Breathe Easy

New masks create breathing space
A place to thrive.

Dräger neonatal competence.
There is a perfect place in the world of perinatal care where everyone thrives. Where the vulnerable neonate can devote all its precious energy to growth. Where caregivers can anticipate and stay ahead of the changing needs of their delicate patients. Where the entire NICU works as one, for a new level of simplicity, connectivity, efficiency, and synergy. We call this place the Zone of Care. www.draeger.com

Dräger. Technology for Life*

Over 888 kilometers, a Porsche Cayenne Turbo emits exactly as much CO₂ as one person in one year. Read more on page 12.

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They work in Afghanistan, develop OR lights, work 200 meters under the sea, and detect gases

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What Moves Us—Dräger Worldwide

Dr. Božetěch Jurenka, Chief Physician, Anesthesiology & Intensive Care, Prague Military Hospital

“Afghanistan is a land of extremes. During the four months I worked there as an anesthesiologist in the Czech field hospital at Kabul Airport, the temperature fluctuated between -25 and +35 degrees Celsius. We also had to cope with lots of sand and dust. Those were tough challenges for the staff and for our equipment. In addition, the base was bombarded with rockets and subjected to a terrorist attack that our combat troops had to repel.

What astonished me most about this country, besides its very different culture, was the excellent equipment in our field hospital. It was comparable to the technology here in the Prague Military Hospital. We had medical gas equipment, modern medical technology that measured up to European standards, and familiar devices such as the Oxylog 2000 emergency and transport ventilator, the patient monitors Delta and Gamma, and the Fabius anesthesia workstation. Everything worked reliably, even under difficult conditions. Our medical technicians and service specialists were flown in regularly. They performed maintenance procedures while the hospital’s regular operations continued without interruption and all beds were occupied.

Now I’m back in Prague, where there’s plenty to do in our hospital. In our country, anesthesiology has a proud tradition, which we are continuing today at a high technical level. But I’ll certainly be traveling again to deal with tanks, pipes, and valves—on my next vacation I’m going diving.”

Dräger review 96.1 | November 2008
Duncan Cumming and Neil Halewood, divers at Bibby Offshore Ltd., Aberdeen, UK

“We are aquanauts. We work on the sea floor, for example at the base of oil drilling platforms or in rescue operations. Just as though we were in a space station, our lives are completely dependent on technology—smoothly functioning technology that’s reliable at all times. That’s why we divers are 100-percenters. For us, innovation means ‘trial without error.’ Obviously, someone whose diving helmet develops a leak many fathoms below the surface won’t have a chance to report the fault. On our ship, we live for one month at a time in the pressure chamber at five to 20 bar—exactly the pressure that our bodies are under at our working depth. Typical working depths for the North Sea are between 50 and over 200 meters—but with our equipment it would also be possible to work at 300 meters. In addition to deep-sea diving suits we also use diving bells, in which we ride from the ship to the sea floor. All of this depends on the pressure chamber technology that Dräger has installed in the hold of the ship: it’s got 20 million liters of compressed air on board. There’s also a special rescue boat for the divers, which is also kept under deep-sea pressure. That’s because a safe return from the pressure at 200 meters below the surface would last a week—that’s how long the tissues of a human body would take to release the accumulated gases. We’ve worked for as long as three weeks in the depths of the sea. Afterwards, when we’re aboard ship but not actually working, we have to stay cool, relax, read books, and literally breathe easy. When we’re at home—for seven months of the year—we have to stay fit. That means working out five days a week at the gym, climbing, and skiing. Just like technical equipment, the human body also requires ideal maintenance in order to meet the challenges of the depths.”

Olaf Barski, award-winning designer from Frankfurt am Main, Germany

“Hospital equipment was new to me. I had designed telephones and electric shavers, things that we use every day. But how do you illuminate a wound so that a doctor can make a clear diagnosis? I have to understand all aspects of the problems involved. What happens to an operating theater light when it’s switched off or being cleaned? And will people use the equipment improperly when they’re under stress.

To prevent misuse, I rely on design—and communication. That’s why I listen to the people whose tools I’m designing. And some of the things I’ve learned amaze me. For example, many highly technical devices that are moved around every day don’t have automatic cable rewind mechanisms—something you’ll find on every kitchen appliance! Of course my first Dräger light had an automatic cable rewind. I want the things I create to perfectly match their function. So I have to do tough and meticulous development work on every detail until I find the highest level of functionality. A key factor here is inspiration. When I was working on Stella, the first surgical light I made for Dräger, I visited the development center, which at that time was still located in Travemünde. Looking at the Baltic Sea I began to think about lighthouses and realized I wanted the light to float. Today we can design the most important thing—the light itself—even more perfectly. In the new light, 54 pairs of special LEDs located in 54 specially developed reflectors will generate light that permits an even better diagnostic view. In the future I’d like to design a complete operating theater, where all of the systems are seamlessly integrated so that people can do their very best work.”

The new Dräger LED surgical light received the red dot design award in 2008 and has been nominated for the 2009 Design Award of the Federal Republic of Germany. Market launch is scheduled for March 2009.
In keeping with a Chinese proverb that states “the louder the music, the greater the prosperity,” Dräger inaugurated its new production building in Shanghai’s Nanshi district on September 26, 2008—complete with a dragon dance and thundering drum rolls. Stefan Dräger, Chairman of the Executive Board of Drägerwerk Verwaltungs AG, symbolically cut the red ribbon together with customers and representatives of the city government.

From now on, the 11,000 m² building will house a facility for manufacturing sub-assemblies for anesthesia devices and respirators, including the trolley for the “Fabius plus” anesthesia workstation. The new production hall will replace leased space. Dräger has always been written by people at the company. However, beginning with this issue, the magazine’s concept has been advanced, because Dräger has always considered its magazine’s concept has been advanced, because Dräger has always considered its magazine to be its “company’s best ambassador in the market.”

