Delft Outlook
MAGAZINE OF DELFT UNIVERSITY OF TECHNOLOGY 2013 • 4

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Spending energy rashly

Weather stations for Africa
Network improves weather forecast

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Working on tomorrow's challenges

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Tinkering

The engineers at TU Delft are often nicknamed 'the bicycle repairmen'. Hopefully, this is not meant derogatively, because students trained in the art of cutting-edge 'tinkering' can help to solve many of society's problems. This need to tinker often starts at a very young age, and during these students' studies it is honed to the point that they are able to build ingenious machines to race against fellow tinkerers from other universities. These are excellent exercises in cooperation. This issue of Delft Outlook features a machine designed to travel underwater, the Wasub submarine. TU Delft staff members have also stimulated African students to start tinkering. After a week of soldering, programming and building interfaces, together they produced some twenty weather sensors. A network of these sensors is intended to provide Africans with more certainty about weather conditions and precipitation. Back home, we tested the energy-neutral apartment Concept House, a prime example of high-tech tinkering. Our Science Editor tested this prototype's claim to energy neutrality to the limit. Planetary scientist Daphne Stam does not regret the early demise of NASA's Kepler space telescope, a disaster of tinkering caused by failed reaction wheels. Thanks to the Kepler, we know that almost ten per cent of all the stars in the Milky Way have at least one planet that could potentially sustain life. Stam wants to launch a space telescope that can search for signs of life on such exoplanets. Might not one of those planets be home to equally talented tinkerers with whom we could race our machines?

Frank Nuijens, Editor-in-Chief, Delft Outlook

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Delft in Brief

Student protests

Do you remember this? In December 1972 a group of five hundred students occupied the main building of the then TH (technical college). The reason for the action was the reduction in the child benefit that loomed for parents who refused to pay the steeply increased tuition fees. Stylos, the student association of the Architecture faculty, is creating a theatre performance about these student protests to mark its anniversary. Were you a student at the TH in 1972 and did you witness these events? Stylos wants information about the democratic process in general and the 1972 occupation in particular. Would you be willing to share your experiences and maybe even photos of this event? Please e-mail us at **lustrumtheater@stylos.nl**. All information is welcome.

Artificial photosynthesis

Artificial photosynthesis, the use of sunlight to split water into hydrogen and oxygen, usually requires costly semiconductors. But Delft researchers developed a promising alternative by combining an inexpensive solar cell with a photo anode made of the light-sensitive metal oxide Bismuth vanadate, a very cheap material used as a pigment in the paint industry. The findings were published on the 29th of July online in Nature Communications.

delta.tudelft.nl/27029

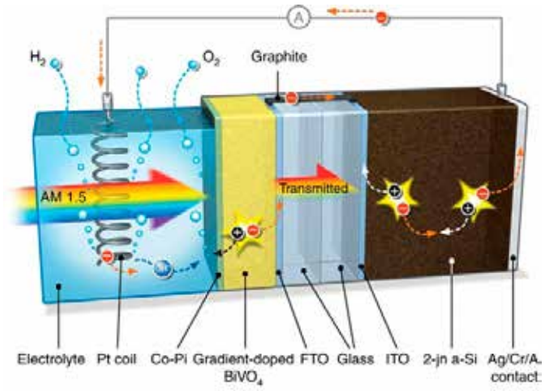


Image: TU Delft

Algal blooms

Prediction of algal blooms can be improved with the use of satellite data, as mathematician Dr. Joanna Pelc showed in her PhD research which she defended on the 16th of July. With colleagues of Deltares, Pelc developed an ecological model called Bloom/Gem to calculate algal growth in the Southern North Sea.

delta.tudelft.nl/27024

Photo: Nasa

Algal growth in the Barents Sea, August 2011

Iceland grows

Students from the geoscience and remote sensing track have been recording the geophysical activities on Iceland in July. The measurements are part of a series that has been set up by the University of Iceland twenty years ago. Icelanders estimate their country grows by two centimetres per year. Because of the manifest volcanic activity, the Krafla region is a popular site for geothermal power plants that convert heat into electrical power. Local people are concerned that another plant may cause accelerated subsidence because of the loss of groundwater. Students gave a preliminary presentation of their fieldwork. The general trend in the data was subsidence, as expected. But further analysis and fitting the newly acquired data into the existing time series will be needed to help determine the underlying geophysical processes.

delta.tudelft.nl/27016

Lie detector

Where do we draw the line when it comes to sharing information? Last August, Prof. Pieter Jonker provided the opening lecture of Lowlands University. He outlined a vision of the future in which we have become cyborgs that are controlled from the cloud. To illustrate his vision he invited Dorith onto the stage. Dorith was dressed from head to toe in the Memachine, a robotic suit that measures, interprets and reveals practically everything about the wearer – from their brain activity, breathing and heart rate, to the most intimate kinds of behaviour and feelings. While Dorith kissed her boyfriend on the stage, the audience followed her breathing, heart rate and the production of sweat on a big screen.

delta.tudelft.nl/27074

Photo: Tomas van Dijk

Strange life

Newly discovered microbes may provide new insight into the earliest life on Earth, believes microbiologist and professor emeritus Gijs Kuenen. For the past three years he has been visiting California to conduct research on bacteria in three highly alkaline locations (with a pH of 12). The organisms have now been isolated and their DNA has been read. That led to a publication on the PNAS website (3 September). Kuenen and his colleagues want to solve the puzzle of how anything can survive in such alkaline water, which, moreover, contains barely any phosphorus, nitrogen or sulphur – the building blocks of life. It is thought that the first life on Earth evolved under similar conditions to these.

delta.tudelft.nl/27121


Photo: Vibeke Kuenen-Boumeester

Nuna7: a real car

The Nuon Solar Team had to build a solar car with four wheels instead of three this year: Nuna7. It is to participate in the World Solar Challenge from 6 to 13 October, a race that is intended to demonstrate alternatives for petrol engines to the world at large. The race organization wants the designers to make their vehicles more closely resemble conventional cars. "This caused a major upheaval," says team member Allard Lambers. "One of the first questions we asked ourselves was: where should we put the driver?" The team decided on the right hand side. This will ensure that the solar cells catch the most sun as the vehicle crosses Australia from the north to the south in an almost straight line.
In previous years Nuna came in first four times and finished in second place twice.

delta.tudelft.nl/27031


Photo: Nuon Solar Team

CO_2 into alcohol

Delft researchers have improved the anaerobic fermentation process in yeast by making use of the abundant CO_2. The ethanol production rose by around 10 percent while the undesired glycerol production fell by 90 percent. The Delft biotech team, including Dr. Ton van Maris, Prof. Jack Pronk (industrial microbiology at Applied Sciences) and lead-author Victor Guadalupe-Medina, thought the already present CO_2 might well be used as an electron-acceptor. This could limit the excess production of glycerol. They found out that only four additional genes were needed to equip yeast with the biochemistry of carbon fixation. "They all work harmoniously together in a yeast cell", says Van Maris.

delta.tudelft.nl/27108

Partying in Delft

There was just enough time to catch your breath after the first-year weekend... and then it was time to get back to work. 'No Limits: You're a student, Partying in Delft!', the new first-years sang along with the student band Capital S at De Markt on Sunday night, 18 August. 'Friday afternoon, with a hangover in bed and still a wee bit drunk. All you can think is: Delft is super cool!', the song continues.


Photo: Sam Rentmeester

Won again

The electric four-wheel drive DUT13 won the Formula Student Germany design and racing competition, known as the unofficial world title held last month. DUT Racing has already secured the world title four times: in 2008 and 2010 with a combustion engine and in 2011 and 2012 in the electric classification. Formula Student is an international design and racing competition in which teams of students must design and build their own racing car.

delta.tudelft.nl/27030


Photo: DUT Racing Team

Offshore with a difference

The next generation of offshore windmills will be designed to pump seawater, believes professor of wind energy Gijs van Kuik (AE). He is the creative mind behind DOT (Delft Offshore Turbine), a concept whereby electricity is no longer generated high up in a nacelle, but in a combined generator at sea level. The propeller drives a hydraulic pump that diverts energy under pressure to a seawater pump at the bottom of the mast via an oil flow. The flow of seawater drives a generator. The concept is intended to put an end to the problems with the vulnerable gearboxes in the nacelle. Dr Niels Diepeveen received his PhD on 29 August for his research on the DOT concept.

delta.tudelft.nl/27120

Numerus fixus

TU Delft has requested a numerus fixus for the mechanical engineering programme. The Executive Board wants to set a limit of six hundred first-year students for the 2014-2015 academic year. The Board has rejected another request, conceived by the faculty last June, to set a numerus fixus of one hundred students for the maritime engineering programme. According to Director of Education Hans Hellendoorn, the reason is 'the high demand in the industry for shipbuilders, as well as the current intake, which in absolute numbers is manageable.'

delta.tudelft.nl/27103


Photo: Sam Rentmeester

Forze

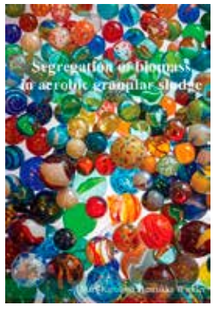
TU Delft's Forze team is ready for the real work. Having already built three hydrogen karts, this year the team of seventy students have decided to build a fully-fledged racing car. At 880 kilograms, this racing monster is almost one-and-a-half times heavier than a Formula One car, but it should still be able to reach a top speed of 220 km/h. Former Formula One driver Jan Lammers was at Valkenburg airfield for the vehicle's unveiling ceremony. "It's fantastic that Forze IV is bearing up against conventional racing cars," Lammers said. Forze IV will participate in its first races next spring.


