

Dräger Review¹⁰⁹

Technology for Life **2014**

Women in Mining

Joining the men in
Colorado

Antarctic

Diving into
the nursery of krill

Teamwork

More efficiency in the OR



Who Says I'm Old?

Demographic change in the workforce:
a new understanding

Fire, water, earth, air – man cannot live without the four elements. Yet he must protect himself against their dangers. Dräger's 'Technology For Life' has been helping people deal with the elements for 125 years.

“To ward off these four elements, most especially when they rage wild and tumultuous, without allowing the threatened human life to be torn away by their power and energy, and to rein those elements back in again – that has always been, from the very earliest beginnings, the mission of Dräger.”

Senior Pastor Wilhelm Mildenstein, St. Mary's Church Lübeck, on January 16, 1928, at the funeral of Bernhard Dräger

Water

People have fought over clean water just as they have fought over access to the seas. From early times they have considered lakes, seas, and rivers as transport routes and means of conquest. Enormous pressure, cold, darkness and of course the absence of breathable air make the depths of the ocean a place still largely unknown – the first deep sea dive was in 1960 when the Swiss Jacques Piccard and his companion, the American Naval Lieutenant Don Walsh, dived to almost 11,000 meters in their submersible, the Trieste. Despite protective equipment, the underwater world remains one of the loneliest and most challenging places to work.

Around **6 million** is the number that the working population of Germany will shrink by 2025 as a result of demographic change. A challenge for many countries – more starting on page 8.



PHOTO: GETTY IMAGES; COVER PHOTO: DIGITAL ZOO/GETTY IMAGES

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People Going Places



PHOTOS: PICTURE ALLIANCE/SAHAN NUHOGLU; TEXT: BARBARA SCHAEFER

Ass. Prof. Dr. Şirin Güven, Head of a Preterm and Neonatal Unit in Turkey

“The birth rate is high in Istanbul – we have 350–450 births every month in our hospital alone. Women have an average of four to six children each in the district of Ümraniye, and that figure is rising. The families that live there are very traditional, and people often marry their relatives. This leads to a higher level of premature births, and unfortunately to abnormalities also. I try to educate women, but they have a tradition of modesty which unfortunately leads them to seldom use our screening facilities. Because we have such a good reputation, we treat a growing number of problem pregnancies, our patients include women from Syria. The hospital was originally built without a neonatal ward, back then 1.5 million US dollars was invested. I’m especially impressed by Dräger’s breathing system for newborns. We were the first hospital in Istanbul to receive

the system, and now we have 14 of them. Sometimes children are admitted from other hospitals who have already given up on them, but we see them through. Safety and hygiene are our most important principles, because young infants are so sensitive to germs. I, for example, have very short fingernails, I don’t wear nail polish, nor do I wear jewelry. We don’t just want them to survive, we want parents to take healthy children home with them. One special moment I remember was the birth of Nuray. Her pregnant mother had died in a road accident, and it was a postmortem delivery in the 32nd week. The girl is now four years old. I never saw her again because the family moved away. Nuray is probably laughing somewhere, for me this is a lovely thought. I love children, they’re our future, and I would definitely choose this career again if I were given the chance.”

Serkan Karadayi, Captain and HSQE Manager, MSC Shipping, Turkey

"They used to take little birds into tankers as gas detectors – can you believe that? Once they had unloaded the vessel they put the birds into the tanks to check if there was still any gas left inside. Today we use multi-gas measuring devices for the task. We transport chemicals, various oils and gases. After training as a captain I sailed all of the world's seas, and of course I sailed on the Bosphorus too. At night, a coffee in your hand, navigating between the Asian and European shores – it's quite something. But the Bosphorus is dangerous too: ferries cross and tankers move – from the Black Sea to the Sea of Marmara and back. And all in between are countless fishing boats. You have to be alert. I come from Gallipoli on the Dardanelles. My uncle was a fisherman and I grew up on the sea. Being a captain is not an easy job, but it's interesting. I've been on board for four months at a stretch, including

in dangerous waters. There have been times when I slept badly; not because of the waves but because of the dangerous cargo we had on board. Regulations on tankers are very strict. The safety-check for chemicals alone covers 50 pages of small print. Our tankers are all equipped with Dräger equipment, and we also manage vessels for other shipping companies. We wear gas measuring devices on our clothing. Many gases are heavier than air. You can stand on board and be unaware of what's happening around your feet. If you drop a pen and bend over to pick it up and there are gases there, the alarm goes off. I was sailing at sea for ten years, then my family protested because I was always away from home. Since then I've worked as a Health Safety Quality Environmental (HSQE) manager. What do I miss? Sailing across the open ocean, stars in the sky above, and dolphins in the water."



WHAT THIS IS ABOUT

Keywords

Each keyword reveals a new aspect of an article and shows it from a different perspective. Every theme, after all, has many facets. The explanations and definitions of these keywords are drawn from lexicons, dictionaries, and encyclopedias – and they include forays into other fields **so that we can view them from different perspectives.**



MAJOR

Anniversary

When anniversaries arrive, we like to look back on what we've achieved. It is no different for companies. **Those things include the achievements of 125 years of Dräger's history: more starting on page 16**

DOWN

Below

Rolling fields of wheat, a multi-ethnic state, patterns of Islamic art – each of the stations in Central Asia's only subway, in Tashkent, is a work of art decorated with colorful ceramic tiles (maiolica). We know little of the fire protection facilities there. **But that is certainly not the case with these subways and suburban railways: more starting on page 34**



FULL OF COLOR

Written on the wall

In the age of the Internet it is hard to imagine how uncensored public communication used to take place. One way was by means of pictures and writing on walls known as graffiti. Pompeii is full of it. And even the scratchings of certain wandering peoples have represented languages in their own right. Facade art can be a sign of protest, revolution, and culture. It can certainly be a nuisance – **but it can also be a stunning attraction in public spaces: more starting on page 40**

CHECKLISTS

Organization at work

There are few jobs that a lone hero can tackle. Work almost always requires collaboration – and a social structure which makes the best use of different technical expertises and different character traits. Whether and how that is achieved depends on the formal as well as the informal structure of a working group – **and that applies especially in the operating room: more starting on page 22**

DEMOGRAPHIC CHANGE

How old?

The age of objects and living things is measured in terms of time and can range from the shortest physical unit, the 'Planck time', which is around 5×10^{-44} seconds, to the period of approximately 13.8 billion years that has lapsed since the Big Bang. If the age is not documented then it must be estimated or measured. Dendrochronology, for example, determines the age of felled trees by counting their rings. Since these can vary in breadth on account of the conditions of vegetation,

characteristic patterns emerge which allow a relatively precise determination of age, and this can extend to objects made from wood (like beams in timber-frame buildings). Radio-carbon dating on the other hand makes use of the fact that after a living thing dies, the ^{14}C isotope it has absorbed decays following a set pattern. **But age and aging don't just cause rings and decay, they have other consequences – many of which are most welcome: more starting on page 8**



SOCIAL CHANGE

Female

An old proverb states that women bring nothing, but bad luck on the sea and below ground – with the exception of Saint Barbara, the patron protectress of miners. Women were not given the right to vote until the 19th century or later.

(Germany: 1918). **Much has changed since then – women lead nations and work down in the mines: more starting on page 18**



ICY

White desert

His team reached the South Pole four weeks after Roald Amundsen, and Robert Scott and his crew froze to death on the way back. In early 1912 he wrote: “To my widow – Dearest Darling – we are in a very tight corner and I have doubts of pulling through. [...] If anything happens to me I shall like you to know how much you have meant to me and that pleasant recollections are with me as I depart. [...] Quite the worst aspect of this situation is the thought that I shall not see you again. [...]” **The Antarctic is and remains a continent hostile to man: more starting on page 26**

REACHING UP

To new heights

People have always wanted to reach for the skies. The Tower of Babel, but also the pyramids, minarets, and cathedrals all attest to this expression for power. The term ‘skyscraper’ was first coined in 1883 to refer to early high-rise buildings. Since 1900 cities everywhere, on the model of Manhattan, have built them to make maximum use of their expensive real estate – and to send out a certain message. The highest building in the world ascends to 830 meters (Burj Khalifa; Dubai). **But smaller buildings can also entail major challenges: more starting on page 32**

A QUESTION OF DOSE

Clever toxins

Botulinum toxin, the strongest known poison, forms in stale cheese. If poison were a life-form, it would certainly be an adaptable one. It can act through the skin, through the lungs, and through the stomach – and it can act quickly (potassium cyanide) or only after 48 hours, as with the death cap mushroom. **Protection is available against all kinds of poison: more starting on page 48**

ELEMENTARY

Fire and flame

As one of the four traditional elements, fire means heat and destruction, life and death – but it is also a sign. Visible from afar, it can show the way for ships: three millennia ago a 555 kilometer-long chain of fire-signals communicated the Greek victory at Troy. For religions like Zoroastrianism, the sacred flame is even considered worthy of worship as a symbol of their deities. **It also expresses joy, as in fireworks – but even then it can be dangerous: more starting on page 42**



**Klaus Cohrs, 53,
firefighter**



**Dr. Gottfried Hagitte, 83,
country doctor**

Forever Young

People are getting older – this also leads to **CONSEQUENCES IN PROFESSIONAL LIFE** and for government budgets – which are only slowly recognized.



**Dietmar Kolb, 50,
miner (retired)**

PHOTOS: DRÄGERWERK AG & CO. KGAA, PATRICK OHLIGSCHLÄGER, SZ PHOTO/DIETRICH MITTLER

among the oldest. If professional soccer players were to be retired straight after their active careers, they would probably be the professional group with the youngest retirees. But at the age where they hang up their cleats, physicians have only just finished their training and are beginning their careers. Many doctors work until the age of 70 and beyond – voluntarily. And if we are to believe the latest statistics and developments, working up to an advanced age is something that more and more people will have to accept – and not always on their own free will.

Six million employed that are missing

While life expectancy is rising in most industrialized nations, the birthrate is dropping. In Germany alone, the number of working age people is forecasted to decline by 100,000 each year until 2020, this is when people born in the baby-boom era from 1955 to 1970 will have reached retirement age. According to current estimates, by 2025 there will be around six million too few economically active people. At the same time life expectancy will be rising without a foreseeable end. Since 1960, each new year has seen an almost three-month rise in life expectancy over the previous one. If you live longer, then you draw on retirement longer – provided your working lifetime does not grow longer as well. It does not take a public finances expert to see that a pay-as-you-go pension system will not withstand that kind of pressure for long. >

At the 2006 Soccer World Cup, Bastian Schweinsteiger and Lukas Podolski were still considered the fledglings of Germany's national squad. At just 22 and 21 years old, nobody would have thought they would

do anything major – yet they went down in history as top scorers. Eight years later, in Brazil, the two of them, each with more than 100 international cups, were not only considered some of the team's most experienced players, but were also

Common illnesses are occurring later – as life expectancy rises, the portion of healthy years is growing

> Until just a few years ago, people who wanted to work up to an advanced age represented a problem. Semi-retirement was invented to free up jobs for younger workers. In a rare case of unanimity, employers and unions dispatched millions of workers into early retirement. Nowadays more and more people are working until they reach the official pension age for their year of birth. People born in 1945, for example, worked for an average of a year longer before entering retirement than those born in 1941. That is according to the Age Transition Report 2014 published by the Institute for Work, Skills and Training (IAQ) at the University of Duisburg-Essen. At 61, the average age of retirement is still far from

statutory retirement age, but there is already a trend towards a longer working lifetime.

Two things are driving this development. Because provision for old age is uncertain or insufficient for many people, they consider themselves forced to work longer. On the other hand, rising life expectancy means that people are staying healthy longer. Common illnesses are generally occurring later. “It is a fact that higher life expectancy means a greater portion of healthy years,” says Professor James Vaupel, Director of the Max Planck Institute for Demographic Research in Rostock. If you live longer, then you age later. And if you do not feel your age, then maybe you want to work

longer as well. Conversely, work that makes you happy also keeps you young. Vaupel has calculated that older people would only have to work for a few hours every day, for a few years longer, to take the frightening edge off demographic change. It sounds feasible, but it also seems like a mammoth task.

Aging remains a puzzle

Every child born today has, from a purely mathematical point of view, a slightly higher life expectancy than their parents. Improved medical care is probably the most important cause of that. At the beginning of the 20th century the most common cause of death was still infection, whereas today people die of cancer, cardiovascular disease, and strokes. Improved hygiene has hindered the spread of epidemics. Progress in prevention and therapy extend the statistical average age as well as a better supply of nutrients from food. So many are reaching a maturity for the first time that makes this apparent.

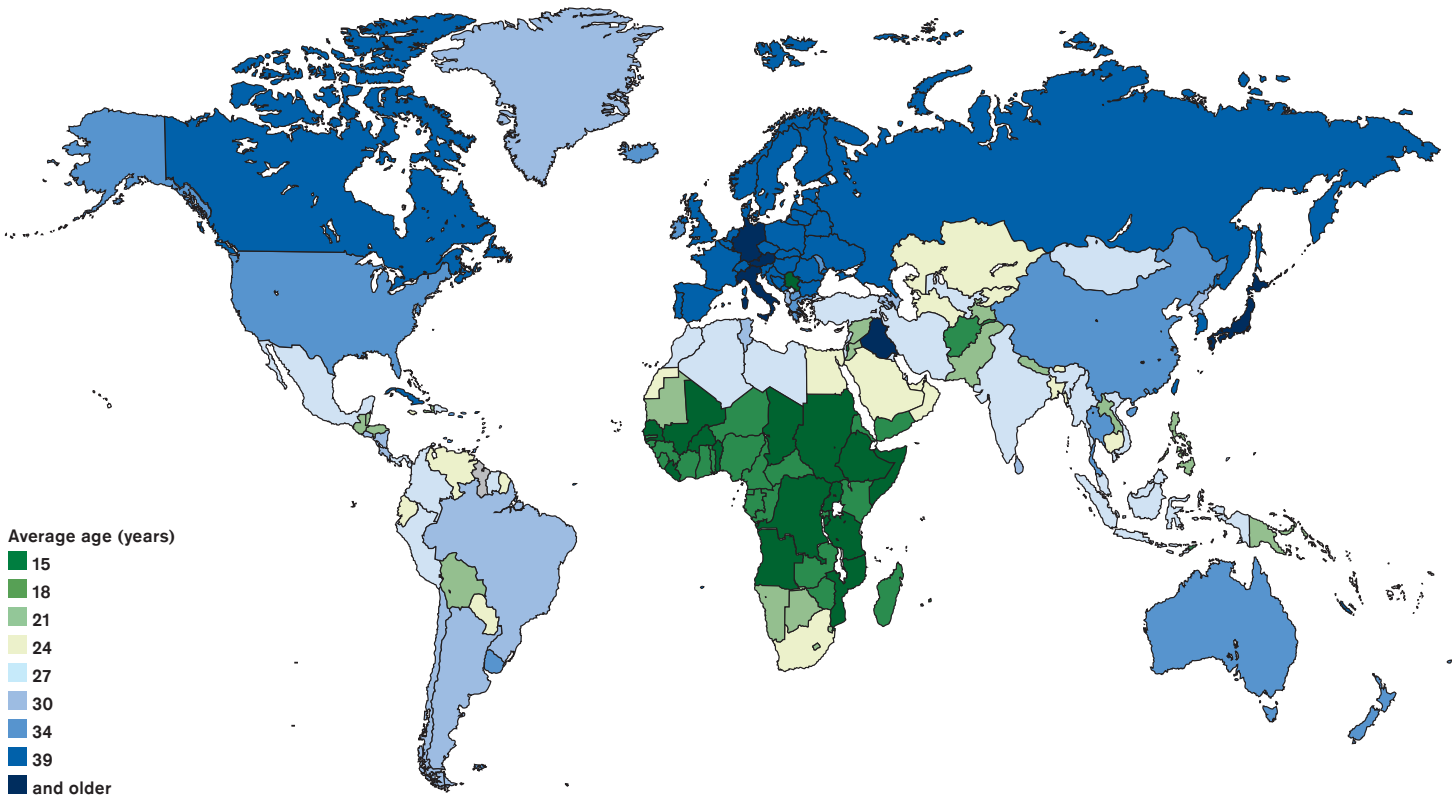
Why people age remains a puzzle even up to this day, but gradually researchers have a better understanding of what happens to the body when it ages. Eyes become weaker, because lenses harden and can no longer be distorted enough by the muscles. This process has already begun at the age of 20, but it is so slow at first that it is only noticed much later. Veins lose their elasticity, resulting in cardiovascular problems. The skin wrinkles when its tension drops as its cells no longer divide so frequently as they did in >

Firefighters – life on the ladder

In the past, most firefighters in Germany retired at the age of 60. Some German states have now raised the retirement age to 62. “This is connected to exercise schemes that many fire services make mandatory for their members, and to the improvement of protective equipment, which has also become lighter – like breathing apparatus,” says Andreas Herlinghaus of the German Fire Services Union. Firefighters have also become more aware. In the old days, you might have been standing in a burning house, fully dressed, only for your incident commander to appear next to you holding a handkerchief over his mouth. “We always used to get a lungful of poisonous fumes now and again.” Then, the mission was complete, you would slap down your clothing. Nowadays equipment is cleaned to rid it of poisonous dust and other deposits. Firefighters are tested every three years up to their 50th birthdays to determine whether they can still perform their duties in full gear. After that the test is annual. If you don't pass, you are not necessarily forced into early retirement, you may be used in other areas such as secondary emergency services or in the office, not always an easy prospect for firefighters – after a life on the ladder.