The magazine focuses solely on technology and its direct benefits for humanity, as the company and its customers share the conviction that only the work proves the craftsman. “…the stories we tell are just as exciting as those our customers experience. The Dräger Review serves as a platform for these stories, which primarily recur and impact knowledge,” says Burkard Dillig, who was responsible for the Dräger Review for more than 20 years and now works as Dräger’s Corporate Spokesman. The magazine will continue to perform this role in the future, thanks in part to a new design that meets the needs of today’s readers. The articles in the Dräger Review have always been written by people at the company. However, with this issue, the editorial staff headed by Björn Wilke will also work together with a pool of experienced journalists. This change will ensure that the Dräger Review will not only remain a publication of experts at its core, but will also offer even greater benefits to its readers.

The pre-configured monitors will use to prove that applied respiratory therapy can help manage recruitment maneuvers. In doing so, he will also use new methods, such as the bedside measurement of functional residual capacity (FRC) and electric impedance tomography (EIT). The analysis of inflammation mediators in blood will be among the factors that Heinze will use to prove that applied respiratory maneuvers provide a less harmful therapy.

The Dräger Review—starting its 97th Year of News

The first Dräger company magazine “Aus dem Draegerwerk Lubeck” (News from the Drägerwerk in Lubeck) appeared in the summer of 1912. Edited by Heinrich and Bernhard Dräger, it was one of the first industrial company magazines. Since then, it has published 96 English issues, each one of which aims to provide customers with information on Dräger’s technical developments and their applications. The publication quickly gained an excellent reputation as a company-published trade magazine. It has remained that way for all of the past 96 years, and the Dräger Review will continue to stay the course in the second century of its existence. From the very start, the magazine’s concept has been advanced, because Dräger has always considered its customers to be partners with whom it has a mutual understanding and is committed to a common cause. The magazine focuses solely on technology and its direct benefits for humanity, as the company and its customers share the conviction that only the work proves the craftsman. “…the stories we tell are just as exciting as those our customers experience. The Dräger Review serves as a platform for these stories, which primarily recur and impact knowledge,” says Burkard Dillig, who was responsible for the Dräger Review for more than 20 years and now works as Dräger’s Corporate Spokesman. The magazine will continue to perform this role in the future, thanks in part to a new design that meets the needs of today’s readers. The articles in the Dräger Review have always been written by people at the company. However, with this issue, the editorial staff headed by Björn Wilke will also work together with a pool of experienced journalists. This change will ensure that the Dräger Review will not only remain a publication of experts at its core, but will also offer even greater benefits to its readers.

MEDICA—World Forum for Medicine

The 40th World Forum for Medicine will be held in Düsseldorf from November 19 to 22. Over 4,200 exhibitors from 65 countries will display their products and services at MEDICA, the world’s largest trade show for medical systems. The presentations on some 120,000 m² of exhibition space will focus on electromedical equipment, medical technology, lab equipment, diagnostics, physiotherapy, orthopedic technology, medical commodities and supplies, information and communication technology, fabrics, facility furnishings, and building technology. In a booth of about 700 m² (Hall 11/J 39), Dräger will once again offer visitors an exciting program. It will display two patient paths (one for adults, the other for neonates) that show how hospital equipment can be used to save lives while minimizing patient stress. It will also focus on non-invasive applications, safe patient transport, and the fast exchange of patient data.

Research Prize for Ventilation Therapy

The European Society for Intensive Care Medicine (ESICM) recently presented the first Bernhard Dräger Award for Advanced Treatment of Acute Respiratory Failure, with which Dräger is supporting a research project for improving ventilation therapy using non-invasive monitoring. The recipient of the award and its 15,000 euros in prize money was Dr. Hermann Heinze, 36, from the Clinic for Anesthesiology and Intensive Care Medicine at the Schleswig-Holstein University Hospital. The award was presented at the Society’s annual conference by Prof. V. Marco Ranieri, President of ESICM, and Dr. Daniel de Backer, Chairman of the ESICM research committee.

In his award-winning research project, Heinze will in 2009 investigate the extent to which the measurement of lung volumes can help manage recruitment maneuvers to re-expand collapsed lung tissue in patients suffering from respiratory failure. In doing so, he will also use new methods, such as the bedside measurement of functional residual capacity (FRC) and electric impedance tomography (EIT). The analysis of inflammation mediators in blood will be among the factors that Heinze will use to prove that applied respiratory maneuvers provide a less harmful therapy.

One-Brand Strategy for New Website

With a redesigned website, Dräger also aims to combine its divisions under one roof on the internet. In addition to sporting a new look, the relaunched website will have completely reworked content and more multimedia features. The focus will particularly be on directly addressing Dräger’s various customer groups and their different needs. The new website is scheduled to go online in January 2009.
New Breathing Masks Help Everyone Breathe Easier

To date, NON-INVASIVE VENTILATION (NIV) has not yet received the recognition that studies unanimously agree is its due. New critical care ventilators and more comfortable masks are contributing to its increased acceptance.

IT’S A HORRIFYING prognosis: chronic obstructive pulmonary disease (COPD) will be the third most frequent cause of death worldwide by the year 2030. The World Health Organization (WHO) is forecasting the extraordinary increase in occurrences of this complex syndrome. This development makes it necessary to reassess the ventilation therapies used to date, as was recently done in Germany in the clinical practice guideline “Non-Invasive Mechanical Ventilation as Treatment of Acute Respiratory Failure” (edited by Dt. Gesellschaft für Pneumologie und Beatmungsmedizin e.V.). The objective of the guideline is to extend and establish the use of NIV in cases where acute medical indications are present. This will be to the benefit of a large number of patients, as Prof. Ralf Kuhlen, Chief Physician at the Clinic for Intensive Medicine at the Helios Klinikum in the Buch district of Berlin, explains. Kuhlen was substantially responsible for the formulation of the clinical practice guideline on non-invasive ventilation (see interview, p. 15).