Photo: RH Fotografie

Best thesis

The thesis 'Magic Granules' by Dr Mari Winkler was selected as the best dissertation in the field by American environmental professors. The award, presented by the Association of Environmental Engineering and Science Professors (AEESP), is the third one for this thesis. Chemist Mari Winkler (University of Duisburg-Essen) attracted international attention to her PhD research by combining two well-known and successful waste water treatment techniques developed at TU Delft. Both techniques are based on the use of granular sludge; a bacterium that makes it possible to do away with sedimentation basins, resulting in smaller, cheaper and more energy-efficient waste water treatment plants.

delta.tudelft.nl/26977



Photos: Sam Rentmeester/LUMC

A low-cost weather station

A network of tens of thousands of low-budget weather stations will give people of Africa more certainty about weather and water. The project was launched this summer in Kenya.

Jos Wassink

On the afternoon of Friday 2 August, after a week of soldering, programming and building interfaces, the project was finally completed. More than twenty weather sensors came online simultaneously and sent their data to the internet.

Participants from all over Africa gathered at Nairobi's iHub – Kenya's equivalent of YesDelft – to build an experimental weather station, with the guidance of staff from TU Delft. The participants had been invited to take part on the basis of their original designs for weather sensors. In the space of a week, a total of 21 sensors (for rainfall, temperature, humidity, wind, etc.) were connected to each other and linked to the internet via a node. It was a small historic step when the system worked, and the first contours of a network of weather sensors created by and for Africa were visible.

The idea for a trans-African meteo-network was thought up at the beginning of the 1990s by three PhD students at Cornell University (USA). They knew that the density of weather stations in Africa was very low (as it was in South America), which meant that agricultural yields in the hostile African climate were not as high as they could be.

Food crisis

Today, twenty years later, their idea has even greater significance and urgency. Since that time, we have had a food crisis (2008) and food prices have peaked, plunging millions into poverty. The world population has increased to 7.1 billion and is set to reach 9.3 billion by 2050. The demand for food is increasing due to a combination of factors: population growth, the rising demand for biofuels, and shifting consumption patterns (more meat) in growing economies.

In a recent article at www.trust.org, Prof. Nick van de Giesen (Civil Engineering and Geosciences) wrote about the fact that food production will need to increase by 30 to 80 per cent to meet the growing demand for food. Van de Giesen, TU Delft's Professor of Water Resources Management, was one of the trio of Cornell PhD students twenty years ago. The others are Professor John Selker, a hydrologist at Oregon State University, and Dr Marc Andreini, a researcher at the Water for Food Institute at the University of Nebraska. The report 'Global Food Security', published last June by Britain's International Development Committee, speaks of a global food crisis – an outlook that Van de Giesen confirms. Unfortunately, it is usually the poor who are hit hardest and first by shortages and rising prices. But the food crisis is a security risk as well as a humanitarian disaster. Food riots in 2008 contributed to civil unrest in dozens of countries, including North Africa.

On the other hand, it is Africa that has the greatest potential in terms of producing more food. Elsewhere, agriculture has been optimised to such an extent that there is little scope for further expansion. And growth in South America would be at the cost of the rainforests. The main problem in Africa is the unpredictable weather, and this would be easier to deal with if there was a denser network of local weather stations.

That is precisely what Van de Giesen, Selker and Andreini have in mind with the Trans-African Hydro-Meteorological Observatory (Tahmo).

Greater stability

The dream is to have thousands of weather stations up and running throughout Africa by 2018, mainly managed by schools. Local data on temperature, humidity and wind etc. will be combined with weather models and satellite data to provide more detailed information on heat and water fluxes in Africa.

Farmers will receive updates on weather and rainfall via smartphones or in spoken SMS messages. The forecasts should enable public authorities to take more effective decisions on water-management measures. Ultimately, this should boost not only food production, but also economic growth in Africa. This, in turn, could lead to greater stability, both within and outside Africa. That would be an enormous benefit. But how do you achieve that?

With modern micro-electronics. The fact is that, in the past few decades, there have been enormous advances in the capacity, price and format of electronics. Who would have thought that programmable microprocessors would one day be available for just a few tens of euros? There are all manner of sensors for radiation, temperature >>

‘It is Africa that has the greatest potential in terms of producing more food’

and sound costing only a couple of euros or less. This ‘sweetshop’ of resources enables people to build their own weather sensors for next to nothing, or, in the words of ir.Rolf Hut (CEG) of the Tahmo project: ‘to use existing technology to measure climate variables in new ways.’ Hut himself - who is known for his ‘hands-on’ approach to science - set a good example a few years ago with his innovative rain sensor. Normally, this piece of equipment consists of a funnel above a readable reservoir. The disadvantage of this device is that it requires maintenance, otherwise it becomes blocked. It occurred to Hut that you don’t need to go outside your tent to find out how hard it’s raining. You can tell by ear from the amount and size of the raindrops as they fall on the tent. On that principle, together with final-year student Stijn de Jong, he built a low-budget, maintenance-free electronic rain gauge, or disdrometer. The piezo element, costing only 25 cents, converts the sound of the rain into an electrical signal, which is then electronically calculated as millimetres of rainfall. Total cost: approximately three hundred euros. Another example is a radiation meter, which costs five hundred dollars as a weather instrument, while an infrared sensor - as used in ear thermometers - can be bought for just ten dollars.

Amateur inventors

Cheap sensors, in conjunction with the wish to build more weather stations in Africa, led to the Tahmo Sensor Design Competition. In this competition students, researchers and amateurs were challenged to develop a weather sensor using elements from alarm systems, telephones and the hardware store.
In the first round, 21 designs were selected. These were submitted by thirteen teams, who now received a ‘Maker Package’ and could set to work with the following: an Arduino microprocessor, sensors, pliers, wires, a glue gun, soldering set and, of course, duct tape.
When the participants flew to Nairobi a few months later, they brought their prototypes with them. The next step - and the purpose of the workshop - was to connect the individual sensors to each other to create an experimental weather station. A Raspberry Pimicrocomputer was to form the core of the network. The next task was to work out which wires from which Arduino to attach to where on the connector board, and how to program the computers for the communication protocol. The Delft team was assisted in this by Adam Gleave, a student from Cambridge and a trainee at the Raspberry Pi Foundation.
By the last afternoon of the week, the working prototypes had been set up on a long table. Here and there, various labels were to be seen, indicating the function of the sensor: ‘psychrometer’ and ‘radiation meter’. Coloured wires and leads run in all directions, and somewhere in the middle of all this is the microcomputer that reads the sensors and publishes the results on the internet. ‘Look - no wires,’ says Rolf Hut triumphantly as the data appear on his laptop.
Is this the beginning of an African weather network? In one sense it is not, because the weather station was dismantled after its première, and its builders left again, heading for all four corners of the vast continent.

But they left, Hut and Van de Giesen firmly believe, as ambassadors for Tahmo. They extended not only their knowledge but also their network of contacts. Although the ultimate aim is a network of weather stations, it begins with a network of people. <<

More information:
www.tahmo.org

Nick van de Giesen with one of the sensors.

Testing a radiation sensor.

Photos: Tanja Hilkhuijsen

Participants and staff of Tahmo.

From the selection for Nairobi:

Rainfall gauge
The Nigerian team (Ladipo Kehinde Ogunleye, Mr A. Okunlola and Dr Ahmed Balogun) made it through the selection round with seven designs. One of the designs is for an automated rain gauge with a tipping bucket. Rain falls through a funnel into a suspended asymmetrically hinged bucket. When the water reaches a certain level, the bucket tips, the water is emptied out and the process begins again. An electronic counter keeps tally of how often the bucket is emptied. So it does involve some electronics.

Temperature
The same Nigerian team also designed a double thermometer that calculates humidity (a psychrometer). The design consists of an aluminium housing containing two identical temperature sensors. One of the sensors is dry, and the other is wet and ventilated. The greater the difference between the wet and dry temperatures, the drier the air. N.B. A red light indicates the battery has power, a green light indicates a low battery.

Relative humidity
Abdullah Akolade Okunola and friends from Nigeria came up with an original plan for measuring relative humidity, using the silica gel normally found in camera bags. Silica gel absorbs moisture from the air, and thus becomes heavier. Take at least 100 grams of Silica gel, measure the changing mass with a piezo pressure sensor, calibrate the system, and you have a humidity sensor.

Air pressure
Dr Carelse and colleagues from the University of Zimbabwe designed an electronic barometer based on an aneroid capsule. They use an evacuated metal box from a standard barometer (with a membrane that bulges when air pressure is low) and measure the displacement of the membrane with a Hall sensor in the magnetic field of a coil around the box. Estimated cost: 25 dollars or less.

Wind speed and direction
A team from the Higher Technical School of Agricultural Engineering of Madrid submitted an elegant design for a wind meter without moving parts. It resembles a vertical antenna with a sphere on top. As the wind blows and moves the antenna, strain gauges indicate not only the force but also the direction of the wind.