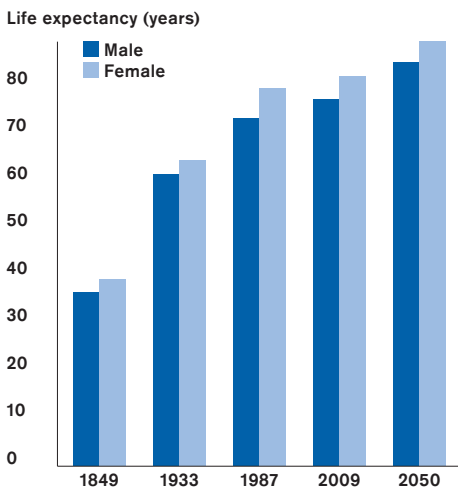
YOUNG AND OLD

The median age of the world's population is just under the age of 30 – half of the people are younger, the other half older. But the average age of a population varies considerably from one country to the next:



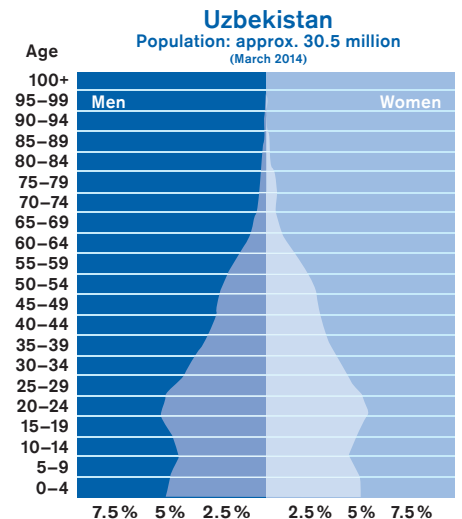
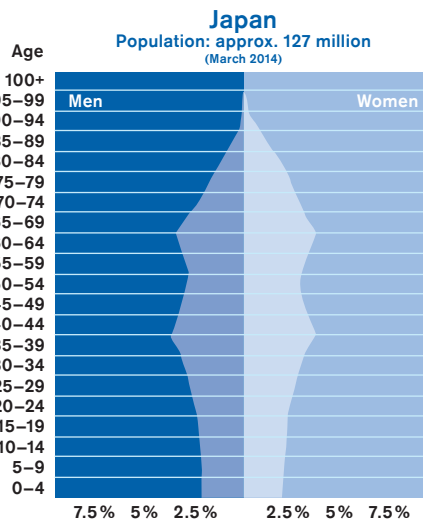
AGE INCREASES

Various factors – especially hygiene and healthcare – influence life expectancy among people: in Germany alone it will have more than doubled in 200 years.



TREES OF LIFE

A population pyramid shows the age structure of a country's population. In countries with a high average age (Japan: around 47 years) it looks quite different from countries with a low average age (Uzbekistan: around 27 years). The traditional shape is that of a pine tree, as in the case of Uzbekistan. Shapes that look like an oak with a large canopy bring with them considerable economic challenges.



SOURCES: WORLD.BYMAP.ORG, GERMAN FEDERAL STATISTICAL OFFICE (GENERALIZED), POPULATIONPYRAMID.NET

Every time one of your cells divides you become a bit older – but you can do something about it

> the years of youth. Hair probably loses its color because the cells, over time, begin to find it difficult to neutralize the waste products of normal metabolism. One of those waste products is hydrogen peroxide, a rather aggressive compound that attacks the molecules in the cells responsible for hair color, until they eventually give up the ghost. Very small inflammations can also lead to various illnesses like cancer, diabetes, and infarct, over a period of many years.

Even without these chemical attacks, defects accumulate in the genetic material of cells because our body's own repair molecules lose their accuracy over the years. Hearing diminishes, because the auditory cells in the inner ear (which transform sound waves into electrical nerve impulses) are destroyed and no longer renewed. Rheumatism and arthritis attack the joints. The insulating layer around the nerves becomes porous causing signals to pass through them more slowly, whereby prolonging reaction times.

Protective caps dissolved

The lifecycles of different bodily parts can vary a lot. The brain reaches the peak of its performance in the mid-sixties, by which point other organs have long been declining. There can also be enormous differences from one person to the next. There are many people who begin to train for marathons when they retire, while others of the same age can barely climb a set of stairs. The causes of these extreme differences

can be found in the genes, but also in lifestyle: whether you smoke, exercise, do heavy physical work, or whether you are exposed to destructive stress, what you eat – all these things leave traces in the body, up into individual cells that eventually will no longer be able to divide.

One of the central mechanisms in this seems to be the shortening of telomeres: molecular protective caps that sit at each end of the chromosomes. Before a cell can divide, molecular machines must be able to duplicate their genetic material. This copying process does not always occur perfectly, and defects can be especially common at the ends. This means that with every cell-division, a little bit of genetic material is lost at the ends of the chromosomes. But since the telomere DNA there doesn't contain any important information, it is not such a bad thing that they shrink. To a certain degree: if a minimum length is reached, the cell receives a signal to enter idle mode.

Elizabeth Blackburn, together with Carol Greider and Jack Szostack were awarded the Nobel Prize for Medicine for their service to telomere and cell aging research, likens telomeres to the plastic sleeves found on the end of shoelaces. As long as they remain intact, the shoelaces do not fray. Blackburn and her colleagues are trying to discover why the chromosome-ends dissolve at different speeds in different people. Genetics, again, play a part. Some people are born with very long

telomeres, while others from the outset have much shorter ones. The researchers found that stress damages telomeres. Traumatic events, heavy physical strain, and mental burden can stimulate cell division and release substances in the cells that attack the chromosome-ends. Smoking is a telomere-killer, while gross obesity impairs the protective caps, also a lack of sleep shortens them.

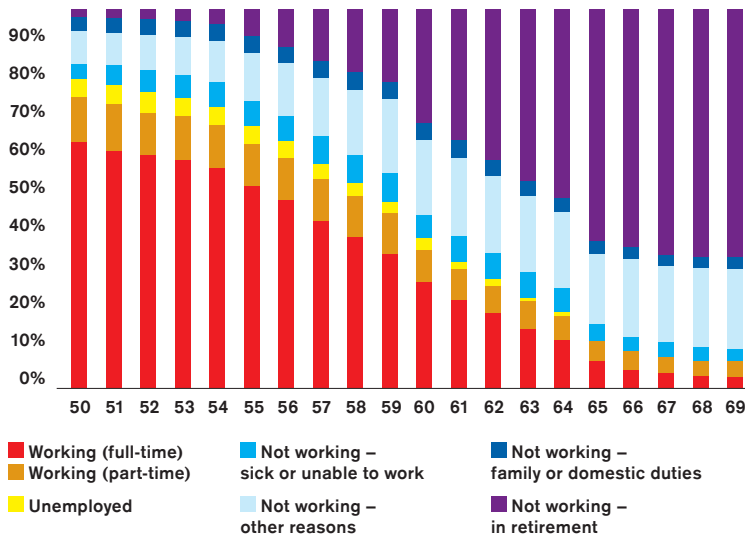
Exercise slows down aging

The list of causes is long, but it also shows that everyone can do something about it. It has not yet been proven that doing these things will really make you live longer, but there are many things that suggest they will. A study of almost 800 people showed that those with shorter telomeres are at greater risk of contracting cancer and dying from it. There is a similar correlation between telomere length and cardiovascular illness. Conversely, several studies have already shown that exercise and other physical activity makes the protective caps dissolve more slowly – provided the strain is not too great.

American age researcher Carol Greider has measured telomeres that would theoretically suffice for 130 years of life. The oldest person documented to date was the French woman Jeanne Louise Calment who died in 1997 at the age of 122. Whether such exceptional 20th century lifespans will become norm in the 21st remains unclear. But they do not need to in order to necessitate social change. >

ECONOMIC ACTIVITY BY AGE

The OECD average retirement age was 63.1 years in 2010, although people in fact entered retirement at an average age of 63.9. Rising life expectancy and lower pensions will extend people's working lives.



COMPANIES PROMOTING THE SENIOR

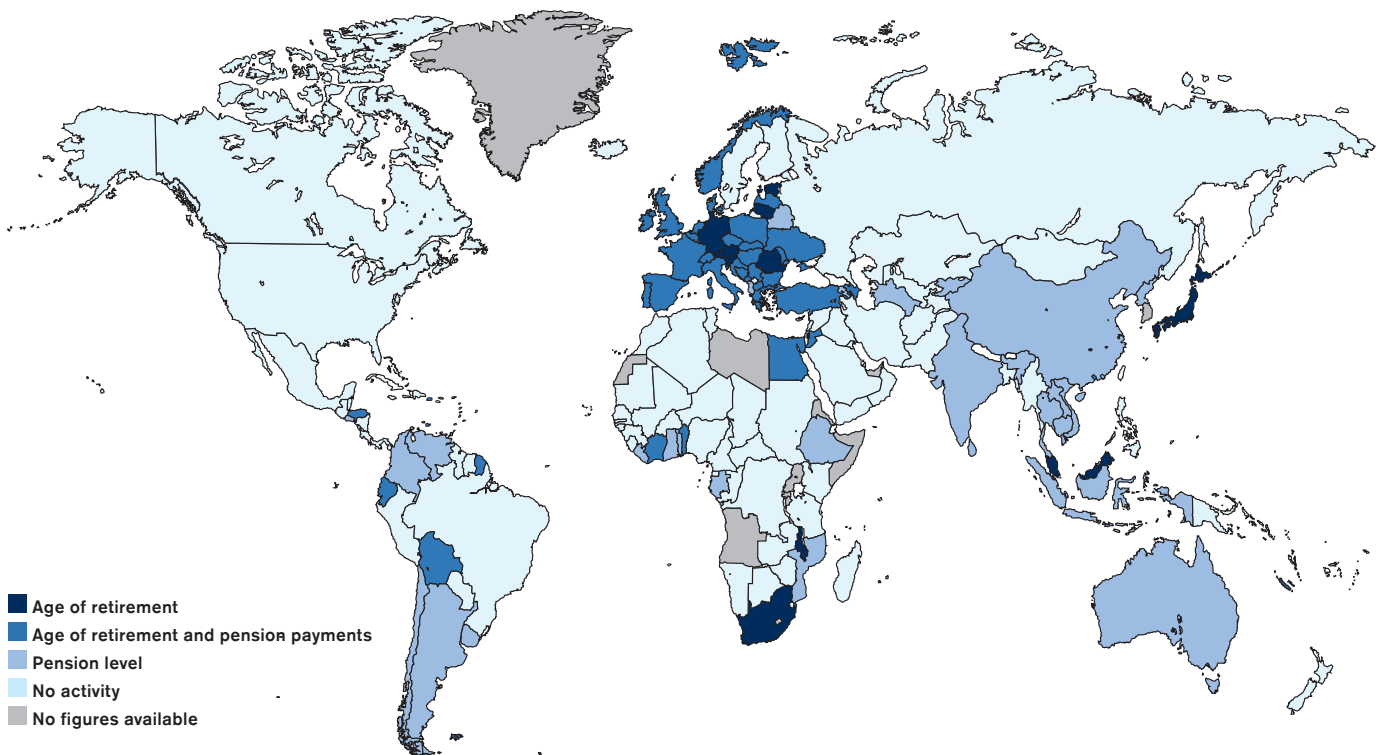
Many companies are responding to demographic change. In Germany, a survey of industry as a whole reveals the following activities (in percent):

Further training of young employees	85
Health promotion among employees	60
Ergonomic workplace design	56
Personnel marketing	49
Workplace models for mothers/fathers (e.g. part-time)	49
Creating additional trainee positions	48
Recruiting university graduates/young skilled workers	45
Setting up mixed-aged teams and work-groups	45
Inclusion of retired persons, e.g. as experts	45
More intensive continuing education for older employees	44
Semi-retirement and pre-retirement arrangements	43
Development of career models for older employees	11

■ Focus "War for talents/young workforce"
■ Focus "Employability/integration of older people"

WHAT IS BEING DONE WHERE

Rising life expectancy coupled with a stable retirement age means greater financial demands on pension funds as well as a shortage of well-trained and experienced workers. Countries all over the world are responding to this, especially industrialized and emerging nations. Key measures include reforming pension schemes (age of retirement and reduction of pension payments), in places where most pensions are subject to state regulation:



Later change? Larger companies can often offer older employees more opportunities

> “Above all employers need to rethink,” says Martin Brussig, Director of the Employment, Inclusion and Mobility research department at IAQ. “Older applicants still get strange looks. They may not perform any worse than their older colleagues who have been working for years at the company, but they carry the stigma of age. Older people who are already established don’t seem to be burdened with this stigma as much.”

Carefully maintaining the ability to work

Despite a bias against older applicants, the number of people working at pension age doubled between 2001 and 2011. That was one of the findings of a study by the German Institute for Economic Research. If you add in self-employed people and all of the older people who work in family businesses, then there are already over a million people beyond the average pension age here in Germany. According to statistics

published by the Federal Employment Agency, the number of employed 55 to 64-year-olds in Germany rose from 2.6 to 4.7 million between 2002 and 2013. The employment rate of 60 to 64-year-olds climbed in this period from 13 to 31.8 percent.

Even though there is a trend towards longer working lifespans in the statistics already, different professional groups are impacted very differently. Painters and varnishers born in 1945 enter retirement an average of one and a half years later than their colleagues born in 1941. They are also the professional group whose average retirement age, 63.2, comes closest to the statutory retirement entry age. In professions belonging to the metalworking industry, retirement age among people born in 1945 is almost 62, three years older than among those born in 1941. If we leave out soccer players, then building workers, people working in the wood industry, and textile industry workers have the worst prospects of staying in their jobs up to the statutory

retirement age. Most of them stop working before their 60th birthdays.

But even in these very tough professions, working lifetimes are getting gradually longer. The same tendency can be seen among doctors, firefighters, and timbermen. First of all, people are simply more healthy today, on top of which, a lot of work has been made easier and less dangerous by machines and improved tools. Painters, for instance, inhale less poisonous fumes than they used to, thanks to protective masks. “The service industry and security jobs have in recent years become a catch basin for people unable to perform the jobs they were trained for,” explains Brussig. A mason who can no longer perform the heavy physical work of his trade becomes a security guard. While private companies still have reservations about employing older people, the state can pioneer the creation of a protected labor market. “There are enough public services to accommodate jobs.” Studies now show that in a small, but growing number of companies older employees are exposed to lesser strains. The same conclusion was arrived at by a report published by the Institute for Employment Research (IAB) which is part of the German Federal Employment Agency in Nuremberg last year. Especially in areas in where there is a shortage of trained workers, the ability of older people to work is being maintained very carefully by specific measures. These can include further training courses, as well as schemes that help to reduce the physical strain on older people.

Physicians – responsible for themselves

When the hand of a 63-year-old surgeon begins to shake in the operating room, then they should stop operating. But that decision is their responsibility or that of their superiors – if they have any. Doctors are obligated not to harm anybody. Part of that is assessing themselves to decide whether they are still able to perform their profession. In hospitals with clear hierarchies there are some outside controls. When the hand becomes unsteady, doctors can move from therapy to diagnostic work. The age limit for physicians was abolished some years ago, and since then many doctors have returned to their old practices. Without them, medical care would in many instances be much more tenuous, especially in rural areas.

PHOTO: FRIEDRIKE HENTSCHEL



“The chemistry has to be right”

DR. PHIL. JÖRG HINNER, of the Institute of Gerontology at the University of Heidelberg, talks about working in old age and teamwork between generations.