Support and replace

According to the guideline, in many cases invasive ventilation is still unavoidably necessary as a life-saving measure. It is, however, associated with the risk of nosocomial infections, in particular the risk of ventilator-associated pneumonia and the consequent higher mortality and increased costs. It entails the risk of infection, since the trachea functions like an “expressway for germs.” It also requires measures to provide sedation and eliminate pain, and its long-term application leads to atrophy of the musculature and the need for slow weaning off the ventilator.

If a patient’s breathing has been adversely affected by pathophysiological changes, it may have to be artificially maintained. This requires the mechanical supply of oxygen and air and the removal of CO₂. In many cases sedation is also required. Equipment that can mechanically take over the function of the inspiratory muscles has therefore been developed. Modern ventilators such as the Evita XL offer a wide range of ventilation modes for optimal adjustment to the specific clinical situation—whether the ventilation is invasive or non-invasive.

A respirator for non-invasive ventilation was available for use in hospitals as early as 1928 in the form of the “iron lung,” which reproduced the breathing process by means of a cyclic sequence of underpressure (inhalation) and overpressure (exhalation) on the thorax. Ventilation by means of a mask is a new technology which has developed since the 1980s. Such techniques were initially utilized for chronic illnesses, but are increasingly being applied in acute cases as well. They were, however, initially unable to gain...
Mask ventilation complies with the most rigorous criteria for evidence-based medicine

> widespread acceptance due to technical reasons, including inadequate synchronization between the ventilator and the patient, which led to complications in this form of artificial ventilation.

Since then, the combination of improved masks and refined mechanical ventilation modes has continually expanded the area of application for mask ventilation, so that it is nowadays even being used in emergency care and neonatal intensive care units. Non-invasive ventilation (NIV) causes much less serious complications than invasive ventilation. This result was obtained in a number of studies with clear statistical significance in the area of intensive care, which showed a significantly lower mortality rate for ventilation using masks as compared to the figure for intubation (e.g. Brochard, Mancebo, and Wysocki et al., 1995). Nonetheless, adds Kuhlen, the use of NIV in acute medicine “remains inadequate” despite a body of favorable evidence-based data.

Costs halved

Purposefully and correctly applied, NIV can “significantly” shorten the time taken to wean patients off a ventilator. In 2003, Ferrer et al. confirmed the general shorter average duration of stays both in intensive care units and at hospitals in their randomized study “Non-invasive Ventilation during Persistent Wean- tilation. This result was obtained in a number of studies with clear statistical significance in the area of intensive care, which showed a significantly lower mortality rate for ventilation using masks as compared to the figure for intubation (e.g. Brochard, Mancebo, and Wysocki et al., 1995). Nonetheless, adds Kuhlen, the use of NIV in acute medicine “remains inadequate” despite a body of favorable evidence-based data.

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NIV shortens the average length of stays and thus cuts case costs significantly

> of 25,000 euros, whereas non-invasive ventilation more than halves such costs to 10,100 euros. Further studies have revealed that, to date, the masks used have often been considered a limiting factor for NIV. On the one hand, masks must be comfortable to wear and may not cause lesions—i.e. skin irritations; on the other, they must not permit anything more than minor leakage that can then be fully compensated for by the respiratory. The new NIV ClassicStar and NovaStar full-face masks provide substantial improvements in these areas. Another focus is on mini-

cizing the dead space of the mask. The NovaStar is the first full-face mask in hospital and institutional use to utilize an extremely soft gel-filled cushion, which provides an extremely good anatomical fit and combines a high level of both comfort and functionality. “We really like the gel cushion and the flexibility of the mask,” commented two physiotherapists after an exhaustive application test in a department of the Karolinska University Hospital in Solna, Sweden at the beginning of 2008. What’s more, the masks are “very easy” to use. In cases where artificial feeding is used, the nasogastric tube is covered by the gel cushion (NovaStar), or led to the patient via an opening (ClassicStar). Unlike conventional solutions, significant leakage and skin irritations can be avoided. Both masks cover the mouth and nose.

Accessories extend the range

A wide range of easy-to-fit accessories extends the range of applications. Components include both humidification filters and barrel filters to protect against viral and bacterial infection. The masks with their respective filters and breathing circuits have, of course, been validated as complete systems. In total, the properties of current developments in mask technology contribute fundamentally to increasing the acceptance of NIV among both patients and care personnel—and so promote the increased application of mask ventilation.

**Milestones: the road to patient-oriented ventilation**

1771 Discovery of oxygen as a component of air: Carl Wilhelm Scheele and later Joseph Priestley (1775)
1775 Respiration serves to provide oxygen: Antoine Lavoisier
1775 Manual ventilation method: Henry R. Silvester
1776 Negative pressure ventilation—the Spiphonne at the Paris World’s Fair of 1878: Julius Bernstein
1778 Henry R. Silvester
1780 May 4: Priestley (1775)
1791 James Watt
1794 Max Billard
1795 Demeyer—portable devices for artificial respiration in a foot-driven curiosae: Rudolf Eisenmenger
1804 Pressure difference method using a negative pressure chamber: Feodor Sauerbruch
1806 Positive pressure machine (Brauer-Dräger®): Ludolph Brauer
1807 Time-controlled alternating pressure ventilation: (Dräger Pulmot®; prototype): Heinrich Dräger
1808/09 Pressure-controlled alternating pressure ventilation—dual-tube system: (Dräger Pulmot® series production): Helmhard Dräger and Hans Schröder
1828 Tank respirator, so-called “iron lung”—intermittent negative pressure ventilation for the treatment of gas poisoning: Philip Drinker and Louis Agassiz Shaw
1904 Production of the “iron lung” by the Deutsche Werft, Hamburg—the topology tube from a destroyer (pressure chamber), bellows from a field smithy (drive), part of a fishing cutter (gearbox): Axel Düntz and Rochard Aschenbrenner
1904 Parallel development of the iron lung at Dräger (proto-type)/Model E 62—series production (1906)
1905 Controlled and assisted ventilation: time-controlled, constant-volume—with humidification and warming of the breathing gas: Dräger Spiram®
1905 Assisted ventilation: pressure-controlled, patient triggered: Dräger Assist®
1904/45 Volume-controlled ventilation and integrated ventilation monitoring: Dräger EVA
1947/49 Positive-pressure ventilation: time-controlled, constant-volume—i.e. skin irritations; on the other, they must not permit anything more than minor leakage that can then be fully compensated for by the respirator. The new NIV ClassicStar and NovaStar full-face masks provide substantial improvements in these areas. Another focus is on mini-

1952 ‘Bag ventilation’: manual ventilation by means of a to-and-fro system: 200 patients ventilated by 1,500 students in Copenhagen
1955 Introduction of patient-adapted ventilation: optimization of the spontaneous breathing support with BFAP: Dräger Evita® series
2005 Reduction of ventilation time by automated weaning off the respirator using the knowledge-based SmartCare system Dräger Evita XL.

