservoir is replenished with water from the lower reservoir. A prototype on the HittePlein (Heat Square) on the TU Delft campus is being used to study

the capillary action of quartz sand and wicks in tubes.”

4 Alumna Mandy Korff, of TU Delft and Deltares, is studying the influence of drought on various types of foundations, such as wooden pile foundations and shallow foundations. She uses satellite images and subsurface and groundwater data to predict which areas are prone to foundation damage due to drought and create maps of these areas. “Parties can then use targeted measures, such as replacing the foundations or stabilising the soil through active groundwater management,” she says. Korff and her colleagues at Deltares have created drought maps for the climate damage atlas (climatedamageatlas.com) and the recently updated climate impact atlas (klimaateffectatlas.nl/en/).

Will cows still be able to graze outdoors?

Satellite measurements reveal that the soils of Zuid-Holland are subsiding rapidly at about one centimetre per year. What is going on and can this trend be stopped?

According to Prof. Ramon Hanssen of the Faculty of Civil Engineering and Geosciences (CEG), the peatlands have been subsiding at a rate of between 0 and 2 cm per year for about the last 800 years. His research group provides the data used for the Dutch soil subsidence map. The first land reclamations that took place many centuries ago marked the beginning of this subsidence. The upper layer of the sodden peat dried up, started to rot, and shrank. After a time, water started to infiltrate these areas and the water level had to be lowered further. “There are polders in Delft where eight metres of soil have disappeared,” says Hanssen.

HUMAN ACTION

The fear is that this process will be accelerated by drier summers, leading to lower groundwater levels and exposing a thicker layer of soil to desiccation and compaction. In addition, the process of desiccation releases carbon dioxide and methane; about 1 to 2 per cent of the national greenhouse gas emissions. After a dry, hot summer, the groundwater level can be as much as half a metre to a metre lower than normal, says groundwater expert Prof. Mark Bakker (CEG). The question for the water authorities is always: will the groundwater level be replenished by next spring? This is by no means guaranteed, because the rate of replenishment is slow. On average, 80



PHOTO: SAMREINMEESTER

centimetres of rain falls each year in the Netherlands, about half of which ends up in the groundwater, while the rest flows to the sea or evaporates. To predict the groundwater level, Bakker

The droughts of the recent summers have increased this conflict of interests between nature and agriculture

collaborated with the consultancy firm Artesia and the University of Graz to develop a software package called Pastas. “Pastas can be used to

determine whether a reduction in the groundwater level was caused by less rainfall and more evaporation, or, for example, by extracting groundwater or lowering the surface water level,” explains Bakker. According to Bakker, the desiccation of the peatlands of Zuid-Holland is mainly the result of human activity, and particularly drainage.

Farmers are hindered by high water levels and use drainage pipes installed under their fields to lower the groundwater to 70-80 cm below ground level and so improve the growth of grass and allow cows to graze and heavy machines to drive over the land.

GRAZING COWS

However, the groundwater level subsequently also falls in nearby nature areas, to the detriment of the sometimes rare flowers and plants that grow there.

The droughts of the recent summers have increased this conflict of interests between nature and agriculture. More than ever, the water authorities have become a political arena where the goals of agriculture and nature conservation are at odds. Will cows still be able to graze in the meadows if the groundwater level cannot be lowered? “Maybe the typical Dutch landscape with a farm and cows grazing along a canal will disappear,” muses Hanssen. ■

New ideas for inland shipping

Extremely low river levels are increasingly common in the summer as prolonged droughts during the European spring leave the major rivers narrower and shallower. The inland shipping sector has adapted by carrying less cargo and seeking the deepest channels. But there is a smarter way, says Rudy Negenborn.

Last year, the European Commission awarded Prof. Rudy Negenborn of 3mE's Maritime & Transport Technology department almost €9 million for his Novimove research programme (Novel Inland Waterway Transport Concepts for Moving Freight Effectively). The goal is to increase the capacity of transport over water by 30% in 2030 compared to 2010. Transport by water has much lower CO2 emissions than transport by road, but the capacity of inland shipping is not being fully utilised due to poor connections and inefficient use of the available information.

"We plan to optimise transport over water along the entire corridor from Antwerp and Rotterdam to Basel," says Negenborn. "We are examining three different things: ship design, smart navigation and logistics, i.e. which ship do you use for which cargo? Fluctuating water levels can have a major impact on what can and cannot be transported by water, and on the



PHOTO: SAMRENTMEESTER

capacity of ships. One idea is a new ship design with inflatable floats on the side that reduce the draught." What does he expect will be the most tangible outcome of the research? "In four years' time, we will have a

'One idea is a new ship design with inflatable floats on the side that reduce the draught'

system that allows us to determine which combination of innovations will bring the most logistic improvements, whereby simulations will allow us to demonstrate the benefits of the innovations. We will also have two 'demonstrators': a smart lock planning

system (based on the communication between a lock and a ship), and a scale model of a vessel type with adjustable draught."

TU Delft joins 21 other parties in the consortium: knowledge institutions, transport companies, port authorities and technology developers. "We can now continue to develop many of the ideas for fundamental research in the department with our external partners," says Negenborn. The Novimove programme is one of four research programmes in the field of inland shipping innovation funded by the European Horizon 2020 programme. The programme started in the middle of last year and will run for four years. Research leader Negenborn expects the first public demonstrations in the course of 2022.



Jerry makes drinking water safe

One effect of a drought is a shortage of clean drinking water. In 2015, graduate Olivier de Gruijter developed a self-cleaning drinking water filter that fits on a jerry can. Soon over a hundred 'Jerrys' will be sent to refugee camps in Iraq and Gaza.

After graduating from the Faculty of Industrial Design Engineering, Olivier De Gruijter continued to develop innovative water filters to provide a solution to the water problems of today. A research trip to India inspired him to come up with the idea of combining a jerry can with a water filter. "I was shocked at how many children suffer from dehydration or diarrhoea due to drinking contaminated water, often with a dreadful outcome," says the IDE alumnus. "Diarrhoea is one of the leading causes of death in children under five years old here." According to the World Health

Organisation (WHO), over 780 million people worldwide have no access to clean drinking water. As a result, one and a half million people die every year from water-related diseases.

De Gruijter received the Dutch James Dyson Award, for his design of the Jerry. The ensuing publicity brought him to the attention of the development organisations.



In its current form, the Jerry is an approximately 30-centimetre-long cylinder with a screw top that fits onto a jerry can. It is operated with a hand pump. The filter cleans itself by diverting 20% of the pumped water back through the filter. The filter membranes, which are also used for kidney dialysis, have pores of 0.01 micrometre and are impervious to bacteria and viruses.

Field testing started in June with 100 water filters in Iraq and 30 in Gaza. Employees of Oxfam Novib and Cesvi will track the users' experiences for a six month period. De Gruijter hopes to use the results to optimise his design before mass production starts. Now that the technology has more or less matured, attention is shifting to the business model, a market strategy and the question of how to get the Jerry to people who can barely pay for it. To this end, De Gruijter is cooperating with partner Eise van Maanen, who used to work as a financial consultant in the water sector. 

Water walk through Delft

What have the Delfland Water Authority, IHE Delft (Institute of Water Education) and TU Delft degree programmes like Water Management and Applied Earth Sciences been doing to keep Delft dry? Find out during the water walk, a tour through Delft central city.

The route is based on the map drawn by brothers Jacob and Nicolaes Kruikius 1712, commissioned by the Delfland Water Authority. The Kruikius map was drawn using measuring instruments such as the Hollandse Cirkel (a device for measuring angles) and a fixed-length surveyor's chain. It displays all the dikes, polder embankments, locks, ring canals, polder drainage channels, windmills, bridges and the plot boundaries in the area. 

You can download the tour on the website of VVV Delft.



View

We have learned to deal with flooding in the built environment, says hydrologist Dr Frans van de Ven (CEG and Deltares), but we have less experience with drought. He thinks it is time for that to change.

“**T**he problem with drought is that, unlike flooding, it does not cause much acute visible damage. The most well-known problem is the rotting of wooden pile foundations and the damage this causes to

buildings. But that only comes to light after many years. The same applies to the effect of drought on subsidence: droughts cause subsidence, but the change occurs very slowly. Water quality also deteriorates during a period of drought, but you only notice this when you are no longer able to swim due to blue-green algae or become ill from swimming in polluted water.