Companies have not yet adapted themselves to nationwide demographic change. According to the IAB study only one in five businesses offers age-specific activities. There is still a lack of such opportunities, especially for less qualified people. It can however be assumed “that in the operational reality more is done informally for these workers than the data would suggest,” write the researchers in their summary. In larger corporations there are now much greater chances of finding age-appropriate work. That is why the Munich-based doctor and psychotherapist Professor Serge Sulz advises older employees to change their employer in a timely manner, if it begins to appear that there will no longer be development opportunities for them in their workplace.

“Life begins at forty”

Up until now, human resources management has sufficed in German companies for 40-year-olds and perhaps those a little older. Rostock demographic researcher James Vaupel, who has managed to secure a place for himself at the Max Planck Institute, being allowed to work until the age of 70, believes that to be a big mistake: “Life begins at 40.” From a biological point of view, a fixed retirement age is in most cases an arbitrary cut-off point anyway. Provided people can perform properly in their jobs, then their date of birth should not matter. They say you’re not old until ten or 15 years before your death. Soccer players are perhaps the exception. **Hanno Charisius**

What bodily changes make work more difficult for older people?

Dr. Hinner: That of course depends very much on the activity, and some things even become better with age. We do see a decline in properties connected to the aging of organs. The speed of information processing is especially attenuated. That doesn’t always mean that younger people are necessarily faster than older people. Everyone is much faster at 20 than they are at 60, but you can still be quick enough at the age of 60.

What can you do about that?

Dr. Hinner: Work itself is in many cases a very good form of exercise. You can build on that, with things like specific forms of training.

In what areas are older employees superior to younger ones?

Dr. Hinner: Psychological and physical stamina often remain constant over the years. Creativity also appears to remain largely unchanged. Older employees often have a better overview of pending tasks, they proceed prudently, and they have a strong awareness of quality. Under the right circumstances, their loyalty to their employers may even rise.

Are older people more often sick?

Dr. Hinner: That is often claimed, but cannot be proven using common research methods. Younger employees can also be absent from work because their children are sick, which generally is not the case with older people.

How can the potential of elderly people be more effectively used?

Dr. Hinner: It begins with awareness. In some businesses, even 50-year-olds can feel like they’re on the shelf. We have to make clear to older people where their strengths lie, and actively encourage this. It is also important to gradually dispel potential prejudices against older colleagues in a company.

Does teamwork involving different generations actually produce results?

Dr. Hinner: We have just launched a project involving mixed teams known as ‘tandems’. Research results do already exist on this, but things still get tricky when you examine it more closely. Older people have to be willing to pass on their knowledge without coming across as arrogant. Younger people have to accept it, and also have to be recognized as experts in other areas. In short: the chemistry has to be right.

Do tandems work better together than old or young people alone, or do they just preserve the performance of the older members?

Dr. Hinner: That’s exactly what we want to find out. In principle tandems should offer something for everybody. Ideally, the abilities of team members complement each other so they can work more effectively together.

Do older people need more breaks or simply shorter working hours?

Dr. Hinner: You can’t really simplify things like that. Every person has their own biorhythm. People who are lively in the morning benefit from our performance-based society, whether they’re 30 or 60 years old. People who tend to be more active in the afternoon and evening are at more of a disadvantage in everyday life. That has nothing to do with age.

To mark our anniversary: 12 things you didn't know about Dräger

"We don't intend to become starving inventors," said the company founder Johann Heinrich Dräger. Much has happened since then. This year the Lübeck-based technology enterprise is even celebrating its **125th ANNIVERSARY** – a year later than expected.

1. Premie or repdigit? Johann Heinrich Dräger and his business partner Carl Adolf Gerling founded the company Dräger & Gerling on December 20, 1888. However, its mandatory entry into the commercial register did not get done until January 1, 1889. In keeping with our correct and law-abiding traditions we are celebrating our 125th anniversary in 2014.

2. It was more of a coincidence that the company founder, a clockmaker by trade, settled on this small **Hanseatic city on the River Trave** when seeking a larger realm of action: "I am doing very well, but I have an appetite for more than just food." It became necessary to move away from Vierlanden in the south-east part of the German city of Hamburg. But Johann Heinrich Dräger was worried: "I am afraid I will not be a match for circumstances here." His wife was from Lübeck. So what did they do? The couple reached a tactical agreement: when they agreed, he would be right. If not, she would be. "Where's the justice if a woman can't get her way now and then?" he asked himself as they entered Lübeck.

3. Hanseatic: Stefan Dräger, the great-great-grandson of the company founder and Chairman of the Board at Drägerwerk Verwaltungs AG, says, "We are not a long-established Lübeck family at all." But the statement is made primarily out of respect for the city's over

870-year history, compared to this the company still seems to be in its infancy. Dräger's origins were guided by a principle formulated by the founder's mother in Plattdeutsch: "**Lever Schaden as Schimp.**" Ever since the Dräger Forum was built in 1974, this saying has embellished the family coat of arms on the building's gables as a creed and a commitment. What it means is that it is better to accept the loss of some money than to risk your good name and the trust of your customers and workforce.

4. A good image as an employer has always been essential to Dräger. This has ranged from pay commensurate with performance, all the way to greater independence and responsibility for staff. In a survey of 14,000 students at 130 universities, the company recently rose to rank 28 among the top-100 employers for engineers ('Graduate Barometer Engineering 2014'; trendenc). In 2013 Dräger received more than 14,000 applications in Germany alone – and far more than 400 people were employed.

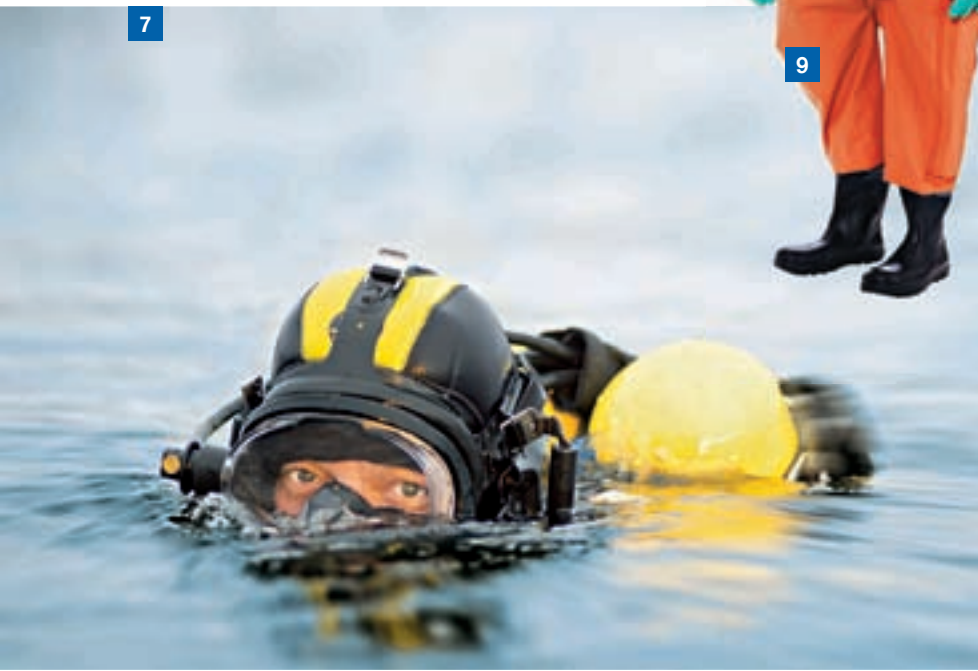
5. Stability: that alone cannot explain why employees identify with the company more than just an average amount, and often remain with it for a long time, as regular staff surveys testify. Around half of the approximately 6,200 employees in Germany (there are more than 13,000 internationally) have been working **at the company for at least ten years.**

6. The power of small: the company's product range consists of **several hundred key products** – none of which contributes more than just a few percent to turnover.

7. These products include the **Panorama Nova Dive diving mask**, with this an extreme athlete achieved what seemed impossible just three years ago: in 24 hours the 38-year-old covered 16.34 kilometers underwater – gaining himself a place in the Guinness Book of Records. The record he had to beat was a mere 1,000 meters.

8. In the 1920s a company mailman would cover around twelve kilometers each day on the expansive premises of the firm – and quickly too. Letters and parcels were instructed to be delivered "with the least possible loss of time". Not much has changed in that respect. Incoming post is now inspected using a scanner. On December 7, 2005 something strange appeared on the screen: wires, a fuse, and powder. A bomb perhaps? No, it was a smoke detector intended as a Christmas gift for the Executive Board. Even in the digital age, company mail handlers cannot complain of a work-shortage: they send well over **400,000 letters around the world each year.**

9. Dräger products can be similarly multifaceted: the **CPS 7900 chemical protection suit**, for example, offers more than a million different configurations – in theory. The production department is reluctant to



reveal who ordered one in size ‘S’ with a shoe size of 50.

10. Growing and flourishing: the Dräger Group generated around 50 million deutschmarks (around 26 million euros) of turnover at the end of the 1950s. More than half a century later, in 2013 to be precise, the company’s products and services were given a value of 2.37 billion euros.

11. Such growth would have been unthinkable at the end of the Second World War. The Allies had forbidden the company’s traditional production. What could be done to ensure the firm’s survival? Necessity is the mother of invention: small cooking stoves, barometers, seed-sowing machines, cough syrup, ladies’ handbags, electrolyte condensers (for radios), paper, and lactose were all produced by the factory. It was still ‘Technology for Life’ – and sometimes for survival: the protein albumin, which was a by-product of powdered milk production, was processed so that it could be used to combat the malnutrition rampant at the time.

12. By that time *Dräger Review* was already several decades old. As one of the first customer magazines in Germany it has been published regularly since 1912. Today it appears in four languages (German, English, Spanish, and French) with a circulation of several tens of thousands of copies.

Björn Wölke

PHOTOS: DRÄGERWERK AG & CO. KGAA

Lady Below Ground

Flame-retardant clothing, boots with steel toe-caps, breathing apparatus weighing almost 15 kilograms – it's all part of mine rescue. How one young American woman steered the world's first women's team through a **TRADITIONALLY MALE DOMAIN**.

Alone among men – familiar territory for Nicole Henderson. The 21-year-old studied mining engineering and specialized in mining technology



The sounds of hammering and sawing reverberate through Edgar Mine in Idaho Springs, around 50 kilometers east of Denver. Part of the mine has collapsed. The mine rescue team is below ground stabilizing the roof of the tunnel, known in mining jargon as a ‘drift’. They will also rescue any miners still down there, and ventilate the shafts. Miners’ lamps on their helmets dance in the darkness; these and a long metal staff are the only things they have to find their way around hundreds of meters below ground. “Watch out, rock fall!” calls a woman’s voice suddenly. There is then the sound of steel against rock. Nicole Henderson uses the staff, or ‘scaling rod’, to prod at the surface of the drift, removing loose lumps of rock from the ceiling. The rest of the team stays where they are. “We’ll have to stabilize, take measurements, and saw,” she calls back to them.

A little later the 21-year-old is kneeling in the beam of a battery-powered spotlight on a three-meter-long piece of wood, called a prop. She is using a carpenter’s square and pencil to write on it the measurements that her co-workers are calling out to her. She then takes a handsaw and begins to cut. Dust rises, sweat runs over her goggles, her breathing apparatus slides to the side, and her helmet slips back into her neck. She then stands up and, with a well-aimed kick, knocks the end off the bar. “Finished – 2 meters 74!” Two of her co-miners bring the piece of wood to the site and jam it vertically between

the floor and the ceiling. “Excellent, well done, let’s keep going,” calls Nicole. She stands up for a moment, claps her hands, and rights her helmet. “But next time it has to be quicker!” Everyone laughs a little; Nicole takes the next block of wood from the stack and kneels again.

The mood is serious yet relaxed. This is, after all, no emergency, it is a training exercise for the Colorado School of Mines in the town of Golden. The School of Mines trains geologists and civil engineers. For the past five years it has had a mine rescue program for students, and since 2010 the first women-only team, whose leader is Nicole Henderson. She decides where and how far the group of five female students penetrates into the labyrinth of tunnels. A fellow student monitors the air composition (‘damp’) – while another marks down readings onto a mine map; further behind is a medic with a stretcher, and the co-captain. Because it is summer vacation time, and three of the female students have just graduated, the team today is mixed. Nicole also has graduated, as a civil engineer specializing in mining technology. There is only one other woman with her today, Katherine Jennings, Nicole’s successor.

You have to say no sometimes

The captain stays in touch with incident command above ground. They give instructions by radio about which direction the team should go into the mine. “But the captain has the last say,” says Nicole. “It’s the captain’s responsibility



PHOTOS: BENJAMIN RASMUSSEN

Members of a mine rescue team in the American State of Colorado; Dräger closed-circuit breathing apparatus (PSS BG 4)

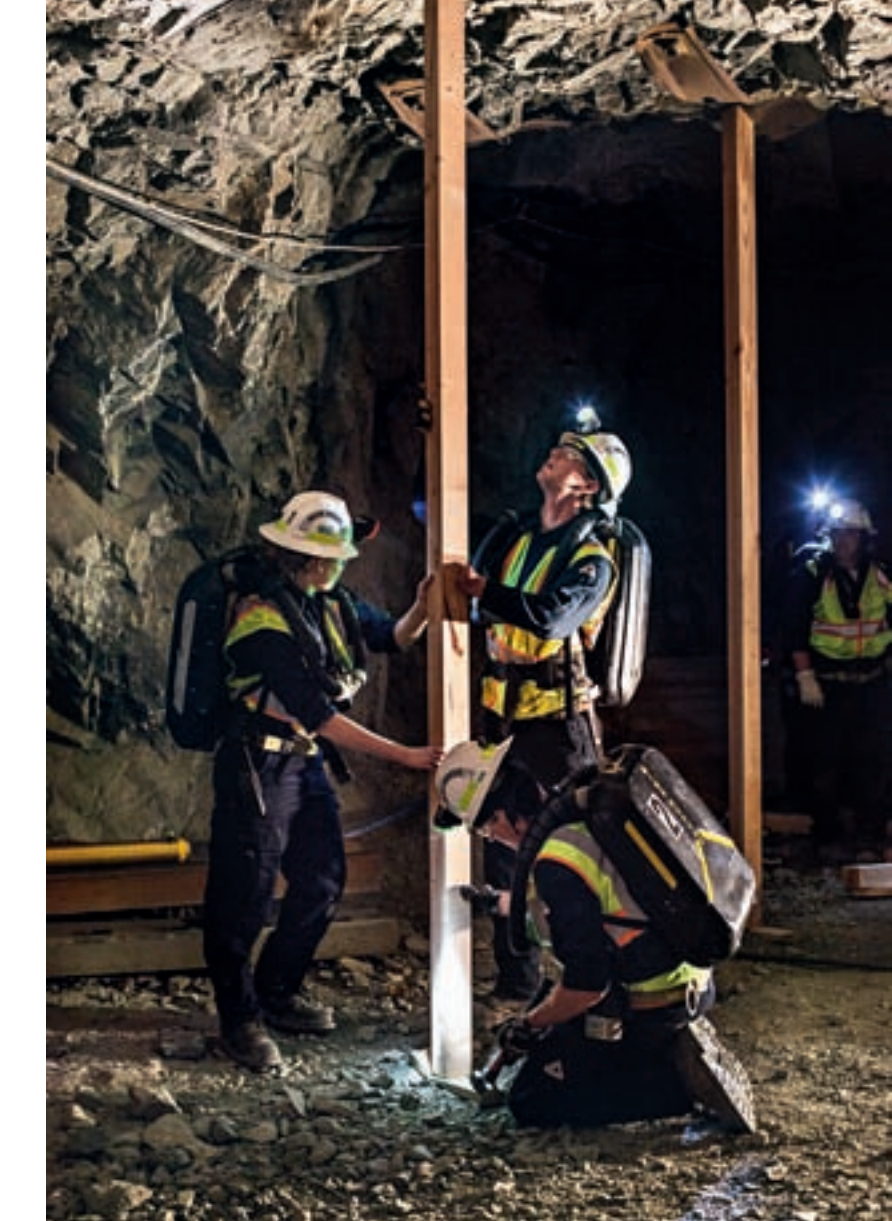
to make sure that the team can go there safely. So if incident command told me to do something that I feel would put us in danger it is my responsibility to say no.” The civil engineer has learned to rise to this responsibility under pressure, even if that means contradicting orders from the command center. “If you can’t get to a victim safely you need to remember that you can’t help someone if you’re injured yourself.” Nicole hesitates briefly, her smile has vanished. “It’s a tough decision to be made but sometimes it is necessary,” she says with a serious expression.