What was previously the limiting factor preventing greater use of NIV?

Kuhlen: Many studies have shown the advantage of NIV, but this knowledge has not yet taken hold in day-to-day hospital practice. NIV also requires a different kind of patient management. Patients who are awake require more attention from medical and care personnel in the initial phase—that of adaptation of the NIV. However, this increased ef-fort at the beginning is compensated for by the corresponding reduction in the care needed as treatment progresses. The total effort required by the two methods of treat-ment—invasive and non-invasive ventilation—is about equal. However, all studies of NIV in cases of hypercapnic respiratory insufficiency indicate that fewer patients require intubation and that the survival rate connected with the ventilation episode is better. Why do you see applications of NIV developing in the future?

Kuhlen: The demographic development in many industrialized countries will mean that we have to face an increase in the number of patients with advanced stages of chronic obstructive pulmonary diseases (COPD). Good data supports the observation that many patients in this group profit from NIV and also experience an improved quality of life when the process is used outside the hospital environment.

Where do you see a remaining need for improvement in mask ventilation?

Kuhlen: A couple of points occur to me as a specialist in this area. But the most important improvement as far as the patients are concerned will be the significantly in-creased consideration of NIV when adequate indications are present in the everyday hospital environment. The primary objectives of the Clinical Practice Guideline are to spread knowledge of the value of the procedure for these indications.

**Focus**

14

**ARTIFICIAL VENTILATION**

15
Rescue from the Air

Air rescue operation profiles in Europe and the U.S. increasingly require the use of a compact ventilator with clinical capabilities. Air Evac, an air medical service company based in Missouri, will also soon be utilizing the Dräger Oxylog 3000 for EMERGENCY TRANSPORT VENTILATION.

ALTHOUGH THE QUICK FLIGHT to the scene of an accident is still an important element of an air medical rescue operator’s repertoire, changes in the hospital landscape have led to a shift of emphasis. Helicopters are increasingly being used to transfer patients from one clinic to another. Prior to these changes, simple ventilators were sufficient to ensure controlled breathing during transport. Now, however, the increasing demands are requiring the use of ventilators that meet critical-care performance criteria.

The general technical demands of the task haven’t changed, however—small installation spaces, strict adherence to the tight restrictions on helicopter payloads, and resistance to vibrations are still essentials.

Helicopters save lives

Air rescue has a long tradition. Back in 1966, the U.S. National Academy of Sciences published a White Book on Death and Invalidity that criticized the lack of coordinated action with regard to the rescue of injured individuals, thereby laying the foundation for the creation of an organized civil rescue service in the U.S. Then, in 1972, the first civil rescue med-

ABSTRACT Structural changes in healthcare systems are creating new challenges for air rescue services in Europe and the U.S. Cutbacks in treatment capacity in rural areas are leading to an increased need for patient transfer services, and the strategy for providing air rescue coverage has been adapted to meet the new demands. Rescue helicopters are no longer utilized solely for primary-care operations but are also increasingly being used for the provision of inter-hospital transfers.

This Air Evac Lifeteam helicopter has landed safely; the patient can now be transferred to an ambulance.
Ventilation is the key to air rescue operations

The German Air Rescue Service (DFR) also ventilates its patients in helicopters with the Dräger Oxylog 3000. “There were two important reasons for us to switch over to this unit,” says DFR medical director Dr. Jörg Braun. “Firstly, the previous distinction between primary-care and clinic-transfer helicopters is no longer present. Nearly all of our helicopters are now in dual use: they are employed for both acute emergency rescues and inter-hospital transfers. The Oxylog 3000 is a compact emergency ventilator that is equally suitable for both applications, and it can be used to ventilate 99 percent of all patients.” The device thus offers advantages in direct rescue situations just as it does in critical-care transfer operations.

Rescue helicopters generally first serve to transport emergency physicians onsite. The patients receive medical treatment there, and, if necessary, the helicopter subsequently acts as an ambulance aircraft, moving patients to the hospital most suited to their needs. “Non-invasive mask ventilation is an interesting option,” says Braun. “Whether the situation involves COPD or asthma, skilled personnel can often use it to avoid intubation.”

Air Evac rescues in rural areas

The development of Germany’s hospital landscape is similar to what has happened in the U.S., where, according to a 2006 study conducted by the Foundation for Air-Medical Research and Education (FARE), “…the closure of rural hospitals because of reimbursement and other financial pressures, or their conversion to Critical Access Hospitals (CAHs) with reduced services and fewer specialist physicians, has created large geographical gaps in the availability of specialized surgical resources. Unfortunately, these rural areas are also the location of the most serious car crashes and are where 60% of fatal crashes in the U.S. occur, a rate nearly...
Regular civil air rescue operations began in the 1970s

> double that of similar accidents in suburban or urban areas. Medical rescue helicopters can help here by filling these gaps in coverage and improving access to special clinics.

Air Evac Lifeteam specializes in helping to close such rural bottlenecks—and with 78 air rescue bases, it’s the number two air rescue service in the U.S. The company operates in 12 U.S. states and is the market leader in nine.