Radiation sensor
The sensor designed by George Sserwadda of Uganda detects visible light and incoming and outgoing heat radiation. This is done with a phototransistor (light), an upward-facing infrared sensor (incoming heat radiation) and a downward-facing temperature-sensitive resistor (outgoing heat radiation). These are all connected to analog-to-digital converters, through which the data are sent to an Arduino microcontroller for processing and storage. The unit has a display and USB port for external connections.

View the presentation of the Nairobi workshop at: youtu.be/zJD1VP6F83k
www.facebook.com/tahmo.initiative

‘I don’t think we are alone’

There are scores of earth-like planets outside our solar system. Dr Daphne Stam (faculty of Aerospace Engineering) wants to launch a space telescope to search for life on these planets.

Tomas van Dijk

NASA’s Kepler space observatory discovered thousands of planets by examining how far-off stars flicker when planets pass in front of them. Our perspective of the universe has narrowed since the observatory met its end this Spring after two of the flywheels used to point the spacecraft failed. However, according to planetary scientist Daphne Stam, it had completed its main task anyway. Thanks to the Kepler, we now know that almost ten per cent of all the stars in the Milky Way have at least one planet that is the right distance from a star for it to be able to accommodate water in liquid form.
And where there is liquid water, there could be life. Stam believes it is time to launch a telescope that can actually see such exoplanets, rather than ‘merely’ observe them indirectly, and also search for signs of life on them. Together with other European researchers she wrote a proposal entitled ‘Exploring habitable worlds beyond our solar system’, after ESA asked scientists to submit proposals for major missions after 2020.

Does your proposal have a lot of support?
“More and more planetary scientists and astronomers are calling for the launch of such a space telescope. Our proposal was signed by almost seven hundred ‘fans’. The world of exoplanets has opened up to us. In the 1990s we detected the first exoplanets with ground-based telescopes. Later came ESA’s small space telescope Corot (convection rotation and planetary transits), which discovered the first rocky exoplanet. The launch of the more specialized Kepler telescope gave a huge boost to the search for these relatively small planets. We now know they exist in great numbers, but we don’t know if these planets have atmospheres and, if they do, what these look like. It is, to a large extent, the thickness and composition of the atmosphere that determines the conditions on the surface of a planet; in other words, whether it is piping hot, pleasantly warm or in fact freezing cold. That’s why the next step is to take a closer look at these planets.”

And hopefully find signs of life?
“Yes, that is an important motive. It is possible that organisms exist in our own solar system, but they will probably be microorganisms at most. Europa and Ganymede, two of Jupiter’s moons, are covered with a thick layer of ice. Potentially, liquid water could be trapped under this layer, thanks to the heat produced inside these ice moons. And of course, we have been looking for life on Mars for a long time now. If there is life there, it will be under the ground. But if we want to find more advanced forms of life we will need to look much further afield, around other stars.”

By “advanced”, do you mean intelligent life?
“There is a good chance that intelligent life exists beyond our solar system. There are a few hundred billion galaxies, each with hundreds of billions of stars. And we now know that most stars have planets. I don’t think we are alone. But whether we will ever make contact I do not know. The distances are probably too great.”

You write that this research is also interesting for the earth sciences. Are you hoping to find out more about the earth?
“The research on exoplanets can provide us with greater insight into our own origins and the future of planets such as the Earth. Maybe we will find a great many planets like Venus that have an atmosphere made of almost pure carbon dioxide with thick clouds of sulphuric acid. This would suggest that Earth’s temperate climate, with clouds made up of water and relatively little carbon dioxide in the air, is not only quite unique, but maybe even unstable.”

Do you wish to study the exoplanets discovered by Kepler and Corot?
“No, they are much too far away for that. Kepler and Corot were only meant to find exoplanets. Kepler kept a constant watch on nearly one hundred and fifty thousand stars, looking for dips in the light produced by these stars. To measure such a dip, the planet’s orbit must be perfectly oriented in relation to the telescope. Of course this is rarely the case. Corot and Kepler monitored such huge numbers of stars simultaneously to increase the chance of encountering such perfect positionings.”
“Now we want to search closer to home. We would like to study the starlight that falls on a planet and is reflected, in just the same way that we can see the moon from the earth. We are interested in this reflected starlight, because it provides information about the presence and composition of an atmosphere around a planet. If the atmosphere contains a lot of oxygen, then it must have a source, because oxygen generally breaks down quickly. This could be an indication of life. We also want to measure the polarization state of the light waves. This polarization state is very sensitive to the properties of a planetary atmosphere. If there are water clouds, we should, under certain viewing angles, be able to see a rainbow using a polarimeter.”

What will the space telescope look like?
“One option is to split the mission into two parts; the actual telescope, with a cross-section of four metres, and a screen that flies fifty thousand kilometres ahead of the telescope. The screen will be fifty metres in diameter and will prevent the telescope from being blinded by the light of the star around which it is orbiting. This starlight is ten billion times >>

‘Now we want to search closer to home’

brighter than the light reflected by the planet. You can compare it to holding your hand some distance in front of your face when looking into the sun. The screen is carefully aligned using small rocket motors so that only the light of the planet is let past."
"The telescope will be sent to the Lagrangian point L2. This is a point on the night side of the earth, about four times further than the moon."

It sounds pretty exciting, a screen with rocket motors.
"But what makes it even more spectacular is that the screen has to fold open once it's in space. It can't be launched in its unfolded state. Moreover, it has to open into the shape of a flower. If the screen was perfectly round then you would get interference from optical effects at the edges."

'Exploring Habitable Worlds beyond our Solar System' is a proposal. It is still uncertain whether the search for alien life on exoplanets will actually take place.
"If the project is approved, I expect the telescope to be launched sometime around 2030. Of course, there are a lot of other very interesting unanswered questions about stars and fundamental processes in the universe, but also about the planets in our own solar system. There is something to be said for gaining a better understanding of Venus' atmosphere before we try to do useful research on planets that are millions of times further away."

Despite this uncertainty, you are working together with colleagues from the University of Leiden on a small polarimeter that you hope one day to put on the moon as a kind of preliminary test.
"You can look at the earth from the moon as if it were an exoplanet. This would provide us with information about the colour and the polarization state of the earth's light, which we could use as reference material for future observations of exoplanets. We will need this information because we will only pick up very little light from the real exoplanets. Moreover, all the spatial variation on such a planet, caused by such phenomena as the rotation of the planet and the dynamics of the clouds, will be compacted into a single pixel."
"Because we know the composition of the earth's atmosphere, the distribution of the oceans and continents, and the behaviour of the clouds, we can carry out measurements of the earth to learn how reliable polarization measurements of exoplanets would be and what information can be derived from these measurements."

Some time ago, ESA and NASA had a plan to launch a cluster of telescopes to search for earth-like exoplanets. This project, called Darwin, and involving TU Delft researchers, was cancelled in 2007 because of the technical risk. If the plans for the new telescope meet the same fate, will your life's work have been for nothing?
"Don't worry, I won't have a breakdown! I'm also studying planets in our own solar system. A small polarimeter, such as that developed by the astronomers in Leiden, can also be used to make valuable discoveries with ground-based telescopes or on missions to the planets in our own galaxy. It could, for example, determine the composition of cloud particles in gas giants and the properties of the dust particles on Mars."

How did you become so passionate about planetary science?
"I actually got into planetary research by accident. I was studying physics at VU University Amsterdam. The only professor of planetary science in the Netherlands at the time, professor Joop Hovenier, was working there too. He introduced me to this field. The student counsellor at my secondary school had also once told me that I should become an astronomer. He said that astronomers were true artists, which was fitting, because as well as being good at maths, I was good at drawing too. And it's true that many astronomers are artistically inclined. Huygens had a talent for drawing too. You need fantasy and imagination to be able to form a picture of objects that are so far away. Maybe that's got something to do with it."

But you became a planetary scientist, not an astronomer.
"That's correct. As it happens, these two disciplines are drawing closer together, thanks to the new research on exoplanets. Astronomers always appeared to find planetary science boring. 'We already know all there is to know about the planets,' I've been told a number of times. Maybe they have the same feeling about planetary science as I had with earth observation after my PhD research. After a time it all comes to seem too detailed and specialized. But we still know virtually nothing about exoplanets, and that seems to have piqued the interest of the astronomers." <<

Who is Daphne Stam?

Daphne Stam (1969) studied physics at VU University Amsterdam. During her PhD research with KNMI and the university's department of planetary atmospheres she focussed on the diffusion of sunlight in the earth's atmosphere. As a postdoc at Cornell University in the United States, she studied clouds in the atmospheres of Saturn, Uranus and Neptune. Back in the Netherlands, she applied her knowledge of light diffusion and polarization to exoplanets, with the help of a Veni and then a Vidi scholarship. She started this research at the University of Amsterdam, then moved on to SRON Netherlands Institute for Space Research, and finally joined TU Delft in early 2013.