Nicole Henderson’s path to mine rescue began early. Her family liked to travel. In Idaho they visited museums of disused silver mines. Nicole was immediately fascinated by the secrets, history, and construction of >

professional, the mood of the team is generally more upbeat. “Women talk more, they help each other out, don’t stick so rigidly to their positions on the team – which is a good thing,” confirms Katherine Jennings. She has led the mixed student team for two years and is now looking forward to taking over the women’s team. Chris Enright agrees. The geologist is a member of the men’s team, but also trained in mixed teams. “Women are as competent as the guys but the team dynamics are different. With us, there is less discussion. Men are more cut and dry. That’s not better or worse. It’s just different.”

According to US Department of Labor statistics, only 13 percent of jobs in the mining industry go to women. According to a study by PricewaterhouseCoopers in conjunction with the British organization ‘Women in Mining’, the global industry is at the very bottom in terms of female experts in leadership positions. Nicole Henderson, however, does not complain. She focuses on the opportunities available to her. Even as a student she spoke at national and international conferences, published articles in magazines, and took part in an exchange scheme with the University of Mining and Technology in Freiberg, a city in the German region of Saxony.

Although she is a pioneer of women in mine rescue, she does not focus much on the role of women when she appears in public. She prefers to emphasize the necessity of student programs involving practical experience below ground. She knows that she has become a better engi-



It’s all a matter of practice: pillars, called props, almost three meters long, help to support an unstable ceiling. Mine rescue workers train regularly for emergencies

neer through her work and through working together with professional miners at competitions. “You have a much better safety mindset. Production and money obviously are important but really what it comes down to is you want to make sure your workers are safe.” She has also learned life-skills. “You learn to work under pressure; you are put under stress all the time. Also teamwork, leadership qualities, and a sense of responsibility.”

Handing over responsibility

She is currently undergoing practical training in a mine not far from Golden.

Nicole Henderson hopes this will turn into a permanent position, and that she will be able to become a member of a professional mine rescue team. But for now she must hand over her responsibilities. A student in the men’s team will from now on be responsible for servicing the equipment, and Katherine Jennings has already taken over the position of captain for exercises. She now monitors safety and communicates with incident command. As co-captain, Nicole encourages the team. “Come on people, just two more passes. The quicker we finish, the quicker we can get to lunch!” She then picks up another piece of wood and her saw. **Kerstin Zilm**



Searching for the Dream-Team

Teamwork is a major priority in operating rooms. The use of **CHECKLISTS** can improve collaboration. But for some surgeons it means a change of culture.

Professor Dr. Chirag Gandhi can still dimly recall tyrannical head physicians who ruled their operating rooms autocratically, sometimes even throwing instruments. “That did happen, many years ago, but not so often – a vestige of times gone by,” says the neurosurgeon at Rutgers University in the

American state of New Jersey. “Nowadays, behavior like that would neither be accepted nor tolerated. It produces unnecessary tension and doesn’t help patients.”

No room for errors

That is not to say that Gandhi’s OR team holds long debates while operating on

open skulls. “The head surgeon makes the decisions and in the end carries responsibility. Despite an improved working atmosphere, nothing has changed in that respect,” he says. “Collaboration has its limits when it’s a matter of life and death.” Gandhi has been working as a surgeon for seven years and performs

No side effects: identification bracelet (l.); leg marked for operation



almost 400 operations a year – almost always complex ones to treat life-threatening vascular conditions like aneurysms and strokes. When he operates for hours on end he has to be able to rely on his team. “The utmost precision is essential – there’s no room for mistakes or errors. Every single team member can and should contribute towards that, not only the chief physician.” There is nothing new about the concept of a small and well-oiled unit working hand-in-hand under pressure of time and under established rules and protocols. Pilots experience it every day in their cockpits. They are the precise model on which the work of many of the world’s surgeons now base their work.

A fundamental component of this teamwork – work which often involves the egos of some very self-confident specialists – is the checklist: a short and universally understandable compendium of key things to remember. In the sphere of medicine there are no fewer than two books written by doctors who have examined the importance of this tool and demonstrated its relevance to everyday clinical procedures. The first of them is by Atul Gawande from New York, a specialist in endocrine surgery. The title of his 2009 book says it all: ‘The Checklist Manifesto. How to Get Things Right’. Gawande explains over 200 pages why specialist physicians like surgeons should use checklists. “We have accumulated stupendous know-how, but the volume and complexity of what we know has exceeded our individual ability to deliver its benefits correctly, safely, or

reliably.” To operate safely in medicine, and in the end to save more human lives, argues the doctor, the checklist is the long-overdue answer to the question of how to use human knowledge in the best possible way while at the same time compensating for its deficits. “Checklists provide a kind of cognitive safety net. They catch mental flaws inherent in all of us – flaws of memory and attention and thoroughness.”

Cognitive safety net

To illustrate his point, Gawande collected material from aviation and modern-day building sites. That which is common to crews and site managers as they steer jets safely to their destinations and erect structures worth billions on time and within budget, is also relevant to work done on and in the human body: an initial checklist for fundamentals, and a second one for crises which encourages the team to speak to each other and respond in the best possible way to nuances and unforeseen events. The Harvard professor is not only referring to a list of technical questions to tick off automatically, ensuring that you have the right patient, the right procedure and the right instruments in the OR. He is talking about a change of culture: a broad rethink across the whole team which creates communication channels and keeps them open. “We surgeons want to believe that we’ve evolved and that we work more as teams now. But researchers have observed that team members are commonly not all aware of a given patient’s risks.” The

greatest obstacle to genuine teamwork, he claims, is not the old-school autocrat, it is the fact that the rest of the team are no longer involved in many of the stages of work, which is an involuntary consequence of the ongoing evolution of specialization. As the chairman of a working group for the World Health Organization, Gawande was able to employ his insights to bring more safety to operating rooms. That particular WHO body developed a 19-point checklist which was published in January 2009. Around ten percent of all hospitals in the USA use it, along with surgeons in more than a dozen other countries. Early surveys indicate that using the checklist reduces the number of serious complications following an operation by 36 percent, and the number of deaths by no less than 47 percent. In anonymous questionnaires, nine out of ten hospital staff said that they would like such a checklist to be used if they themselves were lying on the operating table.

However, the list is not accepted everywhere, because it can restrict the head physician’s scope of action and authority. Gawande admits this: “Teamwork and discipline push against the traditional culture of medicine – a kind of expert audacity.” Relying primarily on the expertise and judgment of a surgeon who makes decisions single-handedly can have negative consequences, argues Gawande with an eye on the statistics. Around five million people are admitted to intensive care wards in American hospitals every year. There are around 50 million operations performed annu- >

Operations in the USA claim three times more victims than road accidents

> ally in the States, as a consequence of which around 150,000 patients die. Medical treatment in the operating room claims three times more victims than road accidents, in other words. One of the biggest challenges are infections that can be picked up in hospitals and that claim the lives of around 30,000 patients a year in the USA – around as many as are killed by breast cancer. That is why Dr. Peter Pronovost

has taken up the cause of reducing infection through teamwork and checklists. Pronovost heads the Center for Innovation in Quality Patient Care at Johns Hopkins University in Baltimore, and since 2001 has been a pioneer in the collection of infection data in Michigan. In 2006 he made headlines with a study which proved for the first time that a new a kind of checklist, to which the whole OR team would hold, reduced

infection rates by two thirds, and saved the lives of more than 1,500 patients in just one US state over the course of one and a half years. Three years later he published a highly regarded book, *Safe Patients, Smart Hospitals*. In it he calls for a fundamental rethink, especially on the part of physicians. “In most industries in which safety is a high priority, transgressions lead to dismissal. This kind of liability is lacking in the health-



PHOTO: PATRICK OHLIGSCHLÄGER

Using checklists can significantly reduce the number of serious complications following an operation

care industry at present.” Doctors who head OR teams but work on their own behalf are, according to his investigations, especially unlikely to be trained in the rules of good collaboration, and are “excessively self-confident” when it comes to the quality of their own work. “We still have a lot of work ahead of us, but awareness has increased. This kind of rethink has to take place not only within teams, but in the way teams work with each other as well, since patients are usually passed back and forth between different departments.”

Sensors to detect emotions

At the Johns Hopkins University, Pronovost utilizes no fewer than three techniques to achieve greater transparency among medics. He systematically educates coaches who then teach others about good teamwork. The curriculum was developed by health experts at the US Defense Department. Its themes include communication skills and how to cope with conflict situations. “We currently have 40 coaches. With around 44,000 employees, it can only work if we train people using the snowball principle across all of our departments and disciplines,” he explains. In the end they want teamwork to be a precondition for accreditation in the medical profession. “Pilots have had to demonstrate these skills alongside technical ones for a long time.” Pronovost has employed two ground-breaking experiments at Baltimore to obtain qualitative and quantitative data about collaboration in operating rooms and

intensive care wards. An observer is nominated for every team, who records unflinchingly whether mistakes are being made and how team members work with each other. In parallel, a pilot study is being performed in which 40 staff and doctors are equipped with wearable ‘social sensors’. These little devices with microphones record who is speaking to whom and for how long, and who listens or speaks for how long. The software can also detect the emotional content of conversations. At the end of the shift, data is collected wirelessly and evaluated. “We are working with our staff on the matter of how best to present the results to them,” explains Pronovost. As with checklists, medics prefer a brief report giving them the key points: am I listening well, do I allow others to speak, am I sympathetic or condescending? “Physicians are competitive,” points out Pronovost. “They want to see how well they are doing in comparison with their colleagues. That encourages better teamwork.” The pilot study is set to run until the end of 2014, and initial results are due a year later.

But according to Dr. Todd Moyerbrailean, Professor of Gynecology at Michigan State University, good teamwork in operating rooms can also be learned without sensors. “Medicine has become more collaborative. Teams consult before operations and refer to checklists. New members introduce themselves so that everyone in the room knows the name and role of everyone else.” Experts refer to this as an activating phenomenon – a simple

trick that ensures that everyone is on board. Moyerbrailean has mixed feelings about checklists. On the one hand they help to prevent simple mistakes and get everyone to focus on the impending operation. “But switching to electronic patient files has led to us working with checklists that are machine-generated and follow the logic of their authors.” Members of his OR team often have to make changes to things like instruments and consumables. “These are errors that need correcting not only in the moment, but also in the system for the next operation – if you remember and have time to do so.”

“This is just the beginning”

Something else has improved, says Moyerbrailean: “Head surgeons meet patients while they’re still awake. We learned this form of communication from nurses.” For this surgeon, who performs up to 200 abdominal operations each year, the era of lonely decision-making is over. “We’ve developed best practices over the years in which each member of the team knows their role. I do still have the final word, since I lead the operation, but there’s more interchange, which allows the whole team to give their best.” Professor Gandhi is similarly optimistic. All in all, he concludes, every variable has improved. “Patient results are better, mortality has dropped.” There is a better atmosphere among people. Surgeons and other staff are more satisfied in the workplace. “And this is just the beginning,” he adds. **Steffan Heuer**

Small Fry for Big Fish





Camping out on an ice floe in the middle of a white desert. Three tents house the diving base. The entrance hole is situated beneath the dome



The fascinating ambience beneath the icy ceiling is reminiscent of a cathedral. The water is around 4,000 meters deep here

PHOTOS: JAN VAN FRANKE@TEXEL.COM, JEROME MAISONIA@FRED WEGENER INSTITUTE

Icy, extreme, enthralling: the **ANTARCTIC** captivates tourists and scientists alike. A journey to the krill's nursery.

They travelled halfway around the world, setting out from Germany and crossing the Atlantic almost 14,000 kilometers, all the way to Patagonia. At Punto Arenas they boarded the ice-breaker *Polarstern*, and sailed eastwards through the Strait of Magellan until they reached the edge of the ice zone. From there, they penetrated further into the Antarctic, that endlessly glistening, shimmering, gray world. Eventually, they found what they were looking for – an ice floe suitable for their purposes, on which they could erect three tents. One of these is heated and used for warming up and changing, one is for the generators, and the last one, the largest and most important, provides protection for their multi-day diving operations. Using an excavator, they dug a hole in the floe, two meters by two meters, and now they stand before it – a black opening in the ice. Dr. Ulrich Freier likens it to the ‘Gates of Hades’, the legendary underworld of Greek mythology. The water is 4,000 meters deep here.

While Europe still bathes in late summer, this freelance scientist from the East Frisian town of Wittmund now stands before the icy jaws of hell together with two colleagues. Freier is wearing a seven-millimeter-thick neoprene dry diving suit, and underneath,

special clothing tested in space research and parts of a Dräger PSS Dive, a system suited especially to cold-water missions (see also Interview: p. 29). This is not the first time Freier has done this, and yet the moment is always tense and thrilling for him – the moment he jumps into the black hole in the ice. He hesitates briefly, takes a hold of himself, and slides into the salty water at minus 1.8 degrees Celsius. The water closes in over his head in a mass of churning wavelets and turbulence. Then there is a ghostly silence. Freier has begun his work. His attention has turned to a tiny creature: the larvae of the *Euphausia superba*, or Antarctic krill.

Operation Wisky

Freier and 50 other researchers and technicians from nine different countries took part last year in an expedition named ‘Wisky’ run by Bremerhaven’s Alfred Wegener Institute, Helmholtz Center for Polar and Ocean Research (AWI). The name of this two-month mission stands for ‘Winter Sea Ice Study on Key Species’. In biology, key species are those types of plant and animal whose decline and disappearance could cause disproportionate changes in the populations of other species or processes in the ecosystem. Among them is the Antarctic krill. >



Home on the horizon: the *Polarstern* is 118 meters long and equipped with four engines with a total power output of 14,000 kilowatts (20,000 PS), and is one of the world's few research ships built as an ice-breaker

Seals and whales alone consume 173 million tons of Antarctic krill each

> These crustaceans are up to six centimeters long and weigh around two grams, and they are the primary source of nourishment for whales, seals, and penguins. They populate the waters around the Antarctic in vast swarms. It is not uncommon for 30,000 or more of them to be bustling around in a single cubic meter of water. With a total biomass of around 350 million tons, krill exceeds all other species of animal.

Currents and wild animals

Seals and whales alone consume more than 170 million tons of Antarctic krill each year, which in its turn feeds off plankton and algae which form gigantic carpets beneath the ice. But

the equilibrium of this elaborate ecosystem is in danger. “Krill stocks have declined considerably in the Antarctic in recent years,” explains expedition leader Professor Dr. Bettina Meyer of the AWI. Long-term studies confirm that stocks have shrunk by 50 percent since the middle of the 1970s. It remains uncertain to what extent this correlates with the reduction of sea ice around the Antarctic in winter. “The ice is extremely important, especially in the winter months when the krill larvae grow. That is when these animals have to be taking in nutrition constantly. But there is hardly any food in the water in winter, which is why the ice and the algae beneath it appears to play a central role in their survival,”

says Meyer. How do the krill larvae behave beneath the sea ice? How do they survive the food-scarce winter months? And what would be the consequences of further climate change for their population? The scientists went on this journey to answer these questions. A major part of their work was observing the krill larvae beneath the ice, which is why, in addition to biologists, chemists, and physicists, an eight-man scientific diving team under the leadership of molecular biologist Dr. Ulrich Freier was on board the *Polarstern*. The *Polarstern* is one of just a handful of ice-breakers in the world that are able to penetrate so far into the Antarctic in winter. Freier has been involved in polar research

Introducing the *Euphausia superba*. These shrimp-like crustaceans grow up to six centimeters long. Antarctic krill is the primary source of nutrition for whales, seals, and penguins, as well as various varieties of bird and fish



PHOTOS: STEFAN HENDRICKS/ALFRED WEGENER INSTITUTE, JEAN-PAUL FERRERO/ARDEA.COM

year

for 15 years. Back in 2006, he dived beneath the ice of the Lazarev Sea in an Antarctic winter to conduct research, placing him among a very select group indeed. “As far as I know, only ten people have dived beneath the Antarctic ice in winter over successive days,” he explains. “That is fewer than have been on the moon.”

Hardly surprising, since conditions are extreme. Frosty air temperatures of minus 30 degrees Celsius and water at minus 1.8 degrees, prevented from freezing only by its saline content. Then there are the currents, storms, and 40 kilograms of equipment on your body. All of that makes each 30-minute dive enormously demanding. Despite good, calorific meals prepared by

the three-man kitchen team on the *Polarstern*, Freier lost seven kilos during the expedition. Furthermore, there are dangers lurking beneath and on top of the ice, such as seals, which can at times be aggressive. Experienced divers especially fear the sea leopard. “If we see one of those we abort immediately,” says Freier. They are unpredictable like all wild animals, he says. “There have even been incidents in which sea leopards have injured people badly.”