Air Evac Lifeteam’s commitment to rural America has generated a lot of public support for the organization, which now has more than 600,000 paying members. It operates 100 Bell 206 Long Ranger helicopters and has selected the Dräger Oxylog 3000 as its future ventilator. Air Evac Lifeteam’s entire active helicopter fleet will soon be outfitted with the Dräger Oxylog 3000.

“We’re the largest independent air rescue service in the United States,” says Julie Heavrin, director of Public Relations at Air Evac Lifeteam in West Plains, Missouri.

“Independent” in this case means that Air Evac is solely responsible for the helicopters themselves, as well as for their equipment, the pilots who fly them, and the paramedics who man them. Unlike their German counterparts, U.S. air medical rescue helicopters generally fly with specially trained paramedics rather than physicians.

Advanced treatment methods

“A total of 70 percent of our trips are between hospitals,” says Air Evac’s safety expert, Tom Baldwin. “It’s exactly in such situations that the Oxylog 3000 offers us options that our current units can’t provide.” Even intubation can be carried out by extremely well-trained personnel, even if they’re not doctors.

“Intubation is actually very common in both rural ground rescue operations and in the air,” Baldwin reports, correcting an erroneous European preconception regarding the standard of care in this area in the U.S. “Air rescue services typically employ advanced treatment strategies such as the fast-acting short anesthesia Rapid Sequence Induction.”

One strategy doesn’t automatically exclude the other, however. After all, short anesthesia and intubation harbor risks that can be avoided through non-invasive mask ventilation in certain cases.

“The medical aspect of air rescue missions focuses strongly on airway management—in other words, strategies for ensuring that air passages remain open,” says Baldwin. “The fact that our crews will now have a non-invasive option for keeping patients breathing without having to resort to intubation will provide our patients with a big safety benefit.”

Baldwin’s conclusion is that Dräger was ultimately selected to provide the required ventilation unit because of the “combination of differentiated ventilation options, robustness, and the positive customer feedback we’ve heard regarding the Oxylog 3000.”

Mario Gongolsky

Further information online, including:

- Product information
- Trainer software

www.draeger.com/96/Emergency
Vital Signs through the Airwaves

The Infinity M300 patient-worn monitor securely and reliably transmits vital parameters of patients on the move via WLAN connections, giving them freedom of movement that can help accelerate recovery.

PARENTS take care of their children when they are young, and often children have to take care of parents once the latter reach old age. In between, doctors and other care givers help them both. Each of these life stages requires a balance between health monitoring and freedom of action. An imbalance here can be dangerous—even a matter of life and death. In such a situation, freedom of movement can work wonders—and a new small device is now doing just that by giving back some of the joy of living to patients with heart trouble, while at the same time monitoring their most vital parameters.

Inside Schröder, a nurse at the Bad Wildungen Hospital in Germany, is one of the country’s first healthcare professionals to have used the Infinity M300 mobile patient monitor. “At first we were skeptical, as we usually are with new things,” Schröder says. “We actually thought it was going to make life more difficult.”

Vital parameters and positioning

However, it’s the device’s many positive features that have been attracting her attention since it went into service in June 2008. “It enables patients to be just as mobile as they were before—and sometimes even more so,” she reports. As a result, patients can now leave their beds, unless otherwise instructed by their doctor. During the entire time, they are continuously monitored by the Infinity M300, which weighs only around 280 grams and is carried in a small case worn around the patient’s neck. The device even comes with a special bag for use in the shower. The Infinity M300 has a color display that shows real-time data on the patient’s condition. It’s also equipped with a wireless connection that continuously sends the information to the Infinity Central Station at the nurses’ monitoring station. Such supervised mobility boosts patients’ self-confidence, which in turn can speed up the recovery process and potentially shorten their hospital stay.

The Infinity M300 stands apart from equipment produced by other medical device manufacturers. For one thing, the Infinity M300 has built into it the algorithms necessary for recognizing irregular heartbeat beats and values outside specific limits. That means the device functions even without the wireless connection to the Infinity Central Station at the nurses’ station. The color screens of the Infinity M300 display patient data, which enables accurate identification of the wearer and helps ensure that he or she will be given the proper medication.

But the real secret behind the Infinity M300 is invisible: the device connects on to the hospital’s computer network via wireless, in the same way a laptop connects to a private network. This eliminates the need to install additional proprietary network components or antennas, which not only shortens installation time but also streamlines network management.

According to Detlev Froebel, a specialist for network solutions in Dräger’s Marketing Department, the use of conventional WLAN data infrastructure can lead to substantial savings. Numerous successfully implemented Infinity OneNet projects (Dräger’s name for the open, multi-service data infrastructure also used for monitoring) have shown that along with the infrastructure cost savings achieved, this approach also results in much greater flexibility and a holistic approach to security. If hospital policies allow it, Infinity OneNet also enables patients to use the network infrastructure to surf the Web. Because of multilevel security, medical data is kept completely isolated from all other information flows, says Froebel. This network infrastructure can also accommodate other uses such as patient location.

WLAN technology is already well established and reasonably priced, so it’s a relatively simple matter for hospitals to set up wireless networks that also function outdoors. Having done this, Bad Wildungen Hospital now has four patients who can move about freely within a predefined area. “It was unusual for us in the beginning,” says Schröder, who had no prior experience with cardiac telemetry monitoring. There were several incidents in which patients accidentally left the wireless network’s transmission area. Fortunately, the Infinity M300 sounds an alarm when that happens—and this alarm is triggered on both the device itself and at the central monitoring station. However, the Infinity M300 continues uninterrupted monitoring and analysis of vital parameters.

Continual monitoring advantages

Prior to going into the market in September 2008, the Infinity M300 also proved itself at the Avera Heart Hospital in Sioux Falls, South Dakota, USA. More than 60 devices have been transmitting patients’ vital signs to a monitoring center at the hospital since June. The hospital’s old telemetry system was shut down when the Infinity M300 was put into operation, says the hospital’s biomedical technician, Jim Hitchcock, who is also happy about the color display of the new Dräger patient-worn monitor. “One of the first signs of a patient problem is often a declining SpO2 value,” says Hitchcock, “and if a clinician can see a patient’s arterial oxygen saturation along with the ECG waveform, the clinician can save valuable time.”