Must-haves

Tonie Mudde (1978) trained as an aerospace engineer. He is a science journalist with the Volkskrant newspaper. **twitter.com/toniemudde**

If you could do with a laugh, I recommend watching the YouTube film 'Mobiel bellen in 1999' (Mobile phones in 1999), in which documentary maker Frans Bromet asks passers-by if they own a mobile phone.
A man who is working on his car doesn't see the need for one: "If I do get stranded somewhere there's usually a roadside telephone or a farmhouse nearby."
A mother with child bursts out laughing: "Just imagine cycling along and then the telephone starts ringing!"
A student gives a shrug: "I already have an answering machine at home. That works just fine for me."
And there are more. Young, old, male, female; they all declare that they have no need for a mobile phone. It is the ultimate proof of the law that says: 'You don't know you need it until you have it.' Some other revolutionary product is bound to turn up again soon. A gadget that you can barely picture now, but which, in a few years, you'll be as addicted to as a junkie is to their needle.
Gadget websites tell us that the iWach will be launched next year. If Frans Bromet had called at my door yesterday to ask if I would buy such an iWatch, I probably would have tapped my wrist and said: "No need, I already have a watch. That works just fine for me."
However, after those street interviews, held barely fourteen years ago, I'm starting to doubt my self-knowledge as a consumer. Do I really understand my own needs?
Techradar.com heard from a reliable source that the iWatch will have a whole bunch of health-related sensors. Sleep phase monitoring, keeping track of calorie consumption, emergency services alerts in case of a heart attack; that kind of stuff.
What a load of rubbish, is my reaction today. But what if my neighbour overtakes me during my usual run with just such a watch on his wrist: what would be my reaction then?

Photo: Sam Rentmeester

Another film on YouTube: 'Martin Cooper – inventor of the cell phone'. This film features the American inventor explaining how he made the first mobile phone for Motorola in 1973. The device was the size of a carton of yoghurt, cost a million dollars and had a battery life of twenty minutes, but still Cooper predicted that one day everyone on the planet would have a mobile telephone.
His next prediction? That in the near future we will have mobile phones implanted under our skin, just behind the ear.
Do I want that? Now my answer is a resounding 'no'. But what will my answer be tomorrow?

Photo: Sam Rentmeester

The enormous influx of new mechanical and maritime engineering first-year students, in combination with the new curriculum of the faculty of Mechanical, Maritime and Materials Engineering (3mE), necessitates increasing the number of rooms for tutorials. It has been decided to replace the steel and synthetic frames with aluminium at the same time this 'sober but efficient' project is carried out.

The Micro Aerial Vehicle Laboratory (AE faculty) claims to have designed, built and tested the world's smallest open source autopilot for small unmanned aircraft. It weighs 1.9 grams, more than 30 grams less than its predecessor. A smaller – and lighter – autopilot allows these small flying robots to fly longer, fit into narrower spaces and carry more payloads, such as cameras.

delta.tudelft.nl/27058

Photo: Sam Rentmeester

Trying not to save energy


Photo: Amber Beckers

Cooking, ironing, watching TV; the team tests the house's claim to energy neutrality to the limit.

The Concept House Prototype may well be the first energy-neutral apartment in the world. Delft Outlook editor Tomas van Dijk stayed there with friends and tried to overload the electricity meter.

Tomas van Dijk


Photo: Sam Rentmeester

Spring was barely in the air and it was ten degrees Celsius outside when we moved into the Concept House in Heijplaat, a district in Rotterdam, with bags full of energy-hungry devices including an iron, an electric kettle and a hair dryer.
The three-bedroom apartment is built on a five-metre-high steel frame so that everybody can see that this is no ground-floor villa, but rather a first step towards something much more ambitious.
The house was built under the guidance of professor of product development Mick Eekhout (Faculty of Architecture) and is meant to demonstrate that not only villas can be built to be energy neutral - examples of these abound - but apartments too. The apartment has been designed in such a way that it will still be energy neutral when combined with other apartments in stacks of up to four stories high. Since it opened its doors in October last year, the home has been functioning as a laboratory for the Faculty of Industrial Design Engineering (IDE) to study users' behaviour and test new inventions.
During our stay in the apartment we intend to test its claim to energy neutrality to the limit.
First things first: we fill the fridge with beer and turn the lights in the living room up full blast. We turn the thermostat up a notch as well.
On the counter in the kitchen we find one of the gadgets developed at IDE. It's a tablet with an app that displays how much energy the house receives from its solar panels and how much energy is consumed. Various residents of the Heijplaat neighbourhood have stayed in the apartment before us and experimented with the app.

This app, called Ampul, clearly shows that our beers, the heating and the lighting have not made any kind of dent in the energy balance: we are still supplying plenty of power to the grid. The solar panels can generate between 1800 to 3200 watts. Our efforts so far are only consuming a few hundred of these.
And this is hardly surprising, considering the apartment has LED lighting, triple glazing, highly insulated walls and huge windows that let in plenty of light. The fridge is the main consumer; the energy consumption doubles temporarily after the fridge is filled. But the heat pump barely has to kick in at all. When we arrived, the house was still a comfortable 18.5 degrees Celsius.

Doing the ironing

Time for tougher measures. We use the kettle to make tea, vacuum the entire house and iron a few shirts. We turn on the TV and one of us takes a nice hot fifteen-minute-long shower. The solar panels, which cover about half the roof, are no longer generating sufficient energy. By the end of the afternoon, when it becomes cloudier and we start cooking dinner, we note that we are regularly drawing up to two kilowatts off the grid. The energy peak resulting from our potato gratin, fillet of pork and banana cake is clearly visible in the graph.
After dinner we experiment with the Niko Home Control app. This app enables you to operate all the lights and sun blinds in the house individually and adjust their settings. We discover other novelties too, such as a urine and faeces separator in the WC and motion sensors in the bathroom. Sadly, the sensors don't quite reach all the way to the shower cabin, so

'The toilets can be connected to a biogas plant'

that you end up showering in the pitch dark after a few minutes.
At night we leave the thermostat on at twenty degrees, which is a bit on the warm side. The next morning we make a copious breakfast and then turn on the dishwasher and the washing machine, even though they are only half full, and we all take another long shower. In other words, we were able to resist the temptation to save energy, even though this house stimulates you to do so in every possible way.

Free heat

We consumed some 20 kilowatt hours during out stay of just under 24 hours, while the solar panels produced over 17 kilowatt hours. However, the month of May was not a particularly representative one. During the whole of 2012 the solar panels produced 2500 kilowatt hours. Divide that by 365 and you have 6.8 kilowatt hours, which means we more than exceeded our budget.
"There were four of you though," IDE man and designer of the Ampul app Jaap Rutten points out as an extenuating factor. "That's quite a lot for a three-room apartment, and you made a lot of use of the oven. On any other day, with less people in >>


Photo: Tomas van Dijk

The Ampul app displays our exact energy consumption, in this case of the vacuum cleaner.

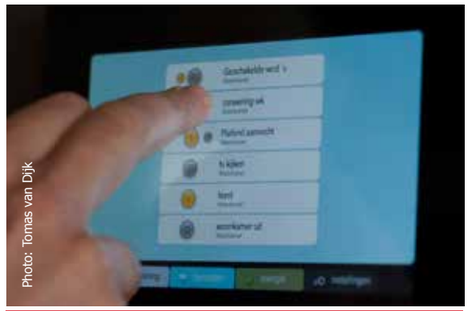


Photo: Tomas van Dijk

The home control system enables us to operate all the lights and sun blinds.

the house, and if you stick to preparing simple pasta dishes on the stove, you will probably break even." David Keyson, professor of smart products & environments at IDE, laughs loudly when he hears about our experiment. He is the Project Manager of SusLab, an energy efficiency project. "You needn't have spent the night in a hot bedroom," he smiles. "The underfloor heating is extremely efficient. We have used a heat loop in the house, meaning that warm water is pumped up from 130 metres deep and channeled past a heat exchanger incorporated into the heat pump, to help warm the house. That warmth is practically free."
The professor tells us our hot showers had little effect either. The water for the shower is also heated using the heat loop. Moreover, there is another heat exchanger under the drain in the shower that ensures that part of the energy that would otherwise have drained away can be reused. But Keyson has underestimated us here; the apps showed us that the heat pump used no less than 5.6 kilowatt hours of energy.

Building the apartments

Admittedly, we did get a little bit carried away. We too have become convinced that this home can be energy neutral. But will it still be energy neutral when it's part of a four-storey apartment building? "The proof of the pudding will be the construction of the Urban Villa, a four-storey building consisting of sixteen of these apartments," says professor Mick Eekhout. "I would like to make a start on the construction of that apartment complex before I retire in eighteen months' time. I'm really pushing this project, while the market should really be taking much more of the initiative. Sadly, these are hard times for the construction industry."
IDE alumnus Jaap van Kemenade is confident that such an apartment complex will indeed be energy neutral. After his graduation he spent four years working on the Concept House under Eekhout's guidance. He was responsible for managing the construction of the apartment on site. (See box on Prefab development baby) "Due to the tight budget we were only able to cover half the roof with solar panels," explains Van Kemenade. "If the apartment complex does eventually get built then of course the entire roof surface will be used."
Up on the roof, Van Kemenade points to another "energy source"; solar collectors. They are in place but have yet to be hooked up. Not only do these solar collectors generate heat, they also cool the solar panels, improving their efficiency. And in the winter you can use them to melt the snow on the roof.
There are more surprises inside too. "The toilets can be connected to a biogas plant," explains Van Kemenade. "There is also a connection for a hot fill, allowing the white goods to use the heat pump rather than their built-in heating elements, which are much less efficient."