Droughts exacerbate heatwaves in urban areas because the city cannot get rid of its heat through evaporation. The heat also causes more deaths from cardiovascular diseases and other ailments, and the mortality rate in a hot summer is much higher. And then there is the stability of the peat dykes – an example is the flood in Wilnis – and the increased fire risk due to dried-out urban greenery.

Droughts have many consequences, but only a very few people are sufficiently aware of them. We have discovered that our society is not equipped to deal with drought in the built environment.

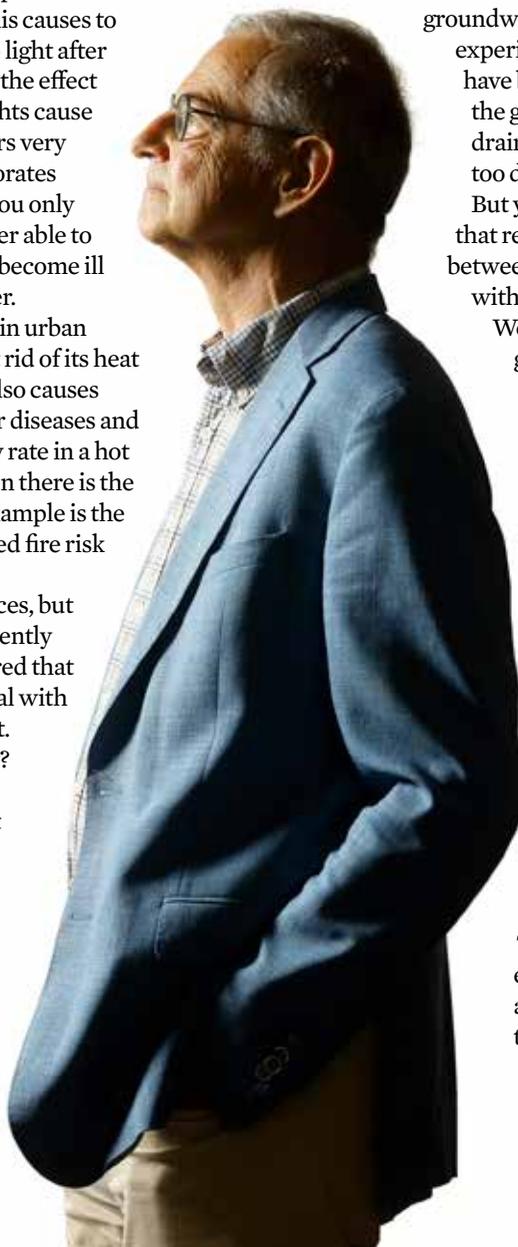
How can we get water to the city? How can we keep water in the city? During a drought, you want the water in Delft's canals and the groundwater to remain at a certain level, and maybe you want to water the public green spaces. With the advent of increasingly hot summers, the need for irrigation is growing. Hopefully, we will not try to solve this using drinking water.

But how otherwise? We are currently trying to get the research programme Drobe (Drought in the Built Environment) off the ground. We want to retain water in surface water catchments and in aquifers with active groundwater level management. We are currently experimenting with this in rural areas. Trials have been conducted in urban areas to replenish the groundwater with surface water via reverse drainage, to ensure that the water does not sink too deep and that the plants can hold on to it.

But you can control this more intelligently and that requires research. You need to find a balance between high and low; you don't want to end up with water in your basements.

We also want to know to what extent active groundwater level management prevents subsidence. There are many research questions involved. And then there are the drinking water reservoirs, which are in danger of drying up due to droughts. There was a severe shortage of drinking water in South Africa last year. In the Netherlands, we pump drinking water from areas outside the city, but that also has consequences.

According to the Delta Programme, Dutch cities must be climate resistant by 2050, which also means they will have to also be drought and heat resistant. That goal can only be achieved if you know how to go about it. So the universities all face a major challenge ahead, particularly TU Delft with its expertise in civil engineering, architecture, public administration and drinking water treatment.”





‘I want to
bring the worlds
of sustainability and
finance together’



Karin Sluis, senior consultant and former director of Witteveen+Bos, has been voted TU Delft alumna of the year 2021. What is her vision of talent development, the role of the engineer and the great challenges facing society? “Diversity gives you strength and makes you better,” she says.

TEXT FLORINE KONING
PHOTOS SAM RENTMEESTER

CV

Karin Sluis studied civil engineering in Delft and specialised in hydraulic engineering. After graduating in 1989, she joined Witteveen+Bos as an urban water management specialist. Over the years, she has held various managerial positions with this international consultancy and engineering firm in the fields of water, infrastructure, environment and construction. In 2013 she was appointed managing director. In keeping with a company rule, she resigned as managing director in the year she turned 55. She is now a senior advisor and closely involved in the company's strategic development, for example developing sustainable investment portfolios. In addition to her work at Witteveen+Bos, Sluis was a member of the 'Top Team' of the Water & Maritime Top Sector. She is currently a member of the Council for the Environment and Infrastructure, a member of the board of NWO's Applied and Engineering Sciences domain and a member of the Supervisory Board of Saxion University, among other things.

Congratulations! You were voted alumnus of the year. Did you see that coming?

"It was a complete surprise! I was on holiday, briefly browsing through my mail. Then I saw a message from Rector Magnificus Tim van der Hagen. I had heard of the title, and of the walk of fame. I am delighted that I will be included. TU Delft, and certainly civil engineering, are dear to my heart."

How did you end up in Delft?

"My children have to laugh when I tell that story. It's like this: as a teenager, I had a poster of the Golden Gate Bridge in San Francisco above my bed. It was given to me for my fourteenth birthday by my father, also a TU Delft engineer. Looking at the poster, I thought: 'That's what I want to do: build bridges!' For me, the Golden Gate Bridge is the ultimate symbol of the work of civil engineers: making useful, durable and beautiful things. It's useful, because over 100,000 vehicles pass over it every day. It's durable, because it opened in 1937, so it has been around for a long time. It's beautiful, because more than ten million tourists come to admire it annually, twice as many visitors as the Efteling theme park gets. I also wanted to make useful, durable and beautiful things, so I started at TU Delft in 1983. Incidentally, I only visited the bridge myself just a few years ago."

We actually planned to avoid the subject of women and glass ceilings, but... When you started in 1983, were you one of the few women?

"There were just a couple. There are more today. I see that reflected at Witteveen+Bos, where I have been working for 32 years. I recently saw an organisation chart from around 1990. There were almost no women in the company. Today a third of my colleagues are women. And there are more and more female engineers."

How did your career begin?

"During my studies, I did an internship at a small engineering firm in Portugal. I really enjoyed it. There I combined scientific thinking with a commercial environment. My graduation research in a Shell laboratory in Rijswijk was quite theoretical. That's when I decided I would rather join an engineering firm. It was difficult to find a job in those days, but I wrote to three firms and was invited for an interview at all three. Two said: 'We will keep you on our files, and if we have something you'll hear from us.' The third firm, Witteveen+Bos, said: 'We think you fit our company. We would like to offer you a one-year

contract and if we have not found a position for you after that time your contract will end.' I'm still working there!"

How does the company deal with young talent today?

"The company is more well known for talent development than when I started. We pay a lot of attention to facilitating employee education. Each year we have about 300 students doing internships and graduation projects, including from TU Delft. The students bring new knowledge and fresh energy to our company, which is inspiring."

How has your work changed in recent decades?

"Witteveen+Bos is 75 years old. You can see societal challenges reflected in all phases of the business. Witteveen+Bos was established in 1946 and focused mainly on reconstruction projects following the Second World War. In the 1960s, the first environmental issues were recognised and we worked on the first wastewater treatment plants. The themes of the last ten years have been the energy transition, climate adaptation,

'The loss of biodiversity really concerns me'

water management, healthy cities and circular construction. These are all fully in line with the United Nations' Sustainable Development Goals of 2015, all things we were not concerned with 30 years ago.

In line with this, the way we cooperate has also changed enormously. Before, an engineer would do 'what he thought was good for you', but now engineers cooperate much more with ecologists, spatial planners, sociologists and end users. As an engineering firm today, we are really part of society, working with society to find solutions. If we want to work on a road through a city, we talk to the residents and businesses first. If we need to strengthen a dyke, we work together with anglers. Working together leads to better solutions. Diversity gives you strength and makes you better."

When did you discover that?

"When I started as director in 2013, I visited a conference of European engineering firms. I came back with three goals: sustainability, digital transition and diversity. The message of the conference was that a company has to have its own



vision of those three goals to be successful in the long run.”