Hitchcock also appreciates the lithium batteries that are recharged every night at a bedside charger next to the patient’s bed. “You no longer have to change batteries like with the old devices,” he says. This saves the staff a lot of time—and the hospital a lot of money. Because the Infinity M300 can be installed relatively quickly, many non-cardiac departments are interested in the portable monitors as well. “The Infinity M300 is ideal for the intermediate level between intensive care and normal wards because it doesn’t require monitors to be installed at beds in order to keep track of potentially unstable patients,” Froebel explains. “Thus it appears that many different kinds of patients will soon be benefiting from these new ‘little hours of freedom.’”

Hanno Charisius
New Networks for Anesthesia

In anesthesia, decisions have to be made quickly and efficiently. **MODERN MEDICAL TECHNOLOGY** can now bring together all the data that is generated before, during, and after surgery onto a single platform. This benefits both the patients and the doctors.

Several observations prompted Wim Amelinckx to tear down the informal fences in the A.Z. Nikolaas hospital back in 2005. At the time, he was working—as he does today—as a head anesthesiologist in one of the largest hospitals in the Flanders region of Belgium, where he and 22 colleagues look after around 35,000 anesthesia patients a year. On this scale, anesthesia is usually performed according to a number of clearly defined routines. And yet, Amelinckx discovered, there were still many problems—too many, in fact—in his area of responsibility.

For example, the treating physicians spent a lot of time filling out the treatment protocols over and over again from scratch, and always on paper. Moreover, the handwritten instructions for the nursing staff had been known to cause misunderstandings during the patients’ aftercare. Ultimately, the paper-based process regularly destroyed valuable information, because patients’ folders would disappear into the archives and were difficult to find again. “We simply had to do something at the time,” recalls Amelinckx. “That’s why, with Dräger’s help, we started integrating operating room technology into the world of information technology.”

In the office domain, information technology (IT) has long proven its integrative strength. Whereas telephones, typewriters, and notebooks used to lead existences independent of one another, now one piece of hardware that is small enough to fit into a pants pocket is all that’s needed to combine the digital tools required for everyday living and working. Software has also unshackled itself from inflexible ties to individual hard drives and instead migrated to the network.

**ABSTRACT** Information technology is an important tool for integrating complex processes and at the same time enabling the seamless central storage of all data and documents. What is already standard in the office world is now making inroads into the operating room. Initial practical experience confirms the practicability, efficiency, and reliability of professionally implemented systems.
The integration of IT in the OR frees up more time for patients

Information and its visualization support rapid and sound decision-making

> work. Texts, images, and corporate data are now downloaded from central servers, which are cheap to maintain and are available 24 hours a day. The hospital staff members’ access to information is therefore boundless.

All on one screen
In the area of anesthesia, such scenarios remain a pipe dream. However, the integration of information is progressing here too. The integration concept that Dräger is pursuing takes the form of a new system which comprises several modules that will improve the treatment of patients, increase efficiency within the hospital, and make the work of doctors and the nursing staff easier.

But freedom from time-consuming routine work is only the first milestone in the process. “With Innovian, our clinical information system,” says Georg Trott, Product Manager Information Technology at Dräger, “information is now presented in a way that enables doctors to make sound clinical decisions quickly.”

To turn this vision into reality, the provider must offer its customers a complete and harmonized product portfolio that is based on three pillars: a standardized product design, cross-departmental networking, and hospital-specific applications.

The biggest advances are currently visible in the design. The Zeus anesthesia system, for example, combines the technology for treating and monitoring patients in a single device and is also equipped with an Ethernet connection, which provides the link-up to the hospital network. The Medical Cockpit, which doctors can use to access patient data as well as monitor and alter treatment, is also markedly increasing the number of functions it encompasses. A 20-inch monitor, for example, now facilitates the clear display of the patient’s vital signs and radiological images on a single screen, which can be operated with just a fingertip. The user guidance system is based on an intuitive concept, while the color layout of the interface and the visual and audible alarm signals are standardized across all of the new system’s modules.

“Complex technology is becoming simpler as a result,” says Georg Trott. “The error rate is falling, while the amount of work required for training is significantly reduced.”

Wireless data
However, the harmonization of inputs and outputs is only half the battle on the way to achieving the ultimate goal. This is because data changes into useful information primarily in situations where it can be called up at any site or location, processed automatically, and combined with other data to create practical decision-making tools. Essential for these processes are software programs that harness the myriad possibilities of a modern hospital network and seamlessly map clinical processes.

Sometimes these processes can be fed directly into highly specialized hardware. One good example is the Dräger patient monitor with Pick and Go technology, which stays with the patient constantly and provides continuous monitoring of his or her progress, hospital admission to discharge. The documentation of data takes place automatically in the background, as does the switch from wired to wireless data transmission when the patient leaves his or her room. The monitor therefore remains constantly linked to the central server, which nurses, care assistants, and doctors at other points of the hospital can access as needed.

Amelinckx has also automated many processes with the help of IT. For example, he has set up the network and applications so that an anesthesia patient’s blood results and X-rays are immediately available on every PC in the hospital. He has also developed standardized forms into which important patient data flows automatically. This data can then be supplemented with new data directly and digitally on the monitor. It is also possible to insert recurring aftercare treatments as a fixed text module.

Amelinckx has also standardized the storage of data: it now moves together with the patient’s electronic folder into the hospital archive. Work in the operating room has also become much less stressful. “We now have more time for our patients,” says Amelinckx with satisfaction. What about his colleagues’ initial skepticism, Amelinckx is asked. “We won them over in just a few months,” he recalls. “Now, IT in the operating room is accepted by them 100 percent.”