Virtual aquarium

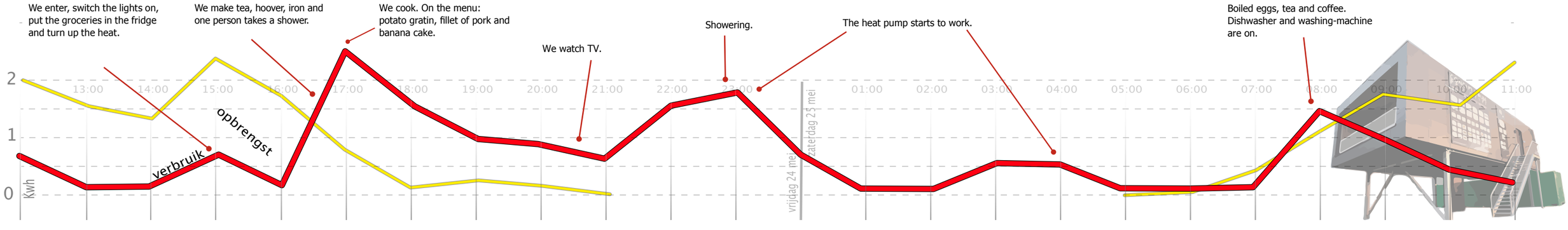
Of course there is also room to experiment with new technologies. Professor Keyson has a whole list of projects in the pipeline; computer-controlled washing machines and dishwashers that automatically switch on when the sun is at its brightest, and smart grid technologies, for charging electric cars at home for example.
The E-quarium app, a virtual aquarium with a goldfish swimming around in it, is intended to make people more energy conscious. If you use energy sparingly, the little fish will look contented and its tank will be filled with clear water and lots of beautiful water plants. The app will be tested shortly in the Concept House.
Together with the OTB Research Institute and research partners in England, Germany and Sweden - who have also built energy neutral houses - he wants to study people's energy consumption behaviour and link this to data to weather conditions. To this end they have installed a weather station next to the entrance of the Concept House.
Keyson: "My main aim is to gain a better understanding of how people use a home. The current models cannot explain the considerable variation in energy consumption. I suppose many people think they can be less careful with energy when they are staying in an energy-neutral house," he laughs. <<

'The energy peak resulting from our potato gratin, fillet of pork and banana cake is clearly visible in the graph'

Prefab development baby

The original purpose of the Concept House project was threefold. First, they wanted to build an energy-neutral house that could be stacked with others to create a four-storey apartment building. Secondly, the house had to be made of sustainable materials, particularly wood. And finally, the Architecture-faculty researchers wanted to demonstrate that the house building industry can be industrialized to a much greater degree than is the case now.
All the large components- the walls, floor, roof and wet room - are prefabricated. Almost all the various parts of the building were completed before they were transported to the building site in December 2011. Walls came ready equipped with sockets, windows and plasterboard. The house was put together like a Lego set on the building site, with the space of two weeks. The prototype cost some €400,000, most of which was paid in kind in the form of building materials supplied by dozens of participating construction companies.
Eekhout is keen to continue the project and build a cheaper version, but the economic situation is against him. Eekhout: "Where two years ago we were able to find companies to participate in the project, today they are no longer willing." Moreover, the Faculty of Architecture has terminated the project. "My development baby has been taken from me for reasons of bureaucracy and frugality," he says. "Happily, IDE retained a budget for the building's maintenance, so that it can still be used as laboratory."
Architecture dean Karin Laglas told us in an e-mail that she thinks the Concept House is "an excellent project". "Unfortunately," she says, "the project grew beyond the faculty's financial capacity, which is why I had to pull in the reins."

www.suslab.eu
concepthouse.bk.tudelft.nl



Racing under water

Photos: Hans Stakelbeek

Students of TU Delft won second place with their Wasub III at the International Submarine Race in the United States. But the race left them with a bitter aftertaste, as the submarine crashed into the side of the course twice.

Tomas van Dijk

A 'giant manta ray' glides majestically through the water, its wings powered by a diver in a wet suit, pedalling fit to bust. Meanwhile, a 'tuna' with a large mechanical tail makes frantic attempts to get its head off the bottom. Left and right, cyclists flash by in cigar-shaped cocoons, leaving a long trail of air bubbles.

Ordinarily, the US Navy patrol uses its kilometre-long indoor basin in Maryland – the David Taylor Model Basin – to test patrol ships. During the two-yearly International Submarine Race (24-28 June), however, the long pool becomes the playing field for some 20 teams of secondary school and university students, most from North America. With their hand-made, human-powered submarines, they race in 100-metre sprints. They're all trying to break the world speed record of 7.2 knots (13.3 km/h).

This is the first time since the Wasub II fiasco that a group of TU Delft students have dared to cycle under water. In 2006, the Wasub II smashed to pieces when it crashed into the wall during an underwater race near Los Angeles. The cause was an unresponsive steering mechanism as a result of corrosion.

The new team, made up almost entirely of third-year students, spent a year in the Dream Hall on campus revamping the vessel. The submarine ultimately took the form of a bright red, elliptical cigar that keeps the flow along the hull laminar for as long as possible. The underwater bicycle looks fast and in fact the team is taking part in the special competition for speed demons: the propeller category. Submarine pilots in this category cannot afford to suffer from claustrophobia. They are required to squeeze into cocoons where they can only just lie flat on their stomachs - with their face to the front. In this position they have to pedal to turn a propeller.

Poor balance

Gijs Bloemen is leader of this new Wasub III team from TU Delft. Halfway through the competition he called in to report that Wasub III had only achieved 5.15 knots so far, which is a mere 9.5 kilometres per hour. The vessel was not properly aligned and several times

'The team is taking part in the special competition for speed demons: the propeller category'

ended up bobbing in the water with its tail waving helplessly in the air. The cause: a new certified American diving cylinder that the students had been forced to purchase to meet the American safety requirements. The vessel had not been designed with this heavier cylinder in mind. In the meantime, their main rivals, the Canadian team Omer who represented the École de technologie supérieure de Montréal, were already achieving bursts of speed up to nearly 7 knots (and they would finally win with a maximum of 7.28 knots).

Later in the week, disaster struck. Just as its predecessor Wasub II, Wasub III crashed into the wall, after a piece of the hull broke loose and damaged one of the fins. The students repaired the hole with Plexiglas and transparent tape. Despite this setback, the next day they were still able to achieve a speed of 6.7 knots. This was to remain their best score. On the last day of the competition they crashed into the wall again. The pilot came to the surface gasping for air and was hauled onto the bank by Navy frogmen.

Bloemen is disappointed. He was convinced that his team would win first place with their innovative propulsion system. Wasub III has two contra-rotating propellers, one behind the other. One rotates to the left and the other to the right. This makes the boat much more stable. "I must admit," he says, "that some of the other teams also have contra-rotating propellers. But they are not nearly as good as ours. We were assisted in the design by MARIN researcher Jan Hamilton, one of the originators of the Hamilton-Mackenzie power prediction for ships and a big name in marine technology."

The project leader also had high expectations of the ventilation system. Most of the submarines have holes on the top to release the air that the cyclist exhales. This means that the exact place at which the air escapes keeps changing. And that makes the vessels unstable. In contrast, we lead the air through a hose to the back."

Breathing apparatus

This solution is not high-tech; in fact, it's quite the contrary. The Dutch navy had given the students an ancient breathing apparatus with only one round outlet for exhaled air. They were able to attach the hose leading to the back of the boat to this outlet. "A breathing apparatus usually has two oval outputs on the sides. That makes it more difficult to attach a hose – and you don't want to mess with a breathing apparatus. It has to be safe."

The fact that the Wasub I performed well back in 2005 reinforced Bloemen's self-confidence. In that year, this vessel finished in first place in the category of one-person propeller submarines. With a speed of 12 km/h, the submarine was even then approaching the current world record.

This year, thanks to the new diving tank, the students had to take care of much of the vessel's fine tuning just before the competition started in the US. This is what led to their downfall, and is in stark contrast with the extensive preparations of many of the other teams, some of whom have been participating in this challenge for more than 20 years. The internet offers countless videos of participants testing their boats in open water. For example, for months, the team from Florida Atlantic University had been merrily completing laps in the Atlantic. And a video on YouTube shows students from Washington University doing all kinds of tests on their underwater bike in a large lake.

However, there were also several technical aspects that made them into formidable opponents. For example, winner Omer had a special trick that the Wasub lacked. Their sub has a gear system built into it. This system can adjust the angle of the propeller blades such that the propulsion increases during the race and with it, the pedalling resistance. This allows the cyclist to accelerate better. This is not a luxury when you have only 100 metres to prove what you can do.

Other teams had equipped their boats with accelerometers and automatic pilots, which meant that the cyclists could concentrate on producing power rather than continuously adjusting their course. "We also tried to make an automatic pilot", Bloemen tells us, "but we didn't have enough time for that."

The new project manager, 20-year-old mechanical engineering student Joshua Neving, who will put together Wasub IV with a new generation of students, thinks the Wasub's ventilation system is one of its main weaknesses. "The system created a difference in air pressure between the front and at the rear of the submarine, so that the pilot did not have access to a constant flow of air. On the other hand, we plan to keep the double propeller system, and we will try to get the steering mechanism to work more smoothly." <<

The Wasub IV will compete in the European International Submarine Races in July 2014 in England.

The pilot came to the surface gasping for air and was hauled onto the bank by Navy frogmen.