How does diversity manifest in your company?

“We believe that we come up with better solutions when we look at a problem from different angles. So we ensure we build diverse project teams. We also believe that everyone deserves the same opportunities. Our appointment procedures are open to everyone and we have made agreements concerning languages. We have learned that, though it takes time and energy to understand each other, in the end it leads to a finer company that offers better solutions and where you can learn more.”

In 2018, you were named ‘CEO of the year’ among European engineering firms. You were hailed for attracting young people to the company and increasing the profit margin.

“We have put extra energy into reaching young people, but not necessarily only to achieve more growth. Growth and profitability are the results of what you do, not goals in themselves. I wanted our company to help find solutions to major societal challenges. The United Nations’ sustainable development goals tell us what challenges we are facing as a world. There are seventeen goals and more than half are things that involve us as engineers, such as the energy transition, sustainable production, cities, water, etc. With four thousand projects a year, we can contribute greatly to those goals.”

What ties do you have with TU Delft?

“For an engineering firm to come up with good solutions, you have to stay up to date with the latest knowledge. TU Delft provides some of that knowledge. I keep in touch with various professors and the dean, so that we can keep up with the latest knowledge and apply it in practice.”

You are no longer a director, but a consultant. Why?

“The articles of association of Witteveen+Bos state that you have to step down as director when you reach the age of 55. I am often asked why that is. The idea behind it is that you can contribute to the further development of the business in another position. I am happy to deploy my knowledge and experience for a better future, without the responsibilities of a director.

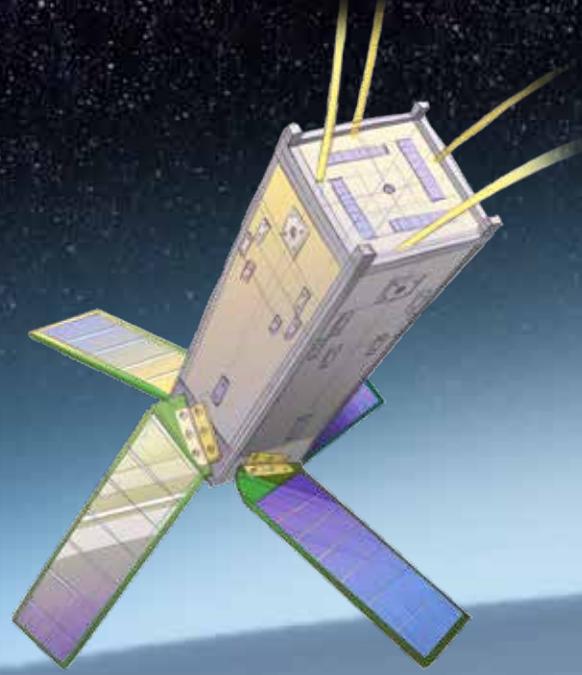
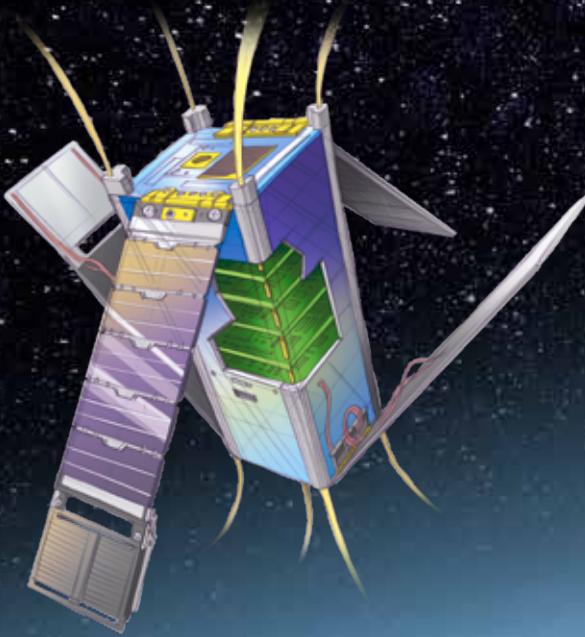
This age rule allowed me to sit on the Council for the Environment and Infrastructure. It’s not about prestige; I’m more interested in having a council of experts that advises the government about our environment and infrastructure. It is important that engineers contribute to these ‘clubs’, or more correctly, public bodies. After all, it involves our field of specialisation, and I’m keen to have a say.”

What topics do you want to see on the agenda of the Council for the Environment and Infrastructure?

“I provided support to the ‘Reviewing nature policy’ project. The loss of biodiversity really concerns me. If we can increase biodiversity while simultaneously solving the housing crisis, then I would love to contribute to that. The infrastructure also poses a major challenge; many bridges and roads need to be renovated, but how can we make this part of a circular economy and at the same time restore biodiversity?

Major societal challenges such as climate adaptation and biodiversity require lots of money. I have just finished a round of talks with bankers and pension providers. They are really keen to invest in sustainable projects, but they are not enough. My ambition is to bring the worlds of sustainability and finance together, for example with a project that combines nature reserves with renewable energy. There must be a business case: decent pensions must go hand in hand with a real contribution to sustainability. Only then will it really be sustainable.”

DELFT IN



If all goes well, two new TU Delft satellites will be launched into space this year. Time for Delft Outlook to take a retrospective of all five of the university's satellites.

Delfi C3

Launch: 28 April 2008 | 34x10x10 cm
2.2 kg | 2.4 Watt | still active

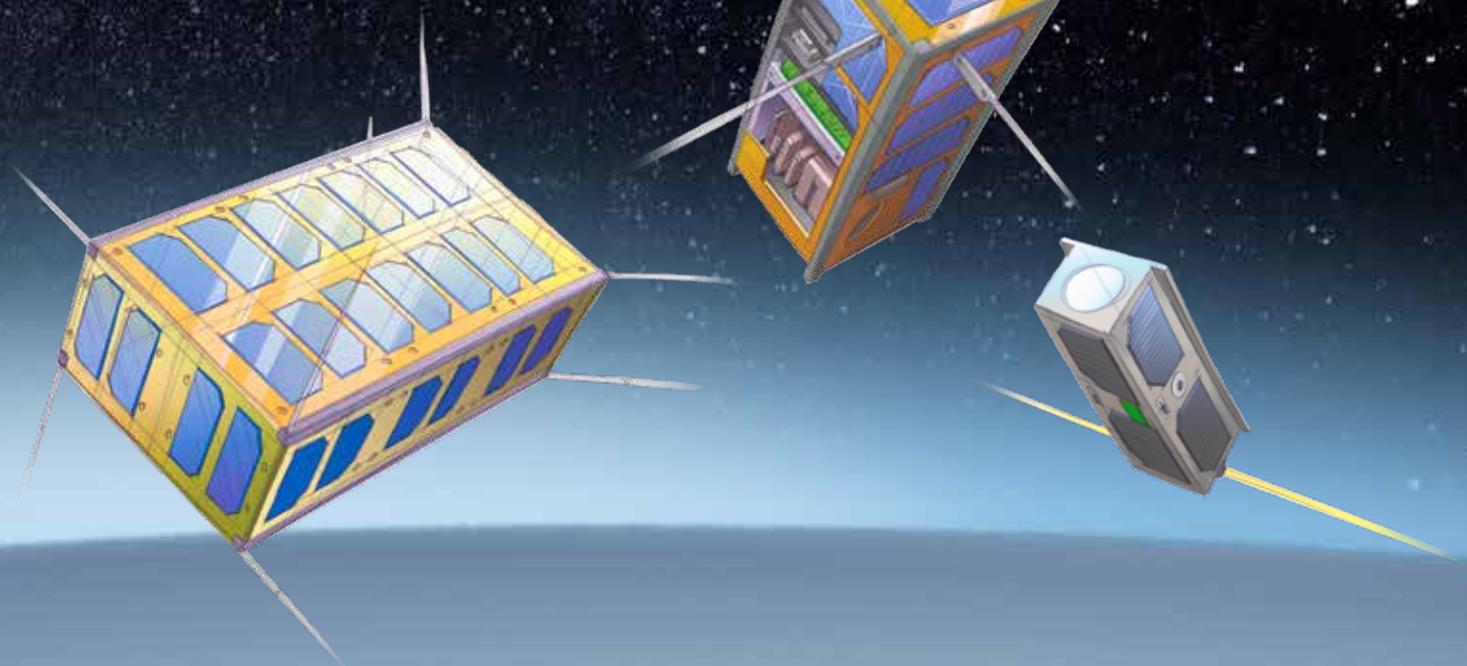
The first TU Delft nanosatellite was composed of circuit boards built into three cubic modules (CubeSat) with 10-centimetre ribs. The project was the result of intensive collaboration between EEMCS and AE with engineers Chris Verhoeven and Rob Hamann as project leaders. On board are two wireless solar sensors by TNO, four sets of thin-film solar cells by Dutch Space (now Airbus Defence and Space Netherlands bv) and an advanced communication unit. There is no battery (to avoid expected issues). Interesting fact: the antennas are made from tape from a metal tape measure.