Black flags along the route

Safety, therefore, is always a major issue during each ten-day diving camp. Even finding the right ice floe is not easy. It has to be strong and large enough to be worked on without risk, to enable the hole to be drilled for diving access, and to permit use over several days, even if waves and wind should change. The research team relies on modern satellite technology to look for such floes. “The German Center for Aviation and Space Travel in Cologne sent us the latest high-resolution radar images from which we were able to discern the size and surface quality. Using that information, we then sailed to the best area. Then, using helicopter-assisted electromagnetic measurement, our physicists were able to determine the thickness of the ice,” explains Bettina Meyer.

The team then erected the diving camp around 500 meters away from the *Polarstern*. It consisted of a heated igloo referred to as the ‘red tomato’ on

account of its bright color, a Scott Tent named after the Antarctic explorer, and a large, white diving tent housing the entrance hole into the icy underwater world. The equipment was transported by snowmobile and helicopter. The men marked the route between the camp and the ship using black flags, which is the only way to prevent people from losing their way completely in the event of a whiteout. “That is always a serious risk in the Antarctic,” says Ulrich Freier, describing the fog-like weather phenomenon in which flurries of snow, ice particles in the air, and sunlight combine visually to form a single white wall. A first-aid-mobile was always nearby during each of the four daily dives, and yet it may always be crucial to reach the *Polarstern* as quickly as possible in the event of an emergency. The vessel has a complete operating room on board: “From extracting teeth to operating on hearts, anything can be done there,” says Ulrich Freier.

Wild animals, cold, disorientation, but when asked about the greatest difficulty facing an Antarctic diver, Freier named something else: “The mental burden is enormous. We’re all experienced divers, but moving around alone beneath 1.2-meter-thick ice really is something else altogether. You have to overcome yourself at first.” Dräger’s full-face mask, the Panorama Nova Dive, is helpful in that respect, he says, including its voice-link to the ‘signalman’ who stands right alongside the entrance hole. It means that the >



Final preparations before diving – in a seven-millimeter-thick neoprene dry diving suit



Diving is teamwork, including in the Antarctic. A signalman above the ice constantly monitors the breathing of his colleague, and a back-up diver also sits at the ready

Any change to this complex ecosystem could have devastating long-term

> diver not only has constant contact with the outside world, but also that the signalman can keep an eye on his colleague’s breathing beneath the water, and raise the alarm if something goes amiss. Also alongside the entrance is a back-up diver wearing full equipment, who can quickly assist in an emergency.

Impressive results

But when you do gather your courage and dive through the ‘Gates of Hades’ into the world beyond the ice, you are richly rewarded with a breathtaking spectacle. “The ice forms cavities underneath and looks like an inverted reef. The light penetrating from above illuminates the blues and greens

of the ocean. All of this creates a unique scene of grandeur almost like a gothic cathedral,” enthuses Freier. But aside from the impressive visual experience, there have been important scientific findings. Intensive work done by the divers on the structure of the ice, the characteristics of its surface, phytoplankton distribution, standardized observation series at different times of day on the behavior of the little krill larvae, and ice sample extraction all now allow clear statistical statements and, combined with other biological and physical data, supplies unique results. “We examined the nursery of the krill closely,” says AWI researcher Bettina Meyer, “and we discovered that the larvae spend their

time during the day directly beneath the ice in order to feed. As darkness descends, they move deeper and deeper into the water, so they obviously have a daily rhythm that is influenced by light and darkness. This is the first time that this behavior has been observed and described scientifically.”

Many questions remain unanswered. Nobody knows what exactly happens when the Antarctic sea ice spreads and retreats. But it does seem certain that any change in this complex ecosystem could have devastating long-term consequences. The realm into which the researchers dive through the black hole in the ice looks like a grim underworld from above, but in fact, it conceals. **René Weihrauch**



PHOTOS: PRIVAT, I. NOYAN YILMAZ, MARTIN SCHILLER/ALFRED WEGENER INSTITUTE; MAP: ALFRED WEGENER INSTITUTE



Frosty science: expedition leader Professor Dr. Bettina Meyer of the Alfred Wegener Institute, and research diver Dr. Ulrich Freier

Diving in the Antarctic

Equipment you can rely on: **DR. ULRICH FREIER ON HIS EXPERIENCE USING THE DRÄGER PSS DIVE**, technical features, and future developments.

What kind of a device is the PSS Dive?

It's a professional system used mainly by police and fire brigades, and is suitable for technical work beneath the water, including at great depths and when special demands are placed on air transport performance. It is not so well known among recreational divers. The system consists of one or two cylinders, a carrying frame, and a combination of diving regulator and diving mask. All of it is easy to operate, strong, and very well made.

What makes it suitable for cold-water missions?

Generally speaking, when it comes to very demanding diving, the PSS Dive has the advantage of being so well made, with its combination of diving regulator and full-face mask. In the cold water of the Antarctic, it is also very important to have two autonomous diving regulators attached to the same mask: two first stages at the cylinder and two on the mask that can be operated simultaneously, but also separately. Each automatic system has a shut-off valve, which is basically an on-off switch situated just in front of the second stage. In the event of a 'freeflow', which is an escape of air, the diver can switch off the first main automatic system, thus preventing the cylinder from emptying quickly and uncontrollably, and the mask from icing up. He can then switch on the second automatic system, enabling him to keep breathing and finish the dive.

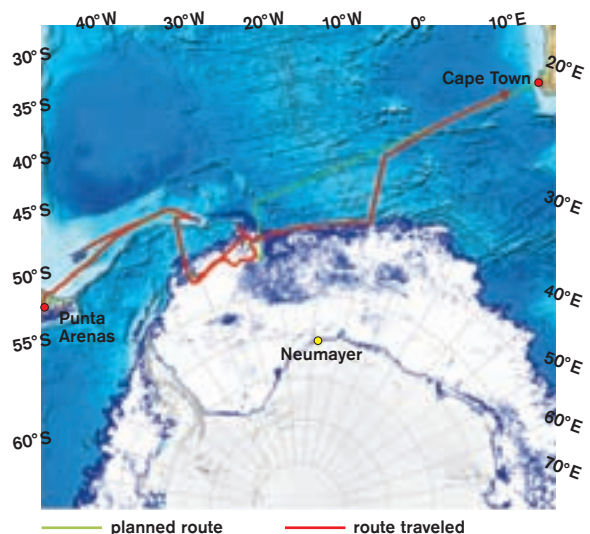
What other special technical features are there?

They include the option of a voice-link to a signalman above the ice. A link like that is necessary and mandatory in research diving under difficult conditions. There are also wireless radio links, but since our divers are equipped with a signal line anyway, we use a cable-based system. The Panorama Nova Dive full-face mask incorporates a microphone so that the diver can speak inside its air-filled facial space, and the signalman can hear him. That's especially helpful given the enormous mental strain involved in dives like ours.

Could the system be developed in any other way?

The communication system theoretically allows communication between two divers via the signalman. But it doesn't work fully yet, and it would be good to improve it.

consequences



The White Continent is surrounded by sea ice. The ice-breaker *Polarstern* brings scientists safely to their research positions, and houses a complete operating room for emergencies

Aiming High

Training for real life, or competing in sports? Both! At **SKYRUN** in Frankfurt am Main, firefighters run up 61 floors. There is a good reason for their doing so: they may have to in an emergency.

The three men give it their all over the final few meters, sprinting in their heavy boots up the steps of a staircase dimly lit in yellow. Their breathing systems whistle shrilly. The firefighters cross the finish line, tear their masks from their faces, gasp for air, and smile with delight: Marcell Büttner, Aron Geisel, and Christian Rausch have just won the *Elite* discipline of the *Fire-Fighter's Cup* at SkyRun in Frankfurt am Main. These local professional firefighters needed around 13 minutes each to ascend Frankfurt's Messeturm tower

in full gear, including heavy-duty breathing apparatus. Their times added together came to 38:13 minutes – just enough to clinch victory over the trio from Zaragoza fire service in Spain (38:14 minutes). The regular SkyRun up the 256-meter Messeturm is in itself a high-performance sporting event. But while normal athletes climb the stairs in running shoes and lightweight sports clothing, of what was until 1997 the highest building in Europe, firefighters run with more than 20 kilograms of equipment up 61 floors, 222 meters of altitude, and exactly 1,202 steps.

Fighters and Elites

Half an hour before the start, Marcell Büttner was handing out compressed air cylinders to his comrades from Spain and sharing a joke with colleagues from Switzerland. At Frankfurt fire service, helping each other before the race is a matter of honor, something guests from abroad appreciate. The contest between firefighters is top of the agenda for spectators this afternoon; this includes not only the *Elite* category but also the *Fighters*, in which firefighters run wearing full equipment but without their breathing apparatus connected up. In the 2014 SkyRun a total 54 fire-

fighters started in the *Fighter* category, and no less than 186 tackled Europe's highest stair-climb using breathing apparatus. Aside from all the sporting enthusiasm, the background to this contest is entirely serious, points out Professor Reinhard Ries, director of Frankfurt's fire service: "Skyscrapers like the Messeturm do of course have a fireman's elevator, but if the equipment breaks down then the team has to be able to ascend the building by the stairs." That is how stair-climbing races are connected to everyday firefighting work. "Recently there was a false alarm in a building in which the elevator had broken down. The colleagues had to run up about 30 floors," recalls Marcell Büttner. "You need to be fit, strong, and have stamina to do that."

Aside from that, the competition generates outstanding publicity for the work firefighters do, he says. In the *Elite* category, no fewer than eight teams entered from Frankfurt alone, where the fire brigade can call upon around 1,000 breathing apparatus wearers. How is it to compete against others from your own fire brigade? "First and foremost you're running against yourself, not against others," says Büttner. It is, he explains, similar



PHOTOS: PETER THOMAS

Ready for take-off in full gear – and using breathing apparatus



The run ascends 222 meters (left). The winners: Christian Rausch, Marcell Büttner, and Aron Geisel of Frankfurt fire service (left to right), smile at the top

to a marathon. The trio lightheartedly recount their training sessions in the Trianon high-rise. “When it started, we were of course pumped up with adrenaline.” The physical challenge of the competition is considerable. On the one hand there is the strenuous climbing of the stairs, combined with the heat of wearing fire protection clothing, and on the other hand there is cold air coming from the compressed air apparatus.

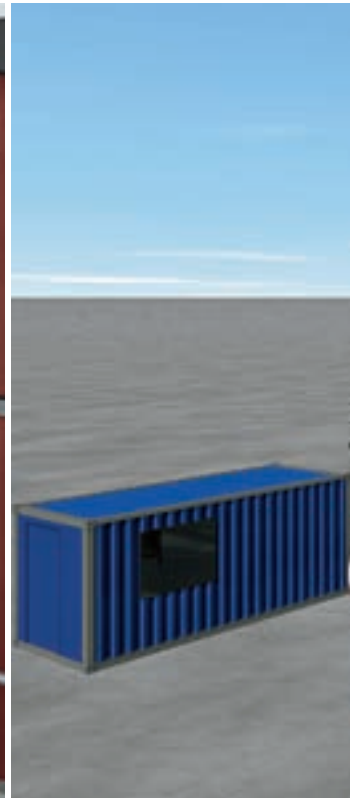
Vertical marathon

SkyRun demands not only fitness but also the right tactics: “At the bottom line it’s very much a mental thing,” says Aron Geisel, “which is why you have to be constantly calculating.” It is essential to expend your strength at the right rate, watch your breathing, and not lose track of the other team members. This year the three firefighters from Frankfurt did everything right, and even overtook several *Fighter* category teams and amateur sporting competitors. When they reached the top, on the 61st floor of the Messturm, they were met with well-deserved applause. After a short breather they went back down to ground level, which, in the elevator, took just a few seconds.

Peter Thomas



PHOTOS: DRÄGERWERK AG & CO. KGAA



Fire simulator in Hamburg: firefighters will be able to train for emergencies here from 2015 onwards

Module II: what do you do when

Danger: fire!

The emergency services number, 112, is dialed up to a million times every year in the German city Hamburg. Being a firefighter is a challenging job with a very wide description. Starting next year, fire fighters can train under realistic conditions in a **SUBWAY FIRE SIMULATOR** at the Fire Brigade Academy.

Hamburg's U-Bahn and S-Bahn, or subway and suburban railway systems, carry well above 450 million passengers a year, to and from more than 150 stations and stops. But one of these stations is unlike the rest: the one on the training grounds of Hamburg's Fire Brigade Academy. "According to the information we have, we are building the world's first subway and suburban railway station in the form of a realistic fire simulation set-up," says Ingo Sandmann, project manager at Dräger, who, in a joint venture with Bremen-based building company Kathmann, won the tender for building the training facility. It is realistic, yet

safe; the same could be said for the first breathing apparatus training course built by Dräger on its company premises in Lübeck back in 1931. This 135-meter-long obstacle course was either filled with smoke from an oven, or supplied with tear gas. A noise-machine made it even more realistic, and for the sake of safety, breathing apparatus wearers remain connected to their teachers via intercom.

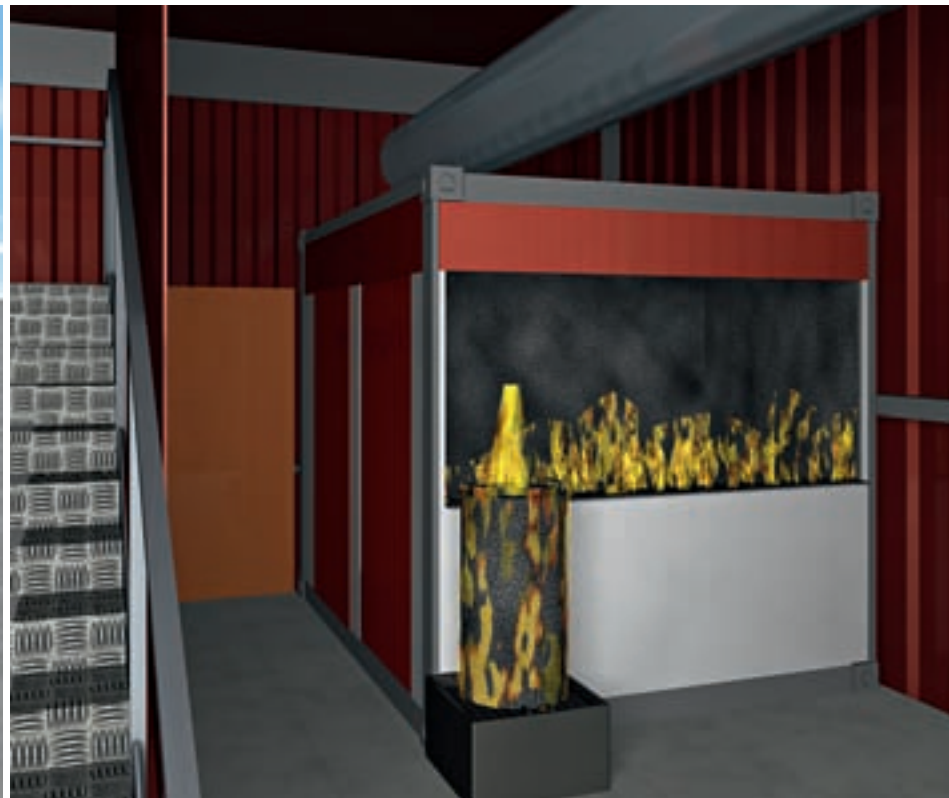
When flames spread

Trainers in a control room could follow the progress of their charges by means of contact plates on the floor, and could terminate the exercise at any time and quick-

ly clear the facility of smoke. That was 83 years ago, but not all that much has changed since. On the new training station in Hamburg there will by the beginning of 2015 be a subway and an S-Bahn, or suburban train, with barrier-free entry, at the same level. "To arrange this we will first have to remove the existing tracks and lay them down again at different heights," says project manager Sandmann. Each of the trains will be given a driver's cab with a communication system, just like ordinary trains. There will be benches and billboards on the platform, and the obligatory kiosk tucked away in one corner of the station, as well as steps leading up and



a refinery catches fire? Extinguishing alone is not a solution



The station will be more than 50 meters long, and training will be documented by video

down. All in all, a typical subway or suburban railway station.

When fire simulation begins, the people undertaking the training will be surprised by flames that quickly spread around them and shoot up out of the seats. And also by a smoldering fire coming from trash cans, swirling through the cars and obscuring the field of view. Propane gas, which is relatively harmless to the environment when it burns, comes from a 2.8 ton tank; a piping system takes it from there to fire-points which resemble the burners on a gas stove. These burners can be switched off immediately by the operations manager, either by remote control or using emergency switches. This immediately and automatically removes the smoke from the facility and lights it up so that trainees can quickly see their way around again.