Propositions

Engineering education teaches students to be problem-solving automatons.
Wim Verhagen, aerospace engineer

The term 'automation' wrongly suggests that things will always go automatically.
Joost Ellerbroek, aerospace engineer

Driving at night would be much safer if all vehicles had reflectors or rear lights that mark their size and also indicate their speed.
Kerstin Siemes, aerospace engineer

More doors and better transport routes to and from the train stations would have been a better investment than the new high-speed train.
Bart Sjenitzer, applied physics engineer

Ikea furniture is a real-life Lego for adults.
M.B. Santillana, material engineer

People tend to believe what they are offered via social networks rather than from scientific publications.
Arash Noroozi, micro-electronics engineer

It is plausible that in Western societies, loving animals will become more beneficial to people than eating them.
Nynke Tromp, industrial design engineer

Proposition

It remains in the interest of The Netherlands to grant residence permits to highly skilled migrants even if they become unemployed.
Miloš Vulović, electro technical engineer

Defence

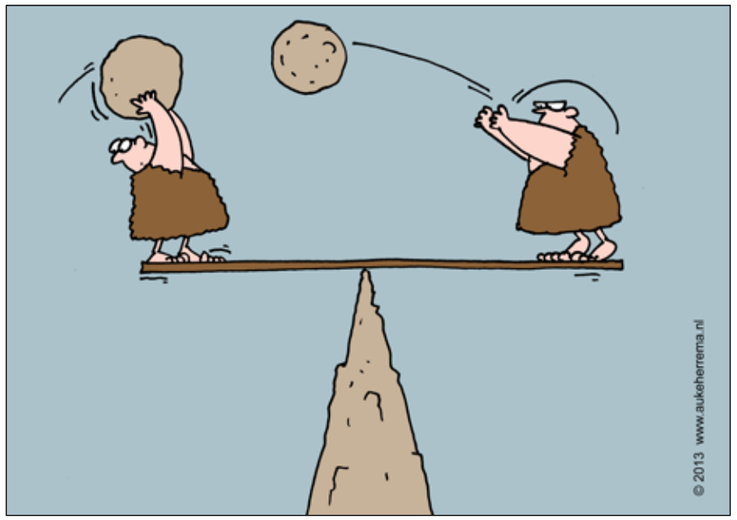
When the employment contract of non-EU migrants ends, they need to leave the country. But highly educated migrants have a high chance to quickly find a new job and again contribute to the Dutch economy. PhD candidates often have to spend quite some energy and time during their final and the busiest year trying to find a way to stay in the country. There should be a mechanism to allow them to stay, at least for some period. There are some ways, of course, but these are not transparent enough. Allowing skilled migrants to stay is also in the interest of multiculturalism and it helps improve the Dutch cuisine.

Soundbites

"We want MAVs to become just as ubiquitous as mobile phones. You would be able to take such a device out of your breast pocket and simply throw it in the air. Farmers could inspect their crops, emergency services could inspect burning buildings, and amateur film-makers could take aerial shots with it.'
From an interview on Micro Air Vehicles, i.e. automatically controlled unmanned aircraft, with project manager Bart Remes in de Volkskrant.

"The tunnel is narrow. There is no hard shoulder. The tunnel appears even narrower because of the concrete walls. Moreover, there is a sharp corner and a slope at the north end. The situation is complex and the result is that less experienced and elderly drivers tend to reduce their speed. The differences in speed lead to accidents."
Traffic psychologist Raymond Hoogendoorn talking to NRC Handelsblad about accidents in the Second Coen Tunnel.

"Cardboard is roughly five times more environmentally friendly than plastic, and the water repellent coating on the cardboard is very effective. The environmental impact of the coating is negligible in relation to the cardboard itself. So cardboard scores better than plastic for external hard disks."
Dr Joost Vogtländer, associate professor of sustainable design, talking to Trouw about BytePac, a cardboard enclosure for an external hard disk.



Peace is practiced as the balance of power rather than living with mutual respect.

Arash Noroozi,
micro-electronics engineer

Science for all

The free exchange of knowledge is truly gaining sway, thanks to the internet. Wilma van Wezenbeek, director of the TU Delft Library, believes we are on the eve of a scientific revolution.

All knowledge gathered with the help of public funding should be made accessible to all, agree more and more scientists and research funding organizations. This open access philosophy tends to conflict with the business models of most publishers. These demand high subscription fees, and, according to scientists, so frustrate the pursuit of science. But not for much longer. Publishers are now starting to lose their influence, now that information is easier to share via the internet.
"There is already a growing pool of open access journals where peer review, archiving and the search tools are organized by the scientific community itself, rather than the publishing houses," explains Van Wezenbeek.
This trend is set to continue, according to Van Wezenbeek. "In twenty years' time the term open access won't mean anything anymore. Free access to publications and data will be a matter of course. I can imagine a kind of Spotify-type system whereby scientists, as well as 'normal citizens', pay a small fee in order to access the data they need. Science for all! As with Spotify, you could opt for a free subscription with 'advertising' or a paid subscription without it."
The emphasis will shift from the publications themselves to the data in them. "The huge databases of the universities and research funding

"In twenty years, free access to publications and data will be a matter of course"

organizations are becoming more important. Scientists can use this data to perform meta-analyses, and so discover new relationships faster. This will provide a huge boost to science and to the economy."
However, a major problem will have to be fixed first. Scientists today are still eager to get their work published in the journals of publishing houses such as Elsevier, because these journals have high citation scores. Often the universities that employ these scientists will demand such high ranking publications of them.
Van Wezenbeek believes such classification systems will be cast aside in the future. Instead, research citations will float around on social media sites. "The mentions in social media will come to determine which publications come out on top."
The manner in which scientific knowledge is disseminated will go the same way as films, music, books and everything to do with the entertainment industry, thinks the library expert. "Today, all kinds of sites offer you suggestions for music, books or other products on the basis of a profile they have of you. In much the same way, scientists will receive push messages about scientific publications on the basis of their profile."
"That will be very handy. But you will need to make sure that you don't get caught in a filter bubble, whereby you will no longer receive random suggestions of other publications that might be of interest to you." (TvD)


Photo: Sam Rentmeester

Scour holes

A dangerous situation had developed just off the coast, and the Directorate-General for Public Works and Water Management (Rijkswaterstaat) Zeeland was unaware of it. Six engineers reported it to the House of Representatives. The scour holes caused by the Oosterschelde storm surge barrier were becoming deeper and steeper than was permitted.

The engineers of the storm surge barrier had taken such scour holes into account in their design. Such holes occur underwater due to the turbulence created by the barrier. To control the phenomenon, long mats have been laid on the seabed around the barriers and weighted down with blocks. "But scour holes are still formed at the edges of the mats, and if these become steeper than 1:5, then extra loose stones have to be poured into them. However, this practice was stopped in 2000, and now a dangerous situation has arisen," says Han Vrijling, professor emeritus of hydraulic engineering. He was among the signers of the warning letter to the House of Representatives. According to Minister Schultz Van Haegen (Infrastructure and the Environment), the tone of the report is exaggerated. She labelled the unrest 'unnecessary'. "Her reaction concerns me. It most certainly is a dangerous situation," Vrijling emphasizes. "The scour holes are forming behind the storm surge barrier, off the coast of Noord-Beveland. If the sides of the holes become too steep, the dyke may collapse, and the consequences will be serious."
Professor of water safety Matthijs Kok shares his concern. "This is an extremely serious situation. It is not an unexpected phenomenon; the necessity of pouring extra stones is described in the design of the barrier. There has been no disaster yet, but the risk was unacceptably high," he says.
Vrijling emphasizes that the people behind the report had called attention to the problem in a letter to Rijkswaterstaat last year. "Measures were taken at the time, but no definitive solution was created. We want a structural solution to the scour holes. This is why we wrote a letter to the minister. When we failed to receive an answer we made our report to the House of Representatives."

'Rijkswaterstaat used to be an engineering stronghold'

The engineers believe there is a larger problem behind the present situation with the storm surge barrier. "Over the past years, Rijkswaterstaat has lost a lot of knowledge. It used to be an engineering stronghold, but many highly skilled technicians have since left the organisation. The thinking behind this was that knowledge could be hired when it was needed. Apparently, not enough knowledge is being hired. The fact that the scour holes have gone unnoticed is an example of this."
Kok wants Rijkswaterstaat to recover the ground they have lost. "They need to start recruiting engineers again." Kok hopes the report will be a wake up call for the politicians and for Rijkswaterstaat.
Vrijling does not have much confidence in a good outcome. "I'm curious to see what happens next. I'm afraid that more such incidents will be required before the minister and Rijkswaterstaat are finally convinced. And there is another factor involved too. My generation experienced the flood disaster of 1953 first hand. It seems as if in recent times there is less awareness of the importance of preventing such a catastrophe and protecting the Netherlands from the sea, so we can prevent a new, horrible disaster." (RV)

Chemical technologist Dr Ruud van Ommen (AS) has made the 2013 list of rising stars and young nanoarchitects in materials science of the Royal Society of Chemistry. Van Ommen coats nanoparticles to make them function more effectively as catalysts. He succeeded in coating little balls of titanium dioxide with nanoclusters of platinum.

Dr Pouyan Boukany (AS) has received an ERC Starting Grant to focus his studies on a more efficient and safer way to transfer non-viral genetic material to cells using the mechanism of electroporation in membranes, and also to carry out further study of DNA transport at the molecular and subcellular levels. The safe and effective transfer of DNA to target cells is essential when treating congenital and non-congenital diseases using gene therapy and DNA vaccination.