Delfi n3Xt

Launch: 21 November 2013 | 34x10x10 cm
2.8 kg | 5 Watt | back to life

The main difference between Delft-n3Xt and its predecessor Delfi-C3 is the active position control. Whereas Delfi-C3 is a 'free-falling' design, Delfi-n3Xt uses a system of sensors and actuators to control its position and point an antenna to the ground station for fast data communication. Delfi-n3Xt has a micro-propulsion system produced by TNO and small rod-shaped electromagnets called magneto-torquers that allow it to cling, as it were, to the field lines of the Earth's magnetic field. After a seven-year radio silence, Delfi-n3XT came back to life last February.

SPACE



BRİK II

Launch: June 2021 from under an aircraft by Virgin Orbit | 30x20x10 cm | < 10 kg

To be quite clear: BRİK-II was not built by TU Delft. But it is a Delft achievement in the sense that the Delft-based CubeSat specialist ISISpace designed and built it for the Dutch Air Force and is also responsible for the launch. The payload includes a scintillation monitor that measures plasma conductivity, a source of GPS interference, at 550 km altitude. The Ministry of Defence developed a kind of ‘space mailbox’ on which messages can be left. Finally, NLR developed a directional receiver for determining the position of military systems.

Da Vinci satelliet

Launch: spring 2022 | 20x10x10 cm
2.5 kg

Helped by the Space Systems Engineering research group, students of AE’s VSV ‘Leonardo Da Vinci’ study association designed a satellite to mark the occasion of their 75th anniversary. They designed the satellite for educational use. Primary school children can experiment with a dice machine with floating dice made by the Leiden School of Instrument Makers. Secondary school pupils can see how a sent file is damaged when the memory card is hit by radiation at an altitude of 500 km. The students won a prize of €15 thousand from the Delft University Fund and have started a crowd funding campaign to finance the launch next spring.

Delfi PQ

Launch: spring 2021 | 17x5x5 cm
0.6 kg | 1 Watt

The Pocket Cube (PQ) is the superlative among nanosatellites. It has even less mass and power, but still has various experiments on board, explains Dr Stefano Speretta, who runs the project together with Dr Alessandra Menicucci. The Delfi PQ uses accelerometers and three mutually perpendicular electromagnets for active position control. Laser reflectors on board allow the distance from Earth to be determined to an accuracy of 3 cm, which is useful for calibrating radar measurements. The next step is to build a swarm of satellites that together provide greater coverage and capabilities than are possible with separate CubeSats.

IN PERSON

Former Industrial Design student **Cora Man** has been awarded the Marina van Damme Scholarship worth €9,000. The Delft University Fund awards this scholarship each year to a young female engineer to help them develop further. The jury praised Cora Man for the ‘challenging career switch’ she made within the Rotterdam-based company Asha International, where she has worked since graduating in 2014. She plans to use the scholarship to take a Master’s in Business Administration (MBA).

TU alumnus **Jan van der Tempel** and two other inventors have made the finals of the European Patent Office’s European Inventor competition. He developed the Ampelmann gangway, which offers safe passage between two ships or between a ship and a platform, even in heavy seas. Some 65 systems have been deployed worldwide since production started in 2007 and they have since transferred an estimated six million offshore workers and 17 million kilograms of cargo.

Student projects **Reef Support** and **Da Vinci Satellite** have been awarded the Ambitious Idea grant by the University Fund. Reef Support uses satellite data to help coral farms protect reefs more effectively. They will use their prize of €15,000 to build an open-access platform. The Da Vinci satellite team wants to take a satellite into space for educational purposes and allow schoolchildren access to the satellite.

Tijo Collot d’Escury has been appointed Chair of the Supervisory Board of TU Delft as of 1 July 2021. Collot d’Escury studied chemical engineering in Delft. He started his career in 1994 with the consultancy firm Arthur D. Little and was then made managing partner at Roland Berger in 2002. Collot d’Escury was a member of the Supervisory Board of that firm from 2003 to 2010 and of the Global Executive Committee from 2010 to 2020.

Consider the impact of technological innovations

Keeping our planet liveable involves major challenges, and drought is one of them, as you can read in this edition. Technology offers solutions to many problems, but ironically, many of today’s global issues are caused by the negative side effects of older technologies; technologies which we used to think had only benefits. The internal combustion engine and oil refining have given us enormous freedom of movement, but are now making a significant contribution to climate change.

The transistor made computers and consumer electronics possible, but now it has led to the depletion of scarce raw materials and huge mountains of non-recyclable e-waste. The internet and algorithms enrich our lives, but also result in increasing surveillance and the creation of overly powerful Big Tech companies. In practice, technological innovation can turn out to be a double-edged sword. Are we learning enough lessons from this?

Admittedly, it is incredibly difficult to predict the undesirable side effects of innovations. Two years after its invention, I attended a bitcoin event for the first time.

Everyone, including myself, was fascinated by the potential social value of a decentralised currency.

I did not foresee at the time that bitcoin would become an energy-guzzling speculative financial instrument far-removed from the socially relevant means of payment it was intended to be. Now,

more environmentally friendly alternatives are in the making, such as TU Delft’s digital euro. These alternatives can be

seen as interventions to nullify the design flaws of earlier concepts. Fortunately, we are now considering ways to predict the potential negative side effects of new technologies at an early stage. TU Delft occupies a unique position here, in line with its ‘Impact for a better society’ strategy. A few years ago, multidisciplinary teams started thinking about the possibilities and risks of quantum internet and quantum computers. Responsible innovation is key: what can we do to maximise the positive impact and minimise the negative impact? The allocation of €615 million by the National Growth Fund to Quantum Delta Netherlands will enable us to conduct scientific research into the legal, ethical and social aspects of quantum technology together with other universities. We will also be starting a Quantum Living Lab in Delft, where we will educate and help companies to responsibly apply quantum technologies in new products and services.

At a technology level, we seem to have learned from the past. At a product level, every company and every engineer will have to take personal responsibility. Therefore, I call on you to extrapolate the success of your future innovations to absurd levels and ask yourself: what will the consequences for society and our planet be if everyone on earth starts using our product? You will be amazed at the insights this provides.

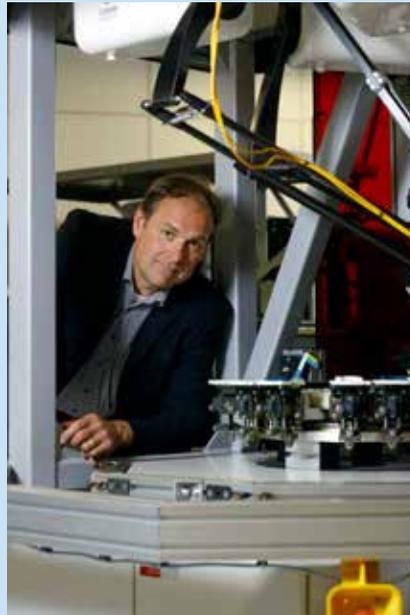
Deborah Nas is an innovation expert and part-time Professor of Strategic Design for Technology-based Innovation at the Faculty of Industrial Design Engineering. She studied Industrial Design Engineering at TU Delft.



THE FIRM

The founder of The Bicycle Repair Man, Marc Evers, is in charge of several high-tech service companies and coaches start-ups in his talent factory.

Bring together engineering service companies and start-ups in a warehouse in Geldrop, and you get a highly energetic and innovative cross-fertilisation, where every idea can be immediately converted into a prototype or production line. With this idea in mind, Marc Evers started his new company The Bicycle Repair Man (TBRM) in 2019. "I've spent my entire career in high-tech engineering and have always owned companies," says Evers. "This model that combines engineering companies with start-ups had been an idea of mine for some time, so when I turned 50 I decided to do it." Evers calls himself an initiator and a leader. "The ideas for start-ups come from the market or the engineers in our service companies," he continues. "The



Marc Evers took his inspiration from Monty Python.