Frank Grünberg

Modular system
Dräger is taking a holistic approach to acute patient care, which ranges from emergency medicine and the OR to critical care medicine and neonatology. In close collaboration with experts from leading European, Asian, and American hospitals, the most important demands on the medical workstations of the future in a process-driven hospital environment were determined. The aim of this process was to shorten training times, avoid errors, and present all patient data so that the treating physicians can make even more effective clinical decisions. Implementing this vision requires the number of different user interfaces to be reduced and data to be more transparent, more consistent, and more closely integrated.

Frank Grünberg
Searching for the Standards of Tomorrow

Dräger’s TestCenter in Lübeck is more than just the ultimate product reliability center. That’s because it develops innovative, reliable, and efficient testing methods that also influence international standards. A tour with TestCenter manager DR. UDO FELDHOFF

IT’S THE LITTLE THINGS, TOO.

Dr. Udo Feldhoff unscrews a metal cylinder: “We test O-rings for anesthesia devices in here. We let them age artificially at temperatures of up to 70 degrees Celsius in a solution with conventional anesthetics.” And this is just one of more than a dozen stations in the Dräger TestCenter, in which all of the company’s products undergo thorough testing. The staff—half of them chemists, mostly female; the other half physicists, mostly male—works here as a team.

“We offer solutions,” says Feldhoff, explaining the TestCenter’s purpose. “If a product doesn’t pass our tests successfully, we make appropriate suggestions for improvement.”

In view of its rigorous approach, the TestCenter has gained recognition and even popularity, not just at the headquarters in Lübeck but also in the subsidiaries, where the team’s concentrated expertise is also highly esteemed.

The heart of the TestCenter is surrounded by offices, which are in turn enclosed by laboratories containing testing equipment. Only on a few of the testing rigs are the functions quite as visible as those that measure mechanical resistance through tensile force or shaking.

“We have programmed the vibrating table, for example,” says Feldhoff, “for road transport, so that we can use this ‘shaker’ to drive virtually over the roughest potholes in the roads between one end of Germany and the other.”

Testing at Dräger means not just ensuring the obligatory adherence to international standards but also safeguarding the product’s suitability for use in day-to-day operation. This is one of the founding principles of product development at Dräger. The TestCenter supports this development at every stage of the process.

New area of biocompatibility

The TestCenter does more than just testing, however. It also carries out research—partly in collaboration with universities, hospitals, and other companies. Research is carried out, for example, on methods that allow the adherence to formulas for raw materials such as plastics to be checked inexpensively and reliably. There is also thermogravimetry—an analytical method in which a sample’s changes in mass are logged and evaluated over a defined range of temperatures.

This testing expertise, which builds on newly developed processes and comprehensive databases as well as their mutual linking according to recognized methods, continues to surprise even the suppliers themselves. The TestCenter invests up to "searching for the standards of tomorrow" 28 DRÄGER REVIEW 96.1 | NOVEMBER 2008 DRÄGER REVIEW 96.1 | NOVEMBER 2008 29
the testCenter team led by Dr. Udo Feldhoff is more than just a group of inspectors. Rather, they see themselves as problem solvers providing a service extensive testing for maximum reliability and safety in everyday use.

A fifth of its budget in research and innovation.

The testCenter is also breaking new ground in terms of biocompatibility. “We’re developing methods that allow us to keep the impact of materials on the human body at a negligible level,” says Dr. Feldhoff, pointing to an incubator to illustrate how the researchers measure the outgassing of the plastics used in it. “Since there are currently few threshold values for babies in this regard, for example, we need to set our own values and have them verified and defined by international studies,” he explains. In this case, the testing revealed just 1.0 percent of the occupational exposure limit (OEL) for adults in the workplace.

These are findings that the testCenter is also contributing to international standards committees. This is one of the roles, for example, held by Corinna Brieske, who was initially trained in the testCenter as a laboratory assistant and continued there in a work-study program during her studies for her diploma in technical chemistry. “At the moment I’m working in international standards committees on methods to safeguard biocompatibility,” she reports.

Brieske is certain that the methods being developed in Lübeck will in the future become the basis of future international standards—which will then also satisfy higher ethical standards.

A few glass doors further along, Gerd Matzke is also working on the standards of tomorrow: “In collaboration with one of the most renowned hospitals in Germany and other experts, we are currently working on a concept for networking hospitals by means of wireless communications that will not interfere with medical equipment.”

For the required studies, the testCenter can rely on climate-controlled and acoustic chambers and on what is probably the most impressive of the facility’s rooms, the completely shielded EMC chamber. Among other things, the electromagnetic compatibility of equipment is tested here. “With its impressive height of six meters, this chamber has already been christened the ‘cathedral,’” says Dr. Feldhoff, rounding off the tour through the laboratory stations, where there is still plenty more to see. The testing facilities range from anesthesia devices with an artificial lung which is used to develop soda lime that leaves no residues in respiratory air, to a battery of mass spectrometers for the automatic and precise determination of ingredients.

The benefits of the testCenter can of course be documented in economic terms by taking into account factors such as the faster access to international markets that results from having the various certifications.

The testCenter’s true value, however, lies in the employees’ expertise: in their training, their team skills, and the creativity with which they distill theory and practice into a constant supply of new solutions. All of the employees successfully face up to the hardest test every single day: ensuring the reliability and safety of all Dräger products.

Nils Schiffhauer
The Hospital of the Future

The MINDEN CLINIC prepared itself for a new era in health care with a radical overhaul. Fundamental process changes and optimized architecture combine the efficient use of resources with a higher feel-good factor for patients.

IF YOU APPROACH Minden Clinic from the edge of town, skirting the fields, you’ll be amazed by its size. The complex is 300 meters long and is built on a plot of land the size of three soccer fields. In other words, it’s much bigger than a traditional hospital. However, the buildings are only three floors at most; clinics covering so much ground are seldom this low. But the novelty doesn’t end there: Another unusual feature is the separate patient and visitor entrances, which help ensure the privacy of patients. The traditional patient admissions area in the foyer is also missing. Further exploration of the clinic reveals many things that are not known in other hospitals—at least not yet.

A clinic reconsidered

Minden dared to do something that most hospitals would never do—build an entire clinic on a greenfield site (quite literally) and combine it with a complete change of internal organization and processes.