ESA wants to send a satellite to Jupiter's moons in 2022. In order to determine the best route, Guido de Croon (AE) and his colleagues at ESA developed a calculation method. This will help the satellite to choose the optimum route based on the continually changing positions of the celestial bodies. For this work the team received the prestigious Humies award.

Dr Grégory Schneider (AS) also received an ERC Starting Grant. He is studying graphene from a chemical perspective. He has been given an ERC Grant to see if he can use the unique edge and surface properties of graphene to develop a standardized method for the functional use of this material. He will apply fundamental knowledge of graphene chemistry at the molecular level.

No-one to look after your plants while you're on holiday? IDE student Kim Monster devised a plastic spout in the form of a spider that you can screw on to a plastic bottle. Fill the bottle with water, turn it on its head with the legs of the spider in the soil and your plants will be drip-fed with water while you are on your holiday. The invention won her the HEMA Public Choice Award in 2013.

Hans van Lint (CEG) has been appointed an Antoni van Leeuwenhoek professor. He received his PhD in 2004 on the subject of reliable freeway travel time prediction, and now works at the department of Transport and Planning and is Director of Studies of Transport, Infrastructure and Logistics (TIL).

Art historian Prof. Timo de Rijk (IDE) has been appointed full professor of the new joint chair of design, culture & society of TU Delft and the University of Leiden, which was launched on 1 September. His teaching and research will comprise the study of the historical and cultural significance of design. De Rijk teaches both students of industrial design engineering and art history, and as such the chair is unique in the world.

Joost Alferdinck, who recently graduated from the faculty of Industrial Design Engineering, has won the 'Autovisie' design competition with his Travel Vehicle Concept. The assignment was to design the car of 2025. The second and third prizes also went to IDE alumni, namely Marco van Overbeeke and Ruben Hekkens.

For the next three years, twelve promising TU Delft researchers will be able to develop new ideas and perform research with the aid of an NWO Veni grant (a maximum of €250 thousand per researcher).

Dr Marie-Eve Aubin-Tam (bionanoscience, AS) intends to study how toxins that invade a cell are transported; Dr Enrique Burzuri (Kavli Institute of Nanoscience, AS) wants to develop molecular magnets from graphene that can be magnetized using a polarizing current; Dr Neelke Doorn (philosophy, TPM) is studying how flood risks can be fairly and efficiently distributed; Dr Bram Klievink (ict, TPM) studies cooperation and administration in the information age; Dr Marios Kotsonis (aerodynamics, AE) wishes to reduce the drag on aircraft by generating a plasma on their wings; Dr Jan Kwakkel (policy analysis, TPM) is researching the measures being taken to prevent climate change; Dr Richard Lakerveld (process & energy, 3mE) wants to build highly functional microstructures; Dr Joost van der Neut (geophysics, CEG) will develop a seismic technology that also allows earth layers to be reached by seismic waves from below; Dr Volkert van Steijn (Chem-E, AS) is developing a microfluidic instrument for studying yeast mutations in microdrops; Dr Wilson Smith (ChemE, AS) will study the production of hydrogen from water and sunlight; Dr Behnam Taebi (philosophy, TPM) is studying the ethnical acceptability of the EU proposal to store nuclear waste outside the national boundaries; and Dr Tim Taminiau (AS) will demonstrate how quantum errors can be detected and repaired.

Name: Lisette Brouwer
City: Rotterdam
Marital status: single, 4 children
Position: strategist, out-of-the-box thinker and CEO of boiler manufacturer Coopra Advanced Heating Technologies
Salary: € 250.000,- per year
Study programme: Applied Physics
Student association: Delftsch Studenten Corps

She drinks champagne with a sparkling straw, wears stiletto heels and is the world's only female CEO in the boiler industry. She travels between the Netherlands, China, Germany and other countries and she shares the couch in her spacious home in Rotterdam with four beautiful children. It's a success story that most men can only dream of. Unsurprisingly, TU Delft alumnus Lisette Brouwer cannot understand why girls in secondary education are not interested in technology programmes.
The world of high efficiency boilers is not the most logical place for an applied physicist, but as far as Brouwer is concerned, the sector is not what it's all about. She prefers to see herself as a visionary, a creator of business concepts. Among her previous positions, she was the head of financial affairs for Museum Boijmans Van Beuningen and the City of Rotterdam. Her father owned a company with a business unit that had developed a high efficiency boiler, and he hired her to reorganise this part of the business. When she lost both her parents to an aeroplane accident in 2006 she found herself alone at the helm of the company - and subsequently transformed it into a business with an international reputation.

'Girls: technology is fun, use it'

But still she is treated with some suspicion by her colleagues. It is a male-dominated sector; not even a woman with straight As can change that. "It's easier in China," she says. "And the same in Germany: if you can give good answers to their technical questions then they will accept you. The Netherlands is way behind where it concerns women in the technology sector. And it is the women themselves who are mainly to blame. Incomprehensible. Girls: technology is fun, use it!"
And so she gathers female high potentials around her, representing every specialization, and she organizes network meetings with whisky and cigars. Many companies haven't got it yet, thinks Brouwer. "They keep too many of their activities in house. But balance is the Holy Grail. A world in which everyone does what they are good at. What we in the Netherlands need to do, is acquire more knowledge and implement this in other countries. We need to leave the large scale production work to the countries that are more geared to it." Which is not to say that she aims to have her own big Chinese factory. "It's time to put my knowledge up for sale. If the price is right, I'll happily move on to something completely different tomorrow." In a new pair of Louboutins, obviously. (JB)


Photo: Sam Rentmeester

Study app


Photo: Sam Rentmeester

On 20 August, the start-up business FeedbackFruits introduced an app aimed at helping improve education. TU Delft's Department of Education and Student Affairs (E&SA) is their first customer.

In September some three thousand new students will start a study programme at TU Delft. However, over the years, some seventy per cent of them will lose their motivation and move on to something else, says Ewoud de Kok of the start-up FeedbackFruits. The difficulty lies in being able to offer personalized education to ever higher student numbers. The ten employees at FeedbackFruit, almost all TU Delft alumni, are trying to help out with a free app.
"We want to make studying more fun, less individualistic and more inspiring," explains De Kok. "The app does not pretend to offer the whole solution, but it is a first step towards improving things." E&SA interim director Nellie van de Griend signed a contract with the enthusiastic entrepreneurs early this year.
The FeedbackFruits app works at three levels: students can comment on lectures they have followed, share lecture materials with each other and participate in live response during large-scale lectures. Students can comment on lectures via a Facebook-like page where they can ask questions, give compliments and submit complaints and suggestions. For students the page will probably mainly offer a sense of shared experience, while lecturers will be able to use it to find out where the bottlenecks are.
More and more useful course materials are being made available online. The difficulty lies in estimating the value of the available documents, reference works, films and lectures. The former students designed a Dropbox-type function, inspired by dean Prof. Hildo Bijl (Aerospace Engineering), who has been using a system of shared storage for instruction materials for some time now. Any student can upload material. Eventually the material will be tagged with a message that it has been approved and/or shared by a lecturer.

'Students can respond during a lecture using their smartphone'

Possibly the most spectacular function of the app is the ability to interact during lectures. A lecturer can use a QR code to incorporate interactive functionality in a lecture. Students can respond to questions with their smartphone, similar to the way television audiences do with voting devices. They might respond to the lecture content via a multiple choice question, but they can also comment on the tempo of the lecture. The students can press any of three feedback buttons: stop, play and fast forward.
The new director of E&SA, Timo Kos, thinks the app is a clever combination of such initiatives as rate my teacher and a place for sharing educational material. But do lecturers really want to hear all this feedback? Kos: "Good lecturers do." (JW)

www.feedbackfruits.com

ALUMNI EVENT 2013


Cees Dekker


Nienke Tromp

11 October: 2013 Alumni Event

‘Working on tomorrow’s challenges’

What is the state of research and innovation at TU Delft? What projects are the students working on and what is happening with the alumni projects? The main programme focusses on a number of challenges for the future.

Programme 2013 Alumni Event

16:00 Doors open
16:45 Main programme starts
18:15 Drinks reception and diner (plenty of opportunity to network!)
19:30 Workshop, mini lecture and presentation round 1
20:30 Workshop, mini lecture and presentation round 2
22:00 End of programme

Cees Dekker on nanoscience

In 2007, TU Delft branched into a new field of research: bionanoscience. Instruments originally developed to examine inanimate materials on a nano scale are now being applied by scientists on living materials, such as cellular DNA. Professor Cees Dekker is responsible for this expansion of the university’s scientific specializations. Together with his research group and the Kavli Institute – of which he is the Director – he is a world leader in his field.

Nynke Tromp and social design

Nynke Tromp received her PhD with distinction for her thesis entitled ‘Social Design. How products and services can help us act in ways that benefit society’ which she completed in July at the faculty of Industrial Design Engineering. Alongside her research at the university, she also works as a social designer at KVD reframing in Amsterdam. Her work for both organizations involves the social implications of design. She is developing tools with which designers can stimulate social behaviour and exercise a positive influence on current social issues, such as obesity, immigration and depletion of natural resources.