'Development doesn't stop and your idea can be made right away'

start-ups mainly focus on developing machines for production. For example, Industrio, a small company, builds large industrial printers. They are currently used to produce shoe soles and dental braces. The start-up Fast Micro makes scanners that measure pollution caused by the microelectronics production." The aim is for the start-ups to develop rapidly. After three years, whether they are successful or not, and whether they grow to ten employees or a million euro turnover, they have to leave the premises.

Company: **TBRM (The Bicycle Repair Man) Group**
 Product: **High-tech incubator**
 Founded in: **2019**
 Degree programme: **Mechanical Engineering**
 Employees: **120/130 (60/70 in service companies)**
 Revenue: **6/8 million service companies, 6/8 million start-ups**
 In five years' time: **"TBRM will be a solid brand, with the same model up and running in the USA and Asia, each with around 150 employees."**

The concept works, says Evers. Not spending too much time theorising and analysing, but instead quickly testing ideas in practice, keeps up the pace. "If a prototype is needed, our Protoshop is only a few metres away, while the staff in our assembly plant can manufacture any parts. That way, development doesn't stop and your idea can be made right away."

Evers is happy with his new company. "I'm doing what I do best, supported by the energy of the youth. Many new inventions are conceived here. It offers perspective to people who really want to get things done. Because we all work together in one place, we have a lot of contact. Employees can ask each other anything and cooperate on projects, sometimes even visiting customers together."

They are growing faster than Evers expected. "It was supposed to be up and running in five years, but now after 18 months we're already on our seventh start-up. The idea is to take this model to the United States and Singapore as well."

The engineering branch of TBRM consists of four service companies: an engineering firm, a secondment agency, a protoshop and an assembly and testing company. In addition, the incubator currently supports six start-ups: the previously mentioned Industrio and Fast Micro, Addcat (metal printed catalysts for air cleaning in aircraft and animal barns), Prespective (Digital Twin software), CatIP (IP licences for using catalysts) and Designo (software for scanning 3D printing designs). **006**

Delft's digital euro: the sustainable alternative to Bitcoin

The price of bitcoin has been breaking records since the start of the year. The rising value has attracted many new investors, because nobody wants to miss the boat. The Delft Blockchain Lab recently presented a sustainable and hybrid form of crypto currency: the Delft digital euro.



Dr.ir. Johan Pouwelse, scientific director of the Delft Blockchain Lab, emphasises that money transfers form part of an essential infrastructure that belongs in public hands.

It is estimated that around 700,000 Dutch people now own bitcoin or other cryptocurrencies. It seems the ideal piggybank, especially

when savings accounts are yielding so little. But what are these cryptos anyway? How do they work, what can you do with them and is the future of money digital?

Cryptocurrencies originated in 2008, when Satoshi Nakamoto – the pseudonym of a hitherto unknown person or group – invented Bitcoin. The starting point was a digital

currency that was not issued or managed by a central bank, but by a network of users.

While banks use a traditional central database to transfer money from one account to another, Bitcoin uses its own decentralised database: the blockchain.

A blockchain is a transaction chain of data shared within a network of individual and independent parties. Transactions stored in a blockchain cannot be deleted or modified and this allows secure transactions to take place between various parties without the need for a central party such as a bank.

Unsustainable

“You can see blockchain as the accounting system for all bitcoin transactions,” explains crypto fanatic and aerospace engineering student Marco. “That accounting system consists of a list that is made up of blocks of information. Whenever a bitcoin is added or traded, all computers will register this new information.” Such a transaction line is created every ten minutes and is

The amount is sent from the one phone to the other without the use of Wi-Fi or other wireless networks

only officially entered into the system (blockchain) when all computers have registered the transaction as such. “This makes it the most secure and transparent payment system in the world. Every transaction is checked by hundreds of thousands of computers and is publicly available, so anyone can see it.”

This method is very safe, but not very sustainable. Transactions are recorded in the blockchain by means of hugely complex calculations. One transaction costs the equivalent of over 600 kWh of electricity. Mining Bitcoin

costs about 121.36 terawatt hours per year, which is more electricity than all of Argentina (121 terawatt hours) and the Netherlands (108.8 terawatt hours) consume, Cambridge University calculated. And even higher consumption is possible, because the greater the value of bitcoin, the more complex the calculations and the more computing power and energy is required.

Delft’s digital euro

In early April, the Delft Blockchain Lab presented a more sustainable and hybrid form of cryptocurrency: the Delft digital euro. This blockchain currency is linked to the IBAN system and is open source, non-profit and transparent.

How does it work? Customers can download an app on their smartphone to activate the digital euro. They log in to their bank and transfer money from their bank account to their phone. The seller enters the appropriate amount and a QR code is displayed on the screen. The customer scans the code, checks the amount and clicks on send. The amount is then sent from the one phone to the other without the use of Wi-Fi or other wireless networks (this is guaranteed by the underlying blockchain technology). The credit on the phone is transferred back to the customer’s bank account.

It may sound like a standard digital payment, but there are plenty of differences. The transactions take place offline between two phones, so the technology is not vulnerable to digital failures. And while retailers have to pay for standard transactions,

using the digital euro is free.

Transactions are only stored on the users’ phones and do not appear on bank statements, so they are just as anonymous as using cash.

Essential infrastructure

With cash now virtually out of circulation (partly due to corona), cryptos are an increasingly interesting alternative. However there are also considerable risks, because it is currently impossible to guarantee the value of cryptos without the backing of a commercial or central bank. The solution might be a centrally issued digital currency, because then the bank would guarantee the value. The European Central Bank and De Nederlandsche Bank (DNB) are currently investigating the possibilities of such a currency – a digital euro. Blockchain researcher Dr Johan Pouwelse (Electrical Engineering, Mathematics & Computer Science) underlines the import of a reliable public payment facility. Debit card payments may be the domain of the banks, but Pouwelse sees how the tech giants Apple, Google and Facebook are racing to develop digital payment technologies. Pouwelse emphasises that money transfers form part of an essential infrastructure that belongs in public hands. DNB brought the physical euro into circulation, and he believes it is also the appropriate body to introduce the digital euro.

Open source

Software that is free of copyright restrictions and so can be used and modified by anyone. An example of open source is the Linux operating system.

Cryptovaluta

Cryp-to-cur-ren-cy; plural: cryptocurrencies; legal tender currency in the form of digital money that can be used to pay for products and services on the internet whereby encrypted information is used to conduct the transaction; virtual money.

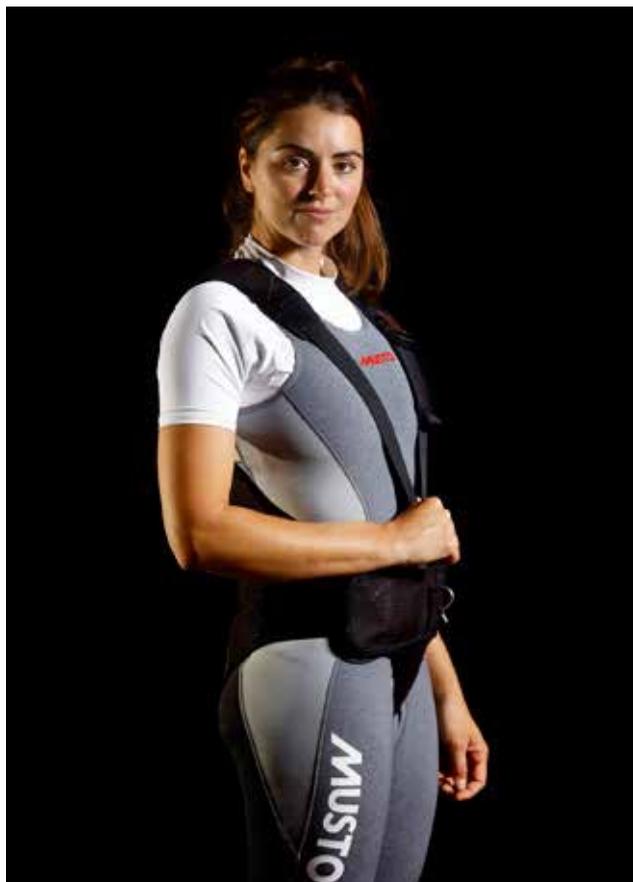
The road to Tokio

Top athletes from TU Delft have a chance to compete in the Olympic Games in Japan. What does their life look like and how are they doing?