Flange fires and leakages

Safety includes a complete control system in the control room, as well

as constant monitoring of the facility using video and heat-sensing cameras. The 54-meter-long station concourse is, like most of the city of Hamburg itself, built upon pillars penetrating up to 15 meters into the ground. The new structures will include the platform, a crawling tunnel, and extinguishing water extraction pipes to a cistern. Water is used to extinguish the fires. “The existing railcars on the training premises at the Fire Brigade Academy had fallen victim to vandalism,” recalls Ingo Sandmann, “which is why the new concourse will be built as a galvanized steel structure incorporating trapezoidal sheet metal cladding, and including insulation and heat-resistant materials.” An emergency exit and concourse gates through which to connect a tunnel system open the way to future extensions – which could include coupling systems by which to move the trains.

Hamburg, however, is not just a transport hub, it is also an industrial

location. That is why two refinery columns used previously for altitude training have now been converted for fire simulation purposes. This will soon be a place where widespread fires can be lit, pumps and flanges set on fire, and leakages of water and compressed air produced. Extinguishing alone is not enough: “Trainees have to gain a picture of the facility and begin by shutting off the leak using valves before they can begin extinguishing,” says Ingo Sandmann. Certain parts of the facility are cooled during the simulation using collected rainwater – which is plentiful in Hamburg.

But the best thing of all is that “this simulator enables us to run a sophisticated training course encompassing two additional and very difficult scenarios,” says Bernd Herrenkind, director of Hamburg Fire Brigade Academy. By doing so they are protecting the 450-million-plus passengers. **Nils Schiffhauer**

Pit Stop in the Premier Class

In motor sport it is not just for the fraction of a second - even in medical care every moment counts. The interface on the Red Bull Ring in Austria is the **MEDICAL CENTER**.



Trimming the seconds: speed counts for drivers at the Deutsche Tourenwagen-Masters (DTM). Seconds are also at stake when the Medical Car is called to the track carrying an emergency physician and paramedics



Race to the rescue: the Medical Car carries similar equipment to an ambulance. But with a top-of-the-line engine, this particular station wagon is destined to serve at the top classes of motorsport

With the engine screaming, the black and white shadow falls into the curve, starts skidding and crashing sideways into the barriers. The audience holds their breath, but at 'Race Control', in a darkened room at the Red Bull Ring in the Austrian town of Spielberg, they don't have time to be shocked. Ten pairs of eyes have been watching the crash on the screen, and now every second counts. Brisk commands echo around the room and are passed down to the track by radio. Dr. Walter Huber, Chief Physician at the track, alerts the Medical Car. This station wagon, a V8 with 400 horsepower, races over the asphalt, carrying on board the complete equipment for an emergency medical vehicle, plus a physician and paramedics as well. Next to Huber at Race Control sits Dr. Michael Scholz, Medical Director of Deutsche Tourenwagen-Masters (DTM). The medics watch what is happening on the track, transmitted to them in full-screen format by cameras that can pivot through 360 degrees.

At the core: the Trauma Room

In the floor beneath Race Control, the Medical Center team stands at the ready. There are eleven physicians and more than 20 paramedics on duty at this DTM race weekend. At the heart of medical care is the Trauma Room, which has treatment stations for two seriously injured patients. The specialty here is traumatology. It's where patients can be stabilized,

prepared for transport and taken to the nearest hospital by rescue helicopter. There are two other rooms where several less seriously injured patients can be treated. The equipment in the Trauma Room ranges from an ultrasound device and defibrillator, all

the way to an emergency ventilator (type: Dräger Oxylog 3000 plus). The Trauma Room is also equipped for the treatment of burns, which used to be one of the most common injuries. For major international events, the Medical Center is additionally equipped. >

The Professor's Legacy

The high level of safety in today's motor racing developed itself over the past 40 years. For many decades, death and serious injury were a normal part of racing. It was not until the middle of the 20th century that seatbelts and helmets were introduced. Nowadays drivers are protected by an extremely strong, single-shell monocoque-chassis with a multi-point belt, integrated helmet, and fireproof clothing. Fires, furthermore, have become rare on account of special tanks. Medical Centers with teams who use correspondingly equipped rescue vehicles, have raised emergency care at tracks to a remarkably high level. As a result of all this, no driver has been killed in an accident in Formula 1 since the death of Ayrton Senna 20 years ago. A key part in that was played by the British medic Sid Watkins (1928 to 2012). He made Formula 1 safer, and as Head Physician he saved the lives of many drivers. Watkins was Formula 1's on-track physician from 1978 to 2004. A trained neurosurgeon, he began improving equipment and the organization of emergency medical procedures. He is considered the inventor of the modern Medical Car. Watkins was known affectionately as 'Prof' by drivers, and after Senna's death in 1994 he headed the committee of experts set up by the FIA world automobile association which has since prepared many of the safety measures introduced into the sport. As a result of these developments, racing drivers can survive collisions involving decelerations up to 75 times the force of gravity (Robert Kubica in the year 2007). A recent new challenge to rescue workers has been how to deal with hybrid technologies which combine combustion engines and electric motors. The high voltages that can be produced by damaged batteries are extremely dangerous.

“The most critical phase of every race is at the start, followed by the first lap”

- > A Dräger anesthesia and intensive ventilation system is also present over the entire weekend for the Austrian Grand Prix Formula 1 race in 2014. A ratio of 28 race physicians to 24 drivers ensures a high level of safety during motorsport’s premier event.

Motors and medicine

An all-clear has now been issued at the DTM track: the driver was able to leave his crashed vehicle unassisted. But just to be sure he is brought to the Medical Center, which is the major intersection between what happens on the track and medical care at the Red Bull Ring. The medics give him a thorough check-up. A few minutes later Dr. Huber’s telephone rings – the driver is uninjured. A few decades ago it would have been almost impossible for a racing driver to survive such a heavy impact uninjured. But since then the safety level in motor racing has improved dramatically (see box on page 37) – largely at the urging of race physicians.

“The most critical phase of every race is at the start, followed by the first lap,” says Huber. It is when the cars drive closest to each other and overtaking maneuvers are especially tricky. That is why doctors have developed their own starting procedure for their team at every race. Part of this is a Medical Car follows the field of racing cars for the first lap, this means helpers can arrive in seconds at any vehicle that may crash.



The heart of the Medical Center: two patients can be treated in the Trauma Room, equipment ranges from a defibrillator to an emergency ventilator. It is even more comprehensively equipped during major international events

Emergency medical care at the Red Bull Ring is all provided by Emergency Medical Service Sports Austria (EMS). This association, whose members include more than 80 emergency physicians and numerous paramedics, was founded in 1996. The historic Styrian racetrack was converted and reopened as the Red Bull Ring in 2011, and since then the association has centered its activities there.

Physicians and paramedics are not only in the Medical Center, they are present at the track. On a race weekend like the DTM event in early August, the EMS always has two Medical Cars and four ambulances on standby. Then there is an 'Extrication Team' on the track which specializes in rescuing injured drivers. "We train for the careful rescue of injured drivers for every single race series that takes place on this weekend – from touring racing cars all the way to Monoposto," explains Dr. Huber.

Suddenly the next accident occurs on the track. This time a driver racing for the Scirocco R-Cup was caught by surprise. Again the driver is brought to the Medical Center. The unit's two roll-up doors provide access from the pit lane and the paddock, as the drivers' camp is known. Because there was a lot of smoke at the accident, the doctors check the driver's breathing very carefully. The Medical Car has now returned to the track, where a blaring symphony of engines penetrates only slightly into the building. **Peter Thomas**



PHOTOS: PETER THOMAS

The action on the track is always in view: Dr. Walter Huber, Head Physician at the Red Bull Ring in Spielberg

Honorary position in motor racing

DR. WALTER HUBER, 56, grew up in Murtal and was interested in racing from an early age. In 1991 he became Chief Medical Officer (CMO) at what was then called the Österreichring, which was rebranded the Red Bull Ring after its reopening in 2011. Huber is also Chief Emergency Physician at the district hospital in Leoben.

Dr. Huber, why does someone become a race doctor?

Our association has 80 practicing emergency physicians who have received the appropriate additional training in Austria. These paramedics and doctors are all racing enthusiasts, which is a prerequisite for this kind of voluntary work. I myself have been at it for almost 25 years.

What does your work entail?

My work is primarily about coordinating things. But if there is a major accident I go on to the track in the Medical Car as well. My work at the Red Bull Ring is not very different from that of a Chief Emergency Physician.

What are the biggest challenges you face during a race?

Our work involves specialized emergency medical procedures. The team, which includes Medical Car drivers with racing licenses, trains regularly for them. Cooperating with the Sicherheitsstaffel (Safety Team) is also important. But our work goes much further than that, because the Medical Center also assists the racing teams themselves, as well as visitors to the paddock. We deal with all sorts of things: from sprained ankles, to allergic reactions from wasp stings, all the way to circulatory failures, heart attacks, and strokes. Our physicians also decide whether drivers are allowed to drive at all. For instance, an accident that seems unspectacular can still impair somebody's reactions and compromise the safety of that person and the other drivers.

Sparkling Ideas

They call themselves media designers: the artists belonging to the company **ART-EFX** beautify things which, in their purely practical form, often tend to deface public spaces. It all started with transformer buildings.

They turn heads, and some have fan clubs: “And there are even organized bicycle tours taking in transformer buildings we’ve designed,” says Ronny Bellovics enthusiastically. A trained business economist, he founded ART-EFX in the year 2013 together with his school-friend Markus Ronge (“We’ve known each other for 30 years”). Based in Potsdam near Berlin, right next to the Babelsberg film studios, today its 16 staff provide artistic facade design for public places. And that includes the often dull-looking transformer buildings belonging to power supply companies – buildings which are frequently the target of a very different group of ‘artists’ with whom the company’s designers do not wish to be confused. “We design public spaces with the approval of the owners of the buildings as well as other people, including the general public,” Bellovics points out.

3,000 minor works of art

Four fifths of the time they work on preparations, says the company’s artistic director Markus Ronge. “Spraying a normal transformer building takes a two person team just one day.” For staff, planning includes investigating the property and its surroundings very carefully. “We not only take the environment into account,” explains Bellovics, “we also examine the history of the place where it is situated.” So far they have created around 3,000 imaginative little works of art using transformer buildings in Germany alone. Many of them play on their environment in a photographically



A painted transformer building can be so much fun – like this one in Rötze, Bavaria

PHOTOS: ART-EFX (2), NILS SCHIFFHAUER

ART-EFX employee Mario Schuster in front of the mythology of German film history
 Right: playing with illusions in Großburgwedel, Lower Saxony



realistic way, and include some striking optical illusions. The artists use nitro-paint and, even more often, highly opaque acrylic paint. What they create is more than just arts and crafts. These are designs with majority appeal, not just pleasing and surprising, but also worthy of repeated and longer examination, rather like picture puzzles. “No politics, no sex, no violence,” says Bellovics, listing things the company avoids. For instance, in a children’s play paradise belonging to an English outlet, they designed primeval worlds populated by dinosaurs whose adorable looking heads make them look almost confiding. This idea alone was so well received that the customer, one of around 6,000 to date, had it reproduced in other countries. Shadowing, perspective, and arrangements of people that look like real life combine illusion with humor. “We do consider ourselves illusionists,” says artist Ronge.

Sprayed imagery

‘Tromp l’œil’ – or ‘deceive the eye’ – is the name for a genre of art known since antiquity where the image gives an impression of reality, but also looks like a picture, which is fascinating to the viewer. However, quite a lot of work is needed before such art can adorn public or private spaces – including interiors. “We go to great lengths to explore the desires of the customer,” says Ronny Bellovics. Then two designs are presented that also attempt to address requirements, of which customers themselves may well not even know anything.

People are almost always amazed. But the work of art often has to survive public scrutiny as well. Take a complete design for a children’s hospital, for instance. “We had as many as 20 people around the table for that one – doctors, nurses, patients,” says Bellovics, before everybody had agreed on a concept in which each floor of the building represented a continent, which the media designers then populated with pictures of indigenous animals. Trained decorators begin by providing a stable undercoat: ART-EFX’s works are designed to last for ten years or more. The color of this undercoat will be based on the subsequent artwork, which by that point only exists on an A4 sheet of paper. Then the artists pack their spray-cans into a crate, put on their breathing masks and filters, and begin to spray the walls without any prior sketches. One image they produced (for a water utility company) depicted the story of Robinson Crusoe – how he came out of the sea, still clean-shaven, and proceeded to build up his own little civilization in progressive phases, his beard growing longer with each. A fountain for supplying drinking water was of course included.

ART-EFX’s designs almost always tell stories – stories people often cannot hear and see enough of. “But we also think a lot about how a work of art will appear in its space,” says Bellovics. They spray anything which paint sticks to: from garbage trucks, to wellness spas, to building facades of any size – and of course transformer buildings, where it all started. “There are four million of them in Germany,” says Bellovics, “so we still have quite a few to do.”

Nils Schiffhauer

Which masks protect against what?

Most sprays contain solvents that can be harmful to the health. The right breathing masks and filters can provide protection. The type of filter depends upon the boiling point of the solvent: if it is above 65 degrees Celsius (‘high-boiling’), then the Dräger X-plore 3300 set is recommended (for painters) – this consists of the X-plore 3300 breathing mask and the A2 P3 R D filter. If the boiling point is below 65 degrees Celsius (‘low-boiling’), then the Dräger X-plore 4340 mask with AX filter might be advisable. Alternatively, fan filter systems or self-contained breathing apparatus may be used. Applications and limitations of single use respirators with filters are shown in the accompanying instructions for use. What is important is to use breathing protection equipment that is suitable for the task at hand.

Further information at:
www.draeger.com

(keyword: Dräger Voice Database of hazardous substances)



Photo series:

For more fascinating sprayed images by ART-EFX around the world visit www.draeger.com/109/xplore

Flare-Up

Soccer is all about passion, and a fan culture has developed around it which includes things like **PYROTECHNICS**. Flares lit in an uncontrolled way can cause serious burns and respiratory ailments. Is that really necessary?



Once tolerated, now strictly forbidden: fireworks in soccer stadiums. Their flames, which can burn at over 1,000 degrees Celsius, are dangerous

Does anyone remember Hans-Peter Briegel? Now 58 years old, he played for 1. FC Kaiserslautern in the 1970s and 1980s. His powerful pitch performance, at times rough-cut, earned him the epithet ‘die Walz aus der Pfalz’ – which, loosely translated, means the ‘Palatinate Steamroller’, referring to the region he came from. Briegel, who never used shin-guards, became Germany’s Soccer Player of the Year in 1985. But one of the lesser-known things he inadvertently contributed to today’s fan culture was the firework. When he switched to Italian soccer club Hellas Verona, he indirectly helped the controversial flare to make an entry into German stadiums. Sports journalist Uli Hesse, in any event, believes that the practice of pyrotechnics began precisely on the day that Briegel switched teams. “The Pfalz-based soccer star played his farewell match in Kaiserslautern on August 2, 1985,” explains Hesse in the soccer magazine *11 Freunde*.

People who were in the stadium at the time reported that it was the first time that fireworks really began to be used. Italian fans had brought colorful smoke grenades with them, and Kaiserslautern fans got heavily involved. Many of them had been to Verona the year before to see Briegel play there. It was there in the stands that they got to see the firework display already common in Italy. Flames, smoke, colorful lights in the club colors – the Germans were impressed. On their way back they stuffed quite a few of the devices into

their luggage. That was the beginning of the general spread of pyrotechnics in German stadiums.

Water doesn't help ...

Fireworks were tolerated by the clubs for a while, but today they are strictly forbidden in every stadium. Flames that burn at well above 1,000 degrees Celsius are simply too dangerous – especially since once lit, they are almost impossible to put out. “Water doesn’t help at all,” says Hendrik Frese, spokesman for Hamburg fire service. “Flares burn with magnesium and other chemical ingredients which in themselves contain an oxygen supply for the flame. That’s why magnesium torches, for example, are used for underwater work and as signal lamps in shipping.”

Nowadays, any adult can order fireworks easily on the Internet. Generally speaking it is not forbidden to purchase, own, or light flares, provided they carry a number allocated by the German Federal Institute for Materials Research and Testing. There are however laws governing where and by whom they may be used. They are popular – and legal – at open-air events and concerts, and for creating atmospheric lighting at outdoor festivals.