YesDelft’s Launchlab

We all know engineers who brood on an innovative idea for a start-up for years but don’t dare to take the next step. In early 2013 YesDelft introduced the LaunchLab especially for this group. The YesDelft LaunchLab is a programme for anyone who has an idea for a new technology business. Participants will start by testing their assumptions. They will meet future customers, business partners and suppliers. Tech-incubator YesDelft’s extensive network will open doors and provide coaching by enthusiastic and experienced businessmen and investors. A certain degree of peer pressure provides the necessary extra boost. The next LaunchLab programme will start on 27 September. You can register via

www.yesdelft.nl/launchlab

IDE Master Classes

The faculty of Industrial Design Engineering started the first series of IDE Master Classes this spring. The enthusiastic response and the interest shown by the participants during this first series was sufficient reason for IDE to offer a new series in the autumn.

The IDE Master Classes are a series of intensive, two-day master classes for design professionals provided by the faculty’s best lecturers. You will hear and learn about the latest developments, methods and techniques, just like the new generation of designers does. At the Alumni Event you can attend introductory master classes on themes such as ‘Vision in Design’ and ‘Creative Facilitation’.

Do you want more information about the 2013 Alumni Event or would you like to attend? Please visit:
www.tudelft.nl/alumni-event2013

During the evening programme, the faculties will present the latest developments in their fields. The following presentations and workshops will be held:

Presentations

- Shale gas – Auke Barnhoorn
- Massive Open Online Course (MOOC) on ‘Solar Energy’ – Arno Smets
- A visit to Silicon Valley – an inspiring EEMCS trip
- Super-resolution microscopy and bio-medical applications – Bernd Rieger
- Recent developments in the field of medical ultrasound (3D echoscopy, echocardiography, local administration of medicines, etc.) – Martin Verweij
- Observing the earth from the moon – Daphne Stam
- Massive Open Online Course (MOOC) on ‘Next Generation Infrastructures’
- Iconoclasm Then & Now – Parallels between the seventeenth century and modern architecture
- Innovations in aerospace, with a focus on ‘swimming satellites’

Workshops

- New career services for Young Alumni – a taster
- Biotechnology & society
- Mini Master Class on ‘Vision in Design’ – Paul Hekker
- Sports innovation – Valorisation Centre
- Build a Modular Dome – Buckylab, Marcel Bilow
- Energy Management – Jan-Henk Welink
- YesDelft Launchlab in an hour

MOOCs

TU Delft recently started offering free Massive Open Online Courses (MOOCs) open to anyone, anywhere in the world. The courses on ‘Solar Energy’ and ‘Introduction in Water Treatment’ are currently underway. The MOOCs ‘Introduction in Aerospace Engineering’ and ‘Next Generation Infrastructures’ will start in 2014. During the Alumni Event you can experience the MOOCs ‘Solar Energy’ and ‘Next Generation Infrastructures’ courses for yourself.

Alumni Activity calendar

See also www.alumni.tudelft.nl

7 October	Start of the Master of Business in Energy Systems
10-12 October	Conference on ‘Complexity, Cognition, Urban Planning and Design’
11 October	2013 Alumni Event
11 October	Presentation of the Alumnus of the Year
31 October	Conference on Building Materials and Innovation
16-17 October	IDE Masterclass Service Design
6-7 November	IDE Masterclass User-centered Innovation
14 November	UfD Royal HaskoningDHV prize for best graduate and best lecturers

Career Centre

Since August 2013, the TU Delft Career Centre has expanded its services. Alumni can now use the digital career tools, attend career workshops or request a personal interview with a Career Counsellor up to five years after their graduation. Join one of the TU Delft Career Centre’s interactive sessions during the Alumni Event. There you can meet the staff of the Career Centre and get a taste of what they have to offer. They understand the study programmes and job market for engineers and can quickly help you on your way if you have career-related questions.

UfD Leermeester Prize

The 2013 UfD Leermeester Prize was awarded to Prof. Pieter Kruit. Prof. Kruit is professor of particle optics at the faculty of Applied Sciences. He is also a cofounder and the first CEO of Mapper Lithography, a company that develops advanced electron lithography machines. Kruit won the FOM Valorization prize in 2011 and in 2012 he was appointed Knight of the Order of the Netherlands Lion. The 2013 UfD Leermeester Prize was presented during a ceremony held prior to the opening of the academic year on 5 September.

For more information see:
www.universiteitsfonds.tudelft.nl

Colophon

Alumni portal
www.alumniportal.tudelft.nl
Changes of address
Subscribe or unsubscribe
- e-mail newsletter
- alumni events

Join our LinkedIn group

Register with the Delft University of Technology Alumni group

Friends of TU Delft
Become a ‘Friend of TU Delft’ and support Talent, Technology and TU Delft with your contribution.
Account number: 22 68 50 471
Stichting UfD, mentioning “Friends”
universiteitsfonds.tudelft.nl

Questions or suggestions?
Alumnibureau@tudelft.nl
Telephone (015) 2789111

who & where

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

TU Delft
P.O. Box 139
2600 AC Delft
The Netherlands
telephone +31-15 278 9111
telefax +31-15 278 6522

Disciplines

Aerospace Engineering
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 2058

Applied Earth Sciences
Mijnbouwst raat 120
nl-2628 RX Delft
Telephone +31 15 278 1423

Applied Physics
Lorentzweg 1
nl-2628 CJ Delft
Telephone +31 15 278 7774

Architecture
Berlageweg 1
nl-2628 CR Delft
Telephone +31 15 278 4184

Chemical Technology & Bioprocess Technology
Julianalaan 136
nl-2628 BL Delft
Telephone +31 15 278 2667

Civil Engineering
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 5440

electrical engineering
Mekelweg 4
nl- 2628 CD Delft
Telephone +31 15 278 4568

Geodetic Engineering
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 3289

Industrial Design Engineering
Landbergstraat 15
nl–2628 CE Delft
Telephone +31 15 278 4750

Life Science & Technology
Julianalaan 67
2628 BC Delft
Telephone +31 15 278 8271

Marine Technology
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 6666

Materials Science
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 6666

Mechanical Engineering
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 6666

Computer Science
Mekelweg 4
nl- 2628 CD Delft
Telephone +31 15 278 4568

Applied Mathematics
Mekelweg 4
nl- 2628 CD Delft
Telephone +31 15 278 4568

Technology, Policy & Management
Jaffalaan 5
nl-2628 BX Delft
Telephone +31 15 278 7100

Multidisciplinary Centres

Adhesion Institute
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 5353

Biotechnological Sciences Delft Leiden (bsdl)
Julianalaan 67
nl-2628 BC Delft
Telephone +31 15 278 5140/2342

Centre for International Co-operation and Appropriate Technology (cicat)
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 3612

Centre for Transportation Engineering
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 6634

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

Koiter Institute Delft (Institute for Engineering Mechanics)
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 5460

Netherlands Institute for Metals Research (NIMR)
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 2535
Fax +31 15 278 2591

Wind Energy Research Group
Kluyverweg 1
nl-2629 HS Delft
Telephone +31 15 278 5170

Reactor Institute Delft
Mekelweg 15
nl-2629 JB Delft
Telephone +31 15 278 5052

OTB Research Institute for Housing, Urban and Mobility Studies
Jaffalaan 9
nl-2628 BX Delft
Telephone +31 15 278 3005

Open Building Working group (obom)
Berlageweg 1
nl-2628 CR Delft
Telephone +31 15 278 5400

Delft Institute for Microelectronics and Submicron-technology (dimes)
Feldmannweg 17
nl-2628 CT Delft
Telephone +31 15 278 3868

Interduct Delft University Clean Technology Institute
Rotterdamseweg 145
nl-2628 AL Delft
Telephone +31 15 278 7233

J.M. Burgerscentrum Centre for Fluid Mechanics
Mekelweg 2
nl-2628 CD Delft
Telephone +31 15 278 3216

Netherlands Schools for Advanced Studies in Construction
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 3332

Advanced School for Computing & Imaging
Mekelweg 4
nl-2628 CD Delft
Telephone +31 15 278 8032

Trail Research School
Kluyverweg 4
p.o. box 5017
nl- 2629 HT Delft
Telephone +31 15 278 6046

Central Library

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

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

Delft University Press
IOS Press
Nieuwe Hemweg 6B
nl-1013 bg Amsterdam
www.iospress.nl
Telephone +31 20 688 33 55
Fax +31 20 620 34 19
E-mail order@iospress.nl

Information

General information:
Information office
p.o. box 5
nl-2600 AA Delft
Telephone +31 15 278 5404

Information on facilities for foreign students:
Student Advisory Office
Jaffalaan 9a
nl-2628 BX Delft
Telephone +31 15 278 4670

Liaison between business and research:
Liaison Office
Mekelweg 2
nl-2628 BX Delft
Telephone +31 15 278 1500

Information on research fellowships:
Mrs. M.Y.M. Spiekerman-Middelplaats
Stevinweg 1
nl-2628 CN Delft
Telephone +31 15 278 3773

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

(Post Graduate) Courses

Delft TopTech
(vocational courses)
Mekelweg 2
p.o. box 612
nl–2600 AP Delft
Telephone +31 15 278 8019
Fax +31 15 278 1009
www.delft-toptech.nl

Institute for Biotechnology Studies Delft Leiden (bsdl)
Julianalaan 67
nl-2628 BC Delft
Telephone +31 15 278 2355

For information on courses in the Dutch language:
Language Laboratory
Jaffalaan 5
nl-2628 BZ Delft
Telephone +31 15 278 4124