- Who: Victoria Pelova
- Degree programme: Applied Mathematics
- Sport: Football, midfield
- Club: Ajax, joined in 2019
- Team: Dutch Lionesses/Netherlands women's national football team (qualified for Tokyo)
- Debut as an international: 20 January 2018, Spain-Netherlands

“My life consists of football and studying, even during the corona pandemic. I now live in Amsterdam, but I had already been doing a lot of distance learning. I started in 2017 and am now in my third year. Some days there are two or three training sessions at Ajax, and then you are at the club from 9 to 5. I really don't feel like studying when I get home in the evening after a day like that, so I try to catch up later. Football is currently number one for me, but my studies are no less important and I do intend to complete my degree. It is also good to do something else besides sports, which I particularly noticed when I had a sports injury. My ambition is to get selected for the Olympics, to play in Japan, and make a real contribution to the team. A pity that there will probably be no spectators; international spectators are in any case forbidden. And no Olympic village or Holland House; we will be living in a bubble there.”



- Who: Annette Duetz
- Degree programme: Applied Physics, started in 2014
- Sport: Sailing
- Sports association: TeamNL
- Team: 49er FX class, with Annemiek Bekkering
- Status: Qualified for Tokyo

“We wanted to keep travel to a minimum because of the coronavirus, so we spent pretty much the whole winter in Lanzarote. The sailing conditions there were perfect. We were able to sail a proper race against all our competitors in late March. We spent much of the summer of 2019 in Japan getting to know the water and conditions like the currents and wind. In hindsight we were very lucky, as this was no longer possible in 2020. I have not had much time for my studies. I was planning to start my final year of the Master’s programme in September 2020, after the Games, but I have now delayed that until the coming September. I’m very much looking forward to that as well. NOC*NSF has always been very confident that the Games would go ahead, and I believe that too, even if it is without foreign spectators. For us, the most important thing is that the competition goes ahead. We want to be there at the Games. There is a lot of competition, but we are going for gold. We will give it our best shot!”



- Who: Dieuwertje den Besten
- Degree: Industrial Design, Bachelor’s degree completed
- Sport: Rowing
- Club: D.S.R.V. Laga
- Team: ANRT (Aegon National Rowing Team), Eight
- Status: Not qualified for Tokyo (status unknown at time of interview)

“I have completed my Bachelor’s degree and I will be starting my Master’s in September, but now I’m focusing entirely on rowing. We were able to row in Eights and went on a number of training camps abroad, following a strict protocol and with regular testing. I joined the national rowing team in January last year, but all the sessions were soon cancelled and I found it difficult to keep up the training. Now we can do much more this year, I see everything as a bonus. I initially fought for a place in the association selection squad, then in the Eight, and then for the European Championships. I always set my sights on the next goal; this keeps me motivated. We had only just formed the team when last year’s Olympic Qualifying Tournament started. That was a real benefit for a young team like us. The current team has been selected with an eye to Paris 2024. I’ve only been rowing for four and a half years, it’s all still new and exciting for me and I am setting modest goals. The Paris Games are my biggest goal.”



- **Who:** Jan Driessen
- **Degree programme:** Clinical Technology, fourth year
- **Sport:** 3x3 Basketball
- **Team:** 3x3 Orange Lions
- **Status:** The Netherlands qualified for Tokyo in late May

“I am in the 3x3 basketball programme, a group of eight to ten players. I travel from Delft to the training sessions in Amsterdam about three or four times a week, but I think it is important to study as well. I’m in my fourth year of clinical technology. I hope to get my Bachelor’s degree in July. How does 3x3 differ from regular basketball? The basic things like shooting and passing are the same, but the rules are different. You play on a half-court, with one basket instead of two. One team attacks, the other defends. You don’t have a fixed position in the court. The actual playing time is only ten minutes, but afterwards you are completely exhausted, and it’s that intensity that appeals to me. This is the first time it’s an Olympic sport. I think everyone will really be surprised. If everyone stays fit, I don’t expect to play. The first four will be selected for the Olympic team, but the rest of the players will remain in the squad. They need us to train with, otherwise the group is too small.”



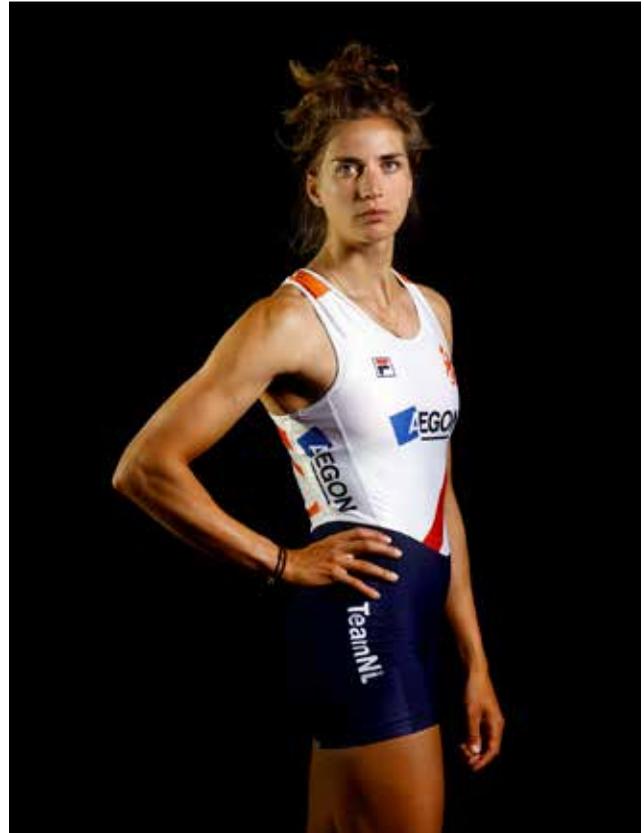
- **Who:** Laila Youssifou
- **Degree programme:** Civil Engineering, started in 2014
- **Sport:** Rowing
- **Club:** D.S.R.V. Laga
- **Team:** ANRT (Aegon National Rowing Team), Quad scull
- **Position:** Bow
- **Status:** Boat qualified for Tokyo

“I completed my Bachelor’s degree just over a year ago. I was going to put my studies on hold in the run-up to the Games, but when they were postponed, I re-enrolled and also did some courses for my Master’s. I recently stopped studying again temporarily to focus completely on Tokyo. Because of Covid-19, we prefer to travel to training camps abroad by minibus instead of flying. When we get back we have to quarantine; but a luxury version, because we can train on the Bosbaan rowing lake. We head straight to the shed, get a boat, get on the water, and go straight home afterwards. The regattas themselves are quite austere. You are where you need to be, but that’s about it. There is no guarantee that you’ll get a place in the boat; something can always go wrong. But I want to stay in this team, though you never know how we’ll do in Tokyo. I originally had an idyllic vision of the Games. It will be different now, but I will be happy if it just goes ahead at all.”



- Who: Justen Blok
- Degree programme: Civil Engineering
- Sport: Hockey, Defender
- Club: HC Rotterdam
- Team: Dutch Men's squad
- Status: Qualified for Tokyo

“At the moment I am focusing entirely on training in preparation for the Olympic Games. I normally go to the club every Monday and Tuesday, from eight in the morning till six in the evening. On Wednesdays I train half a day, on Thursdays I do two sessions, Fridays only in the evening and on Sunday is the match. I'm only free on Friday during the day and on Saturday. I have put my studies on hold for six months, and my output has been far below the norm; I have earned only 55 ECTS credits in three years, so it's going slowly. But I do want to get that piece of paper eventually; I never mind studying. You don't notice much of coronavirus on the field, but off field you do. There's no social life, we can no longer eat together after training and the team meetings are shorter. The Olympic Games is the highest possible goal in hockey, so I'm not lacking in motivation. I don't really know what to expect, whether we'll all be in one big bubble or if there will be various separate bubbles. But I'm looking forward to meeting other athletes there.”