Most of the fireworks you see at soccer matches are ‘Bengal’ tubular flares or high-power magnesium torches. Legally they are referred to as small fireworks classed as Category II pyrotechnic devices (see table on page 45). Flares, which are often no bigger than a cigar, contain a flammable charge which consists of brightly- >

Protection against flares

Aside from the enormous heat generated by flares, the biggest danger for bystanders is the smoke which can harm the health and is caused when magnesium and metal nitrate additives burn. Emergency and security services, on the other hand, can protect themselves by using equipment like Dräger full face masks (X-plore 6000 series) and corresponding filters (X-plore series Rd40; EN148; Part 1). This combination offers protection against almost any harmful substance, from organic vapors all the way to nitrous gas. Especially suitable for operations in pyrotechnic smoke is the X-plore 1140 A2B2E2K2 Hg NO P3 R D / CO20 P3 R D. This combined filter protects against poisonous gases and particles suspended in the air.



If you really wanted to play it safe you would have to declare the soccer stadiums a high-security zone

- > burning magnesium, various metal nitrates ('saltpeter'), and an oxidizing agent to supply the flame with oxygen. There are various types depending on composition: some that develop more smoke, and some that produce little smoke and can even be used in enclosed spaces.

Legal, illegal

What makes them so attractive to soccer fans and others is the way they burn so brightly and in so many colors. The metals they contain are what make the flames colorful. The following are especially popular: red (strontium nitrate), blue (copper nitrate) and green (barium nitrate). Because of the considerable heat they produce and the fact that they are so difficult to extinguish, firefighter Frese mentions another danger, which is the smoke they produce when burning, which can be extremely harmful to the health. Similarly popular high-power magnesium torches are larger than the classic 'Bengal light' flares, and include a safety handle made of plastic which allows you to hold them in your hand as they burn. Like Bengal lights they emit a bright light, but they produce much less smoke. They are not lit at the tip, they have a tear-off ignition instead.

The danger of serious burns remains: "Especially at soccer matches involving big crowds – and in conjunction with alcohol," says fire service spokesman Frese. Added to that, the cinders left over after burning remain extremely



(Bad) Habit: fireworks regularly keep the emergency services busy



Especially popular: flares in red, blue, and green

PHOTOS: FRO/AUGENKLICK, CARO/OBERHAUSER

Explosive Substances Act

Pyrotechnic objects are divided into five categories depending on the degree of danger and/or the purpose for which they are used:

Category I	Very small fireworks	Table-top fireworks, caps, poppers, sparklers ...
Category II	Small fireworks	Firecrackers, flashes, Bengal fire, rockets, sun-wheels ...
Category III	Medium-sized fireworks	Horizontal cascades, Catherine wheels, firepots, fountains ...
Category IV	Large fireworks	Multi-staged and lightning-flash fronts, comet bombs ...
Category T	Other pyrotechnic objects	Maritime and emergency rockets, smoke powder, stage fireworks ...

hot for a long time. For that reason, safety experts such as Cologne’s director of police Volker Lange (who is responsible for 1. FC Köln’s home games) consider the burning of pyrotechnical objects “rightly forbidden”.

Legal or illegal, many soccer fans cannot be kept away from pyrotechnics by laws alone. But how do they get them past strict safety precautions and into the stadium? Fans have shown ample creativity in this respect over recent years. The crotch of your pants used to be considered one of the safest smuggling places, because you cannot really check that area in a body search. But this has changed as safety regulations have become more and more stringent. “If you really wanted to play it safe you would have to declare the whole stadium a high-security zone and perform checks like they do at airports. But that would involve people having to turn up three hours before the game began,” says Wolfgang Osinski of Düsseldorf’s Klüh Group, which performs security tasks in soccer stadiums.

Pyro-users have taken to hiding their materials in the arenas days before the match. Similarly popular is the smuggling of powder, which is hard to feel superficially. The culprits then usually light it in the stadium behind large fence-banners so that they are harder to identify later on. People also regularly manage to smuggle fireworks into the stadium in places like hollow flagpoles, shoes, and even food items like baguettes.

The legal consequences fall primarily on the clubs. They are penalized financially for their fans’ pyrotechnic displays, sometimes with five-figure fines. The actual culprits, on the other hand, are rarely arrested. Using pyrotechnics is controversial even among fans. The foremost users of flares, firecrackers, and signal rockets are the ‘ultras’. This movement began in the middle of the 1990s. Unlike their predecessors, known in Germany as ‘Kuttenfans’, who wore embroidered waistcoats, the ultras, who number around 25,000 in Germany according to police estimates, are not distinguished by any particular clothing. They consider themselves elite fans who support their clubs under any circumstances. Ultras are very well organized and critical of the commercialization of soccer, and they invest a lot of time and creativity in the production of banners, flags, and songs with which they cheer on their own teams. However, ultras often get involved in violent excesses, and they continue to use pyrotechnics in the stadiums.

Ultras: elite fans

Incidents involving smoke grenades, smoke canisters, and New Year rockets occurred as far back as the 1980s. When

the ‘Bengal light’ flares appeared, which were good for enhancing atmosphere, the clubs not only tolerated them but sometimes even encouraged them. Entry tickets for Offenbacher Kickers games around that time depicted a sea of flares accompanied by the slogan: “Der Berg brennt” – the mountain burns – referring to the Offenbacher’s ‘Am Bieberer Berg’ stadium. And during the 1991/92 season, fans of 1. FC Nürnberg were permitted to enhance the stadium atmosphere using hand-flares on the track in the inner zone.

The dangers were recognized later, partly because people would throw fireworks onto the pitch – a reprehensible habit which even most ultras nowadays frown upon. After the turn of the millennium, the German Football Association banned flares. In 2011 there was another attempt to legalize fireworks, at least in certain zones, but talks between the ultras and the German Football Association broke down. The problem therefore remains. And a joint statement issued back then by representatives of 150 ultra groups gives little cause for hope: “Flares and colorful smoke are a permanent part of fan culture,” the paper said. “We will not allow them to be taken from us.” **René Weihrauch**

“Today we’re more critical”

PROFESSOR EGBERT HERTING talks about developments in preterm medicine, the pressure of expectations, and little lives that begin close to death.

Dräger Review: Everyone has heard of intensive care for premature babies, but fewer of us can imagine exactly what it involves. At most we might assume that nowadays things are ‘gentler’ than they were in the early years. But is that a fair description of progress?

Herting: I certainly do hear that often, but I don’t think it’s quite right to call ‘gentle care’ something new. I have been working in child and adolescent medicine since 1985, and in my experience, caregivers back then treated babies just as gently and attentively as they do today. But what we have been able to do is continually refine our treatment strategies, thanks to improved knowledge and improved technology. Numerous new insights into the abilities and needs of preterms enable us to treat them today in a way which promotes their development, much more specifically and much more individually.

Dräger Review: How has everyday work on the wards changed over the decades?

Herting: In my first pediatric clinic the preterms area was still out of bounds for parents, who were not even allowed to touch their children for weeks on end and could only see them through a pane of glass. That would be unthinkable today. Yet there were plausible reasons for doing it according to what we knew back then, such as protecting the infants against infection. Nowadays we know about the benefits of including parents in treatment early on. It helps preterms to develop many capabilities, whether it be their own breathing, or early nourishment from breast milk. Parents are no longer visitors, they are part of the team, which is enormously important for the development of premature babies.

Dräger Review: How has the role of technology influenced that?

Herting: Technology is of vital importance just as it was back then – but now we use it in more careful measure and more critically. Just a few decades ago we still felt we had to be intervening all the time: “Let’s take over its breathing!” – “It would be better to rely on artificial infusion than on its intestines!” Today we employ technology more critically, and we prefer to assist a baby’s organs to function by themselves rather than supplant them completely using invasive equipment and all the concomitant risks.

Dräger Review: Was the danger of infection overstated back then?

Herting: Germs are undoubtedly a serious threat, of that we are now more aware than ever. But it is crucial to weigh up all of the factors appropriately. Only a minority of microbes are dangerous, while

others are needed. Preterm infants, like any other people, need to be colonized by bacteria. We need them for our digestion, and even to absorb certain vitamins in the first place. We couldn’t survive without bacteria on our skin and in our digestive systems. It’s therefore only sensible for a preterm infant to be colonized by its parents’ bacteria from the outset – ones it will have to live with anyway – instead of those of the hospital environment.

Dräger Review: A kind of ecological strategy: good bacteria banish alien microbes?

Herting: In that sense, yes. To summarize, I do believe it’s important for parents to be near their children and included in treatment straight after birth.

Dräger Review: What are the important elements of that?

Herting: First of all you have to think about how parents feel in their situation. Usually they will have envisaged a normal birth: a strong and healthy baby with whom they would quickly be able to leave the hospital. But now they see themselves confronted by anxieties, serious emotional challenges, and the need to spend several weeks in hospital. Whenever it is possible to foresee a premature birth, we do of course prepare parents together with our obstetricians in our perinatal center. We use personal consultations and brochures that explain preterm medicine. We also show parents-to-be our wards, what we do there, and what we will be doing together for their preterm infant.

Dräger Review: To what extent does the principle of family integration affect the design of a ward and its daily procedures?



“Technology is not an end in itself, it should support the abilities of infants”

Egbert Herting is Professor of Child and Adolescent Medicine at Schleswig-Holstein University Hospital, Lübeck Campus, and has worked in the field for almost 30 years

PHOTOS: HELGE MUNDT



Herting: Environment is a key factor, because families spend an awful lot of time here. Most very young preterms stay with us for between three and six months. Although equipment is of course present everywhere, we do take a lot of care with how the environment is: noise levels for instance, and a pleasant level of lighting. As in many other countries, we also practice ‘kangarooing’ in which the parents warm the baby on their own bodies instead of in an incubator. Such intimacy presupposes an appropriate atmosphere.

Dräger Review: How do you manage to incorporate parents into care which promotes development?

Herting: The most difficult thing is achieving a successful transition into an unexpected situation. Parents-to-be are subject to the pressure of expectations, and you often find a certain amount of

repression going on. They’re not aware that almost one in ten children born in Germany arrive before the 37th week. Almost 13 percent of all newborns have to be admitted to pediatric clinics after birth and treated. High expectations are suddenly let down, and the parents have to cope with that first of all. On the other hand our possible treatments are now much better and we’re able to give parents hope about how their child will develop. Early inclusion in treatment gives parents the good feeling of being able to do something real and positive for their child.

Dräger Review: Does the equipment have to adapt itself to the human needs of the baby, the parents, and the professionals?

Herting: That is what technology is there for actually. Take CPAP respiration for instance: it means we no longer have to intubate preterms right away and force them

to breath at a fixed rhythm. Even the very smallest patients can breath independently very early on. Diet has also been adapted to needs and abilities so that infants can develop a natural digestion early on, and with breast milk if possible. That’s another area in which you can see that our specialism is developing rapidly, that we’ve learnt quite a lot, and that we respond nowadays very much more individually to the needs and abilities of each preterm baby. Technology does of course offer opportunities, but we specialists also develop new demands which then have to be met by manufacturers. Modern equipment is an expression of that, and technology is not an end in itself. At its best it’s designed to do its work in the background, support an infant’s own abilities, and place the young patient at the center of things.

The Interview was held by Silke Umbach.

A Touch of Haute Couture

Making **CHEMICAL PROTECTIVE SUITS** involves a kind of high-end tailoring, or, in French, 'haute couture'. These suits allow you to work in places where hazardous gases, chemicals, and bacteria are causing trouble.

If you see someone coming along in this suit, you should run in the other direction," advises Marco Lange, pointing at a chemical protective suit (CPS) which has been pumped up for testing. Lange is a team coordinator at Dräger and responsible for the production of several thousand of these high-tech garments yearly. The suits enable people to work in adverse atmospheres. Wherever the suits are, the danger of gas, chemicals, and bacteria will not be far away – which is why he recommends fleeing in the opposite direction if you are not involved. But if you happen to be hurrying towards a hazard wearing one of these suits,

then you will be protected by the latest technology. This can be seen most clearly by following the production of the top models, CPS 7800 and 7900, step by step.

Five protective layers

The two suits differ in one key point: with the CPS 7800, a SCBA is worn outside the chemical protective suit, whereas it is worn inside the CPS 7900. The latter is immediately recognizable by its large visor, whereas the 7800 is closed off to the outside world by a breathing mask or face cuff. Both suits are made of the same material, which was developed with Dräger's help and

is now manufactured exclusively for the company.

This material, known as *D-mex*, is symmetrically built up around a tear-resistant fabric, encased on both sides by a chemical-resistant film. The material is then sealed off outside and inside by an elastomer layer which is self-extinguishing and highly flame-retardant, and which also offers protection against cuts and punctures. It may sound simple at first, but it is not. "The material has to be lightweight, yet strong," says Lange, "and it has to feel good and accommodate all of its wearer's movements without difficulty." The suit – which in its lightest form weighs 3,500 grams – also stands up to the cold produced by liquid gases, which can be as low as -80° Celsius. The material is supplied on rolls in various colors, and it feels very similar to outdoor clothing fabric. Chemical protective suits are made only to order. The variations are too diverse, and the possible combinations produced by customized features are immense. "There are more than a million possible combinations for the CPS 7900 alone," interjects Lange. That is why a chemical protective suit's life begins with an order, which in turn breaks down into a detailed list of >

Outer shield

Dräger develops, manufactures, and distributes a series of chemical protective suits in various protective categories. The most advanced of them at the moment are the CPS 7800 and 7900. These are reusable and offer protection against industrial chemicals, chemical warfare agents, infectious agents, and radioactive particles, and are suitable for work involving liquid gases (at down to -80° Celsius). With the right accessories they can be adapted to different applications, and they are carefully tailored as well. An ergonomic, body-hugging cut gives more freedom of movement, which can reduce stress and accidents. The lifespan for such a suit is up to 15 years.



If air cannot escape, then it cannot get in: every protective suit is tested for leaks under pressure

If all you know is your sewing machine at home, then you're in for a surprise here

> components required for its production, ensuring that further on down the line they are not missing a loop needed for the compressed air cylinder's manometer, or a *D-Connect*, which is a shackle for hanging measuring devices onto, which can also be used for crash rescue. Cutting the blanks for the production of such clothing is a considerable challenge. "We position them," says Lange, pointing to a pattern sheet on the CAD screen, "so that, from size S to XXL, we lose as little material as possible."

Sewing, welding, bonding

Cutting is done automatically using a standing blade which needs replacing after every 1,000 suits. The blanks are marked on the inside for things like loops that need attaching. Then they are printed onto the material. "We use a thermotransfer process to print not only our company logo, but also customer requirements – such as names and numbers – using a very thin and flexible, wear-resistant film." This allows the people wearing the suits to recognize each other during missions, and also to find their own suits again when they have to put them back on. "These suits need to be professionally cleaned and disinfected after every use, which is done at between 30° and 60° Celsius using a special detergent in an industrial washing machine," says Lange.

All of the work-stations that follow gradually assemble the blanks to create a gas-proof suit. The main techniques used for this are sewing, welding, and

bonding. Each of these technologies has its various secrets which affect the reliability, longevity, and handling of the product. To make a cut piece into an arm, you quilt the sides using a double-stitched seam. Because the material is extremely resilient to physical damage, the industrial sewing machines have their work cut out for them. "If you sew at home and think that our machines do the same thing, then you should think again," says Marco Lange.

Welding the seams so that they are gas-proof requires a complex combination of technology and skill. The welding tape is brought up against the seam at a certain angle, and welded on by means of a stream of air at over 300° Celsius coming out of a broad nozzle. Bonding is done using a two-component adhesive which is applied beneath special extraction hoods. "Once mixed, this glue can only be used for quarter of an hour." That is why its components, which are not exactly cheap, are weighed to the nearest gram for work which is about to be done over the next few minutes, so that losses are kept to a minimum. A rolling-on machine applies a constant pressure to ensure that the bonded areas connect properly. By now the suit has begun to look like a suit, yet there are still challenges awaiting the production team on the 'home straight', such as fitting the gloves, boots, and visors, all of which also have to be connected to the suit in a gas-proof way. It is all a little reminiscent of changing a bicycle tire,

which, once the inner tube has been repaired, has to be eased back into the wheel.

Don't slam the door!