The aim was to improve and speed up treatments and increase both cost efficiency and patient comfort. The building work cost 210 million euros and the clinic has been in operation since March 2008. Other companies are more likely to attach their new developments to old buildings and therefore miss possible opportunities to optimize processes.

With regard to this conservative behavior Peter Lohfert, the clinic adviser at Minden, says, “Clinic builders often engage an architect quickly without going to the trouble of restructuring the organization. This is because most clinical workers are afraid of new organizational changes and the political co-financers want to see fast results.” Basic reorganization requires time for a long planning phase and the time-consuming implementation of the new processes.

However, this is essentially what the future will look like. After all, without such changes many hospitals would have to close for financial reasons. “Without reform, 30 percent of clinics will not survive the structural changes currently taking place in the health care industry,” says Lohfert.

Minden has taken this approach on board, even though it is initially more difficult, and in doing so has awakened interest both in Germany and abroad. Hospital operators and investors who are also planning new developments and require information make regular pilgrimages to the clinic—there has even been a visit from as far away as Saudi Arabia. After all, only a few new hospitals actually provide full service health care.

As with many other institutions, planners were faced with the choice of modernizing their century-old building on two sites or daring to contemplate “something completely new.” The introduction of flat-rate payments in the healthcare system clinched the decision for something new.

With the new scheme, patients no longer pay per night but rather a flat rate fee depending on their individual case. It would be expensive if patients were to stay longer in hospital and involve many departments, those responsible completely redesigned the hospital. In particular, they combined the construction...

The future of the hospital is reflected in Minden.
Building a new clinic also means rethinking processes and organization

of the new complex with a reorganization of the processes.

“A key element here was the centralization and grouping of tasks in order to avoid the repetition of work and so keep the costs as low as possible,” says PD Dr. Christian Schmidt, medical representative on the Board of Directors of the Minden Clinic association, to which the Minden Clinic belongs. Architectural changes help speed up the work of the staff by making their paths around the building shorter. At the same time they increase the patients’ comfort. Finally, moving to electronic patient files, including x-ray images, helps to reduce paper usage.

“Previously, four folders per patient were not unusual,” recalls Schmidt.

Centralization creates space

These guiding principles for new construction are being implemented in many places. What is most radical here is the interdisciplinary arrangement of the hospital. The individual departments no longer have their own operating rooms (ORs) and separate wards. Instead, 17 of the 21 ORs are located in a central part of the building and are used by multiple departments. This helps utilize the individual length of care for each patient required—from intensive care through to general nursing for multi-night stays. In contrast to the previous situation, patients with different medical conditions can now share the same room. For example, a rheumatism patient could be together with a cardiac patient. This leads to better utilization of beds and, as hospital stays are shorter, only 864 beds are required instead of 1071.

Of course patient comfort has also been considered. The majority of patients have a double occupancy room with a bathroom and floor-to-ceiling windows overlooking the countryside. According to a British study, this aids their recovery.

Fewer painkillers are required and hospital stays are shorter. These developments demonstrated that higher process efficiency can be combined with improving the recovery process.

The new operational structure is supported by the architectural design. Having fewer floors speeds up processes, so less time is wasted waiting for elevators.

The number of elevators has been reduced to 21 (previously there were 36) and these are used much less than before, helping to reduce maintenance costs.

Additionally, staff members are relieved of time-consuming transport duties—laboratory samples and medications are transported in pneumatic tubes while laundry, food and other heavy items are distributed in small containers by fully automatic, battery powered transporters, mainly in the basement but also in the elevators. The separation of patients and visitors into two corridors avoids encounters between visitors and bed-ridden patients on their way to consultation, and also prevents emergency cases from crossing paths with outpatients or logistics traffic.

Architecture helps healing

The centralization was made even more attractive by the fact that, together with four other institutes, the Minden Clinic has been part of the Mülhenkreiskliniken association since 2006. For example, the central kitchen cooks for all five hospitals, a rheumatism patient could be together with a cardiac patient. This leads to better utilization of beds and, as hospital stays are shorter, only 864 beds are required instead of 1071.

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The number of elevators has been reduced to 21 (previously there were 36) and these are used much less than before, helping to reduce maintenance costs. Accordingly, professional staff have more time to concentrate on their core activities.
Precise Anesthetic: Vapor 2000

The Vapor 2000 is used to introduce precise amounts of an anesthetic agent into the fresh gas for the purposes of anesthesia. The anesthesia device delivers air or a mixture of oxygen and nitrous oxide to the Vapor 2000, where it is separated into two different gas flows. One of these gas flows is saturated with the anesthetic agent in the vaporizing chamber. The other flow is routed directly to the Vapor 2000’s outlet via a bypass. The final concentration of the anesthetic gas results from the mixing ratio of the two gas flows. The anesthetist enters the vaporizing chamber via a textile tube, which functions like a candle wick. The anesthetic agent enters the vaporizing chamber via a textile tube, which functions like a candle wick. The anesthetist uses the control dial to adjust the dosage cone to supply the exact quantity of fresh gas saturated with anesthetic agent. The mixing ratio of the two gas flows produces the desired concentration of anesthetic agent at the outlet—e.g. two percent Sevoflurane by volume. The saturation of the fresh gas with the anesthetic agent is dependent on the vapor pressure of the anesthetic agent and thus depends on the temperature. The higher the temperature of the Vapor 2000, the more the anesthetic agent will be taken up by the fresh gas. Therefore, a mechanical controller ensures a constant concentration of the anesthetic gas at an ambient temperature of 10 to 40 °Celsius. This controller is like a bimetallic thermometer and functions using the differing coefficients of expansion of different materials. The Vapor 2000’s pressure compensator eliminates pressure fluctuations during ventilation by the anesthesia device. If necessary the Vapor 2000 can be transported although it is filled with anesthetic agent. It has a capacity of 300 ml—50 ml greater than an anesthetic agent bottle. The first Dräger Vapor was developed in 1958.