- Who: Roos de Jong
- Degree programme: Architecture, Master's degree
- Sport: Rowing
- Club: DSR Proteus-Erethes
- Team: Aegon National Rowing Team, Double scull (with Lisa Scheenaard)
- Position: Bow
- Status: Boat qualified

“After Lisa and I qualified for the double scull in Tokyo, in 2019, they re-opened the selection process, which was a real letdown. Then came the cancellation of the Games and a period of uncertainty followed. These are all moments when you have to be adaptable and adjust your goals. You think about your studies and all the sacrifices: is it still worth it? But there will be other opportunities to graduate. I love rowing and had invested ten years of my life in it and did not want to stop. During the coronavirus pandemic, we were allowed to train outside, alone. At home I did strength training and ergometer training. The ergometer is still at home. It suits me that we are not together with the team all the time. That was a real discovery. Three years ago, I did not think we would be able to go for a medal at the Games. You dream of gold, but silver or bronze would be nice too.”

Nanoparticles in the fight against breast cancer

Each year, approximately 17,000 people in just the Netherlands alone are diagnosed with breast cancer. The chances of survival are steadily increasing, but treatments for breast cancer can have severe impact on the body and patient quality of life. Kristina Djanashvili is working with her team in Delft on an effective and less invasive one-stop-shop therapy using nanoparticles.



PHOTO: GETTY IMAGES

“**T**he impact of existing treatments for breast cancer is considerable,” explains Kristina. “An operation is damaging to the body and a breast amputation has a large psychological effect on a woman. Radiotherapy often damages healthy tissues and chemotherapy is very intense and stressful for the body. For this reason, our research is aimed at providing the most precise treatment possible, with the least possible stress and damage for the patient.”

Precise breast cancer treatment is possible because of an increasing capacity for an early diagnosis and more accurate mapping of the tumour. “We are currently working on a method in which nanoparticles can be injected directly into the tumour using an ultra-fine needle. These particles are made up of iron oxide and are radioactively

charged. Once the particles have been injected, they are heated by a special device using alternating magnetic fields. This simultaneously irradiates and heats the tumour from the inside out, an extremely effective method for destroying cancer cells. Healthy parts of the body are spared because we inject directly into the tumour.”

One-stop-shop treatment

If this method proves successful, just one treatment may be sufficient. “Our treatment is a one-stop-shop approach. It is a single treatment that continues to work in the body because the nanoparticles bond with the cancer cells. Just imagine what a positive difference it would make for both the patient and the healthcare provider if we could replace a whole series of radiotherapy sessions with one single, less stressful session.” But we are not there yet.

The nanoparticle design needs to be very accurate and it is a sensitive process. “The material quality, size and shape are all variables that affect functionality and application. The question of how the particles are inserted is also important: they need to be kept together long enough so they can be targeted to the right location, yet loose enough to work as individual particles upon arrival. We are now working on a special gel to achieve this.”

Towards treatment

It is hard to predict when the first patients will be able to be treated using this method, as this depends on many factors. Kristina Djanashvili is optimistic, though. “We have a distinct advantage due to the close involvement of Erasmus MC; our research is a true collaboration. They have the equipment for producing the heat,

Tech for Health

With the Tech for Health campaign, TU Delft is shining a spotlight on its research innovations that contribute to the improvement of healthcare, especially in countries like The Netherlands. Research aimed at on quicker diagnosis, more effective treatment and reducing shortening waiting times and treatment processes. This research often involves collaboration with medical institutes such as Erasmus MC in Rotterdam and LUMC in Leiden.

Less pain from arthritis

It is important to initiate the most appropriate treatment of arthritis symptoms as early as possible. Professor Jaap Harlaar is set to make an important contribution to this goal by creating a unique lab that will combine biomechanics and radiography.

Rapid diagnosis with ultrasound

If a mild stroke is recognised early, preventive treatment can avert serious damage. Researcher David Maresca is working on an advanced ultrasound application that will make this possible.

Consulting room of the future

Very few innovations have yet to be applied to the consulting room, which is the place where almost all healthcare processes start. Professor Richard Goossens has started an innovation process that should turn the concept of the consulting room on its head.

Algorithms against alzheimer's

Two decades from now, it is expected that 500,000 people in the Netherlands will suffer from Alzheimer's disease. Using big data, Professor Marcel Reinders works effortlessly to gain a better understanding of this still incurable brain disease.

Mapping cardiac arrhythmia

Special technology has enabled the first detailed mapping of conduction properties in the hearts of children. Professor Natasja de Groot is working on refining this mapping method in order to collect data with even more precision.

Ethics an important instrument for sustainable innovation

Samantha Copeland is leading the mission for including ethical and social considerations in every step of the discovery-development-implementation cycle.

the knowledge of the physics and the models to determine the proper dosage. Medical practitioners are already involved in the research, and this will make the eventual practical application more straightforward. I expect that we may have a working prototype within two years' time."

Important to get support

The research is presently in the fundamental phase. "It is very important to get support right now. Additional budget will allow us to purchase extra measuring equipment and so speed up our research. With our prototype, we will soon be the first to demonstrate that it is possible to fight breast cancer from the inside out using thermotherapy and radiotherapy simultaneously. After this breakthrough, the time will be ripe for other parties to join, shortening the time required to get the

treatment to patients." Once its success is proven, the method may potentially be suitable

for other types of cancer, such as prostate cancer, expanding the range of patients that will benefit.

Will you help?

Your help will allow us to expand labs, grow our capacity and accelerate research. Together, we are committed to better and more accessible healthcare for all, both today as well as for future generations. You can donate via www.tudelft.nl/technologyforhealth

Donate directly

You can also donate via this QR code. Use the camera of your mobile phone.



Over 1,500 registrations for virtual Xperience Week

Karin Sluis, former General Manager of the consultancy and engineering firm Witteveen+Bos, was elected TU Delft Alumnus of the Year 2021 during the TU Delft for Life | Xperience Week. The event is aimed at TU Delft alumni and relations of University Fund Delft and took place for the second time this year.



Rector Magnificus and Chairman of the Executive Board Tim van der Hagen (left) and Ernst Kuipers (Chairman of the Board of Governors of Erasmus MC) explained how convergence and collaboration could lead to high-impact technological innovations in healthcare. In the middle is moderator Lexter Woodley.



Willy Spanjer, Andy van den Dobbelen, Saraf Nawar and Phil Vardon were guests at the Climate Action session on 8 June.

The TU Delft for Life | Xperience Week means five inspirational evenings around the themes of the digital society, climate action, health & care, the energy transition and urbanisation & mobility.

The Alumnus of the Year was also announced and the winner, Karin Sluis, received the award virtually from the Rector Magnificus and Chairman of the Executive Board Tim van der Hagen. Read the interview with Karin Sluis on



A temporary studio was built in the co-creation centre at the Green Village.

page 18.

On Monday evening the theme was artificial intelligence and the first edition of the Home of Innovation magazine containing a special on this subject was presented to Prof. Geert-Jan Houben (Pro Vice Rector Magnificus Artificial Intelligence (AI), Data and Digitalisation (PVR AI)) by Paul Althuis (Director of the TU Delft Innovation & Impact Centre). Houben was joined by seven fellow scientists to discuss both fundamental and application perspectives. On Wednesday evening, Tim van der Hagen and Ernst Kuipers (Chairman of the Board of Governors of Erasmus MC) explained how convergence and collaboration can lead to impactful technological innovations in healthcare. Scientists Natasja de Groot, Richard Goossens and David

Maresca gave examples of this and talked about their research using various objects. All medical projects are supported by alumni and contacts through the Tech for Health campaign. On page 32 of this magazine, Kristina Djanastvilli discusses her research on a less stressful form of treatment for breast cancer.

This year, more than 1,500 alumni and contacts living in 41 countries and with 45 nationalities, registered for one or more online sessions. Participants could ask questions directly, which generated lively discussions. At the sessions with Andy van den Dobbelen about a sustainable campus on Tuesday evening, Miro Zeman about the new



Miro Zeman was a guest at the Energy Transition session on 10 June.

Electrical Sustainable Powerlab on Thursday evening and Bas Jonkman on the final evening, we saw much shared curiosity and the enormous commitment of TU Delft alumni and contacts. For one alumna, this translated into sharing an illustration about the energy transition that she produced herself and forwarded that evening.

Recordings and additional material of the five topics are available at tudelftforlife.nl. This portal also has a link to the Home of Innovation online magazine.



Alumni could put their questions to all table guests virtually.

‘Giving while living allows you to see the impact of your donation’

Maarten and Riny de Groot have made Delft University Fund a beneficiary in their will. Their bequest is intended for the Maarten de Groot Fund, which they set up themselves in aid of applied research into the energy transition. They have also arranged a regular donation agreement so that they can pass on some of their assets through this same fund during their lifetime.



Maarten and Riny de Groot.