Before the suit can be tested at the end, it has to spend a night in a 'tempering room' at around 50° Celsius. "This artificial aging process hardens the adhesive and degases the material," says team coordinator Lange. After that comes the final and decisive step: is the suit airtight? This they test inversely so to speak, by pumping it up to a pressure of 17 millibar to see if it leaks. "The measuring instruments are so sensitive that they will register it even if you slam a door," Lange has noticed. When you get into the suit, together with your self-contained breathing apparatus and protective mask, you become the master of a different world. "People normally work in these suits for 20 to 30 minutes," says Lange's voice, coming in from the outside. Careful tailoring to the body's shape, which is one of the things that has been improved upon, pays off when it comes to walking and running, lifting things, and squatting down. The fact that the material is now thinner – yet even more resilient – also makes the suit lighter and makes movement easier. Yet working in a chemical protective suit is still stressful – but it is reassuring to know that its wearer is enjoying the utmost protection. **Nils Schiffhauer**



Photo series:
How a chemical protective suit is made
www.draeger.com/109/cps



The zippers have to be gas tight as well – and their metal must not produce sparks

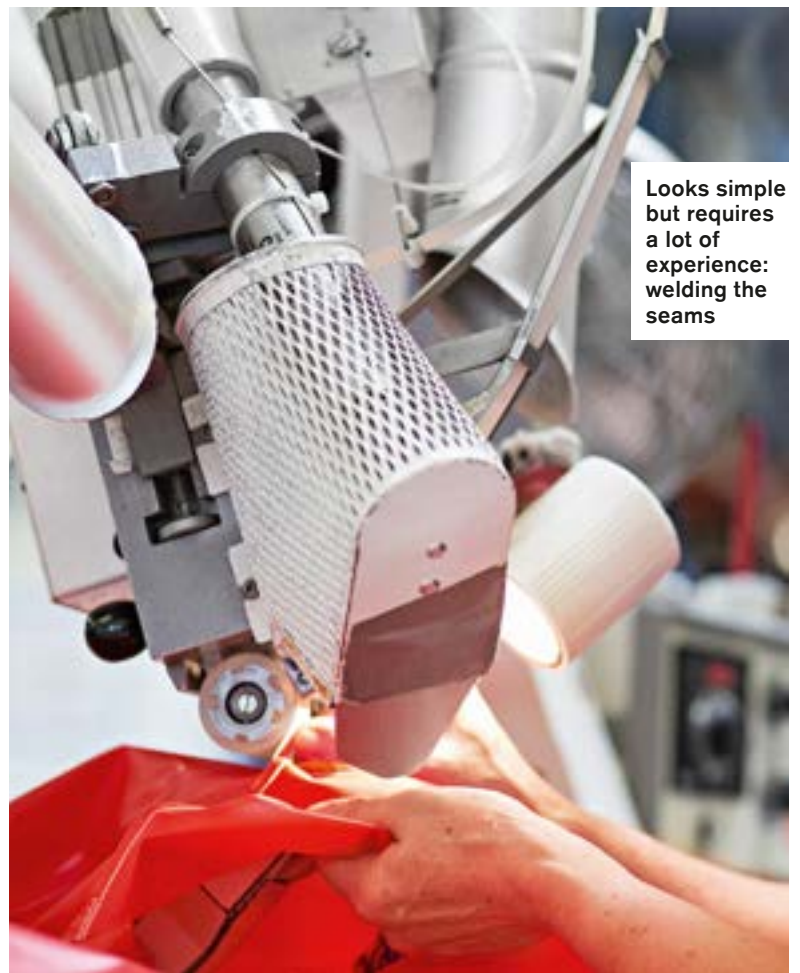


Fitting in the visors is one of the last stages in production

Team coordinator Marco Lange; several thousand CPS each year for the global market



PHOTOS: PATRICK OHLIGSCHLÄGER



Looks simple but requires a lot of experience: welding the seams



From Happiness of a New Building

Around a third of German hospitals operate at a loss. How to **PREPARE FOR THE FUTURE**, by investing in buildings, equipment, and work procedures.

The old days are over and the future has begun at the Florence Nightingale Hospital in Düsseldorf. Outdated machines have been discarded and replaced with new ones – almost all of them from the same manufacturer. The disarray of dozens of products (all with different interfaces) has been unscrambled. Patients and staff now enjoy more safety, and longer distances have been reduced. Never again will patients be rushed inconveniently from the emergency room on the ground floor to radiology on the floor above: both areas are now right next to each other. This saves the hospital a considerable amount

of money. These are just a few advantages of the new function building which was recently just opened. It is one of the largest new buildings in Nordrhein-Westfalen. Erecting the four-floor structure took only 24 months, and it was completed on time. The second phase of construction is now underway. By the end of it all, the building work will have costed 48 million euros, and not less than 80 million euros will have been invested to include conversion work in the old remaining buildings. Kaiserswerther Diakonie, the owner of the hospital, decided on a single manufacturer to equip certain areas: Dräger.

The Lübeck-based technology company supplied anesthesia and ventilation systems, OR lighting, in addition to all of the ceiling supply systems, and is responsible for patient monitoring and patient data management – the heart of the hospital.

Ever-present digital world

The patient monitoring is performed for the first time fully electronically. They used to get disconnected briefly from the monitoring systems before operations (on the way from the preparation room to the operating room). The same happened after the



Florence Nightingale Hospital in Düsseldorf: one of the largest new buildings in Nordrhein-Westfalen. Erecting the four-floor structure took just 24 months – Instead of 20 different anesthesia workstations made at different times, now there are just two

PHOTOS: MARCUS PIETREK



All of the patient data in anesthesia and intensive care is collected electronically

operation, on the way to intensive care. Medical data was also not fully recorded.

Now, all of the patient data in anesthesia and intensive care is collected electronically. Electronic patient files open up new possibilities which were previously difficult or unavailable, because data was documented by hand and in less detail. For example: files now contain data acquired by the systems during operations, as well as the types and dosages of drugs administered. Information and images are accessible to every physician and nurse, wherever they are. A head physician, for instance, can take a look at the file from his or her office and give advice to the anesthetics team without having to rush to the operating room. That saves a lot of time, and can even be done from home. Even experts from other cities can easily be involved. The system networks different specialists within the hospital. They can exchange infor-

mation with each other, and patients do not have to change departments as often as they used to. The electronic storage of information also allows multiple operations to be evaluated centrally. How long do the various working stages take, which complications frequently occur, which medicines are most often administered? These are possible questions, to which the system knows the answers to.

Doctors at Florence Nightingale Hospital enjoy another benefit in the new building: because many of the devices and systems come from one manufacturer, operating them has become easier. The same operating philosophy applies to all the equipment. Instead of 20 different anesthesia workstations made at different times, now there are just two. “Staff make less mistakes operating the machinery and are less stressed. They also need less time to start the equipment up,” says Professor Dr. Wolfgang Weyland, head

physician at the Clinic for Anesthesia, Intensive Care Medicine, and Pain Management. Because the equipment is mutually compatible, there are no software problems sending data through the different interfaces. Dräger also services the equipment for the hospital, including the few pieces which it did not make itself.

The benefits of uniformity

“These advantages were so important that some physicians were willing to give up their equipment of choice that was not made by Dräger. In the end they benefit from the uniformity,” says Prof. Weyland. Persuading people was one of the biggest challenges. Every department wants the best for itself after all, even if it does not fit into the overall concept. Some hospital directors cave in to this in order to keep the peace – but in doing so they deprive themselves of an important opportunity to improve efficiency. At the Florence >

High frequency: operating rooms are used intensively; unproductive breaks between operations have almost been halved from 45 to 25 minutes



Paths have been shortened for employees and patients, plus processes speeded up

> Nightingale Hospital they initially accepted authorized use of different manufacturers, but it quickly became clear that it would be better to acquire not only the monitoring equipment, but all of the major systems from the same supplier to fully make use of the system. “The employees recognized the sense of standardization, and now there’s a spirit of optimism,” says hospital director Dr. Holger Stiller.

The new building has reduced the number of operation, delivery, and endoscopy rooms by around 50%. This means that doctors have to operate less in the evenings and usually finish work at 6 pm. There is enough room for future expansion as well. The facilities have been rearranged, and next to the emergency room and radiology they now have lung and internal medicine, as well as obstetrics and pediatric surgery. This shortens the emergency paths for personnel and patients, plus it speeds up processes. Children have

been given their own preparation and recovery room, which means parents can stay longer with their little ones. Costs have been saved because the operating rooms can now be used more intensively; unproductive breaks between operations have almost been halved from 45 to 25 minutes. This is made possible because the material and equipment for the next operation can now be prepared during the current ongoing procedure. Once everything is prepared, they can simply slide it into the operating room. Another thing that makes all this easier is that the equipment has been suspended from the ceiling. There are no more bothersome cables on the floor, which makes things safer and speeds up cleaning. Operating rooms are multi-functional and used by many different departments. That means employees work in teams and thereby stronger across departments – even that was a challenge for them, because existing structures and proce-

dures greatly changed. But it gave them the opportunity to broaden their areas of work. The new procedures save on personnel, and staff are left with more time for patients. They also reduce the number of people who are needed to be consulted about things. Dräger devices are installed at the bedside in the units, allowing itself to be controlled centrally. This can be particularly important for isolated patients with problematic microbes, and can significantly reduce cross-infections.

New building was economical

Completing the renovation in 2016, by which time the second phase of construction will have seen a thorough renovation of the old function building and a new main entrance will have been created. Dräger has been part of that too. The new building, which was completed in August, was the first since the opening of the hospital in 1975. “It now has to last in structural terms for the next 30 to



PHOTOS: MARCUS PIETREK

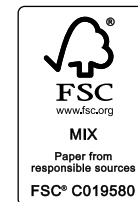
40 years. The equipment will of course need to be replaced more frequently though," says Hospital Director Stiller. They could have opted to renovate the function building, something last done in 1985. But that would have been difficult while running the hospital, if solely based on the requirements for hygiene in the operating rooms, which are not compatible with the dirt of a building site. Building a new structure also meant an opportunity to rearrange rooms and save time and money. This improvement in efficiency was a major criterion, since funds are scarce. "The Land of Nordrhein-Westfalen has halved subsidies in recent years. And health insurance funds pay fixed case rates, they still do not reward gains in quality or efficiency," says hospital director Stiller. Despite this, Kaiserswerther Diakonie's hospital does not operate at a loss like around a third of German hospitals. Dr. Stiller believes that the risk of depending on one producer

is low. "You can have problems if a supplier is taken over by a new owner or merges with another company." But as a family-owned company Dräger is less susceptible to that, he believes. The project is one of the most important in Germany for Dräger as well. "We wanted to show that we were able to equip the hospital to this extent, where now all of our new systems can be seen working there," says Dirk Birrenbach, who is responsible for Dräger's sales in Nordrhein-Westfalen. And because the hospital can be reached by foot from Düsseldorf's exhibition center, Dräger now has a new reference project on show for the world's biggest medical fair, MEDICA (this year from November 12 to 15). During that event, customers who are interested will be able to take a look at the equipment in action at the hospital. So in the end, both Kaiserswerther Diakonie and Dräger benefit from the new function block at Florence Nightingale Hospital.

Dirk Scherff

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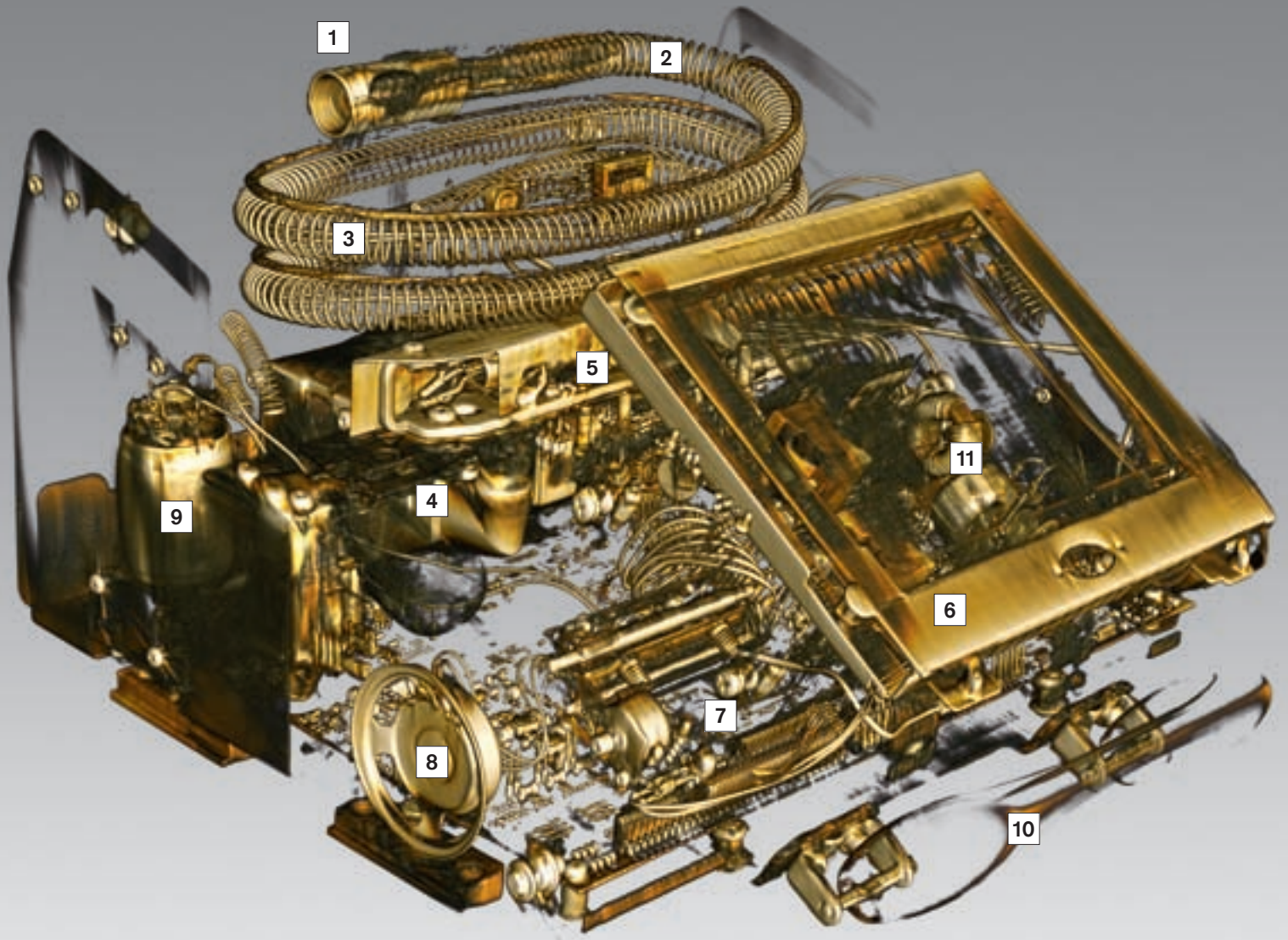


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Dräger Safety AG & Co. KGaA, Lübeck/Germany, manufactures the following products: Panorama Nova Dive, CPS 7900 (page 16); PSS BG 4 (page 19 ff.); PSS Dive (page 26 ff.); fire simulation system (page 34 f.); Dräger X-plore 3300, Dräger X-plore 4340 (page 40 ff.), X-plore 6000 series [and the filters mentioned] (page 42 ff.); CPS 7800/7900 (page 48 ff.), and the Alcotest 9510 DE (page 56). Dräger Medical GmbH, Lübeck/Germany, manufactures the Dräger Oxylog 3000 plus (page 36 ff.).

www.draeger.com



To Your Health!

No doubt: two sensors within the Dräger Alcotest 9510 DE use the subject's breath to determine his or her level of intoxication to an accuracy that can stand up in court. This image produced using a computer tomograph shows the device's inner structure. The subject blows through a disposable mouthpiece **1** into a breath tube **2** reinforced by a metal spiral. A heating wire **3** ensures that the exhaled air does not condense. This breath flows through an optical sensor **4**. A precisely measured volume of it is then fed to the electrochemical sensor **5**. Both sensors measure the breath alcohol concentration with great precision and specificity.

The electrochemical sensor consists of two electrodes separated by a membrane filled with an electrolyte. The materials are selected in such a way that ethanol produces a very specific sensor current. The optical sensor, however, makes use of the

fact that every gas absorbs very specific wavelengths of light. The more ethanol in the atmosphere, the more the light is attenuated – and it is that variable which forms the basis for calculating intoxication levels.

Breathing air temperature sensors measure the temperature of the breath current and normalize it to 34 degrees Celsius. This allows results to be achieved that can be used in court, regardless of the ambient temperature and the way the test person breathes. The result is displayed just seconds later on the color touch-screen **6**, and printed out on a thermal printer **7** for evidence. A speaker **8** provides acoustic feedback. The pump **9** purges the analytical system after each breath test. A handle **10** makes the device mobile, and an integrated mains adapter **11** enables connection to the mains.