The focus of the Maarten de Groot Fund is on research promoting sustainability in urban areas, more specifically on the potential of hydrogen as a fuel and energy carrier. The interests of residents must always be at the forefront. This is something they both feel very strongly about: “It must be pragmatic. Suitable for use in day-to-day life by ordinary people.” The research is being carried out under the auspices of the TU Delft’s The Green Village Fieldlab.

Love for TU Delft

Maarten de Groot spent forty years at TU Delft, originally as a scientific calculator and lecturer in mathematics and thermodynamics in the Faculty of Mechanical, Maritime and Materials Engineering (3mE), in the Process and Energy department. He later became manager of the labs in this department. He also worked as an independent researcher for heat networks for several years, before becoming Deputy Head of the Process and Energy department. His last ten years at TU Delft were spent working in the Faculty of Civil Engineering and Geosciences.

His expertise and interests lie in the field of energy and hydrogen. Having built up considerable networks both within and outside TU Delft, he is now keen to keep up-to-date with his contacts. “All sorts of interesting things are going on. Take The Green Village for example, where one of our friends who holds a PhD for research into hydrogen has found a job, and where I am going to give guided tours.” Riny has always known how much TU Delft means to Maarten. “The long and short of it is that Maarten lost his heart to TU Delft.

“You never know when it’s time for your will to be enforced, and it all feels a lot less abstract now that we can make donations and continue to be involved during our lifetime. It means that we can see the impact of our donations, and hopefully do our

bit to create a better, cleaner world.”

Maarten de Groot

Maarten and Riny already made donations to projects before they started the Maarten de Groot Fund.

After having donated money to various beneficiaries, including water technology at TU Delft, women’s

‘By giving now, it feels less abstract’

development in India and the Hydrogen House (Waterstofhuis) in The Green Village, they knew that this was something they wanted to keep doing. But they were keen to be more involved and to see the developments being put into practice. The idea of TU Delft took root when they realised that they could set up a fund in their own name.

Eye-opener

In an online presentation organised by Delft University Fund, a solicitor explained about giving gifts and making bequests, and a retired TU Delft professor gave his reasons for deciding on ‘giving while living’. This inspired Maarten and Riny to start making gifts via a fund set up in their name, rather than waiting until their will came into force. It was an eye-opener to hear that they did not need ‘lots of money’ to be able to leave a sum to Delft University Fund.

If you have any questions about making TU Delft a beneficiary in your will, if you would like us to send you a brochure or want to make an appointment to find out more, please contact Machteld von Oven by calling +31681060919 or by email at m.w.vonoven@tudelft.nl

Alumni activities

From online events to career coaching, to lectures on campus. If you want to participate in an event, the information offer can be found on the alumni events page: Alumni.tudelft.com/events

6 September

Opening Academic Year

30 September

DEAN alumni event Nordics

30 September

Masterclass Good Friends Delft University Fund

14 October

Career Cafe for Young Alumni

11 November

TU Delft Best Graduate Award Ceremony 2021



Get in touch

Questions, comments or ideas?

Email: alumnirelations@tudelft.nl

Website: alumni.tudelft.nl

Community: tudelffforlife.nl

‘TU Delft for Life’ is the online community for all TU Delft alumni. Expand your network, meet your old university peers and stay up to date on the latest news and events. Sign up on tudelffforlife.nl. You can also change your contact details and communication preferences there.

HORA EST



As long as high impact factors are required for academic success, the majority of academic articles will remain closed-access or expensive to publish.

Daniël Bouman

Open source's biggest obstruction is that beautiful looking code does not solve the problem.

Daniël Huibert Peter Kraak

Diverging from tradition and etiquette should not necessarily be considered as rude or impolite behaviour.

Maurice Krielaart

Individual pitch control can be used to significantly increase wind farm power generation.

Joeri Alexis Frederik

For success in the engineering sciences, intuition is more valuable than mathematical rigor.

Sining Pan

The measurement scale must align with the scale of the problem.

Bas des Tombe

The current awareness of physical contact due to Covid-19 might have a permanent effect on the amount of fingerprints left behind on a crime scene.

Ward van Helmond

Of all forms of transport, the focus of efficiency improvement for the benefit of the climate should be mostly on shipping.

Tom Caton Arnaud Stokkermans

If an idea is met with contradictory critique, it is a good idea.

L.J.G. Huijgens

Doing nothing can be as important as doing something.

Paul Johan Denissen

A new space race is required for a quantum leap in technologies. Only meeting demands of the consumer market is not sufficient.

Amol Ashok Khalate

Work on rainy days, walk on sunny days.

Wenting Ma

Without a valid clinical need, there is no problem to be solved.

Akash Swamy

Soil grains are united and cooperating with each other to fight against structural failure.

Xiuhan Chen

A researcher can never be an atheist.

Manu Chakkingal

A photograph of Max Mulder, a man with a beard and short hair, smiling and holding up a silver award in a blue presentation box. He is standing outdoors in front of a modern building with a TU Delft flag flying in the background.

Max Mulder | Professor of Excellence 2021

On Thursday 3 June, Delft University Fund awarded Max Mulder the title of Professor of Excellence 2021. Mulder is Professor of Control & Simulation in the Department of Control & Operations at the Faculty of Aerospace Engineering (AE). Max Mulder was nominated by Prof. Henri Werij (Dean of the Faculty of AE), colleagues from his field, the study association VSV 'Leonardo da Vinci' and former Master's students and doctoral candidates. "Professor Mulder is receiving the Professor of Excellence Award for his remarkable contribution to teaching, research and the university. The jury considers Professor Mulder to be a true Professor of Excellence, a consummate professional with outstanding research qualities who also excels in every aspect of coaching students, doctoral candidates and colleagues," notes Prof. Van Keulen, Chair of the Professor of Excellence 2021 jury.

A true professor of Excellence

Professor Mulder joined the Faculty of AE at TU Delft in December 1999 as an assistant professor, and was awarded a Vidi grant in 2005. After ten years, in 2009, he was appointed to the chair of Aerospace Human Machine Systems by the Executive Board as full-time professor. In the past 12 years as a professor, Prof. Mulder has supervised the graduation of some 300 students. He was named the Faculty of AE 'Lecturer of the Year' on a number of occasions. In the role of supervisor and promotor, Mulder has now supervised more than 40 doctoral candidates in the successful completion of their PhD research.



"This award feels to me like the highest honour you can get. I've always started doing what I like and getting this recognition at this point in my career feels very special. The fact that my colleagues and students nominated me for this award makes it even more special!" – Max Mulder

► Best of TU Delft

Delft University Fund has awarded the prestigious Professor of Excellence Award (in Dutch: Leermeesterprijs) since 1994. A Professor of Excellence is someone who excels in both research and education, and who knows how to inspire and motivate the next generation of Delft engineers. Recipients of the award are reckoned among the top of TU Delft. Professors of Excellence are not elected on the basis of yield figures or impact scores, nor are they selected top-down. You can only receive this honorary title on the recommendation of your colleagues and your students, who consider you to be their 'Leermeester'. The Professor of Excellence receives the silver Leermeester medal and a check for € 15,000. Also, KLM bestows two tickets for a destination of choice.

Read more: www.universiteitsfondsdelft.nl/professorofexcellence

ALL IN THE FAMILY

Family Van der Jagt

In this series, parents and grandparents discuss their student days with their children and grandchildren. Read the original version here:



“It’s hereditary after all,” said Frits van der Jagt (started Aeronautical Engineering with 55 first-years in 1954) to his son Martijn (Aerospace Engineering) when he too graduated under Prof. Wittenberg. His son had no plans to follow in his footsteps. “I wanted absolutely nothing to do with aircraft,” says Martijn. He wanted to ‘do something with computers’ and began with electrical engineering, but after only seven lectures realised that it was not for him. “Aerospace Engineering was the programme with the most computer science. I started in 1979 with a group of 100 students.”

When Martijn’s son Joris took part in the OWee in 2009, he too was determined to make different choices than his father. “My mother was a member of Virgiel, my father of Sint Jansbrug. I wanted to follow my own path and jokingly said that I would join the Corps.” But he joined Sint Jansbrug instead, where he immediately felt at home. “I ended up joining the same guild as my father after all,” he admits with a laugh. You can try to rebel against your roots, but sometimes it’s hereditary after all!” However this does not apply to their careers: Frits made his career at Fokker, Martijn focused on information technology and Joris works at Allseas.