Pandemic
Small bug, big worries
More than just a device

Dräger Anaesthesia Workstations

At Dräger, we develop complete anaesthesia workstations comprising anaesthesia devices, vaporizers, patient monitors and IT technology. We provide lifecycle solutions for accessories, consumables and technical service, promoting both patient safety and synergies across the workplace.

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Dräger. Technology for Life®
Approximately 100,000 new influenza viruses can be produced in one host cell, with explosive consequences. Read more starting on page 8.

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What Moves Us—Dräger Worldwide

Danny Sacco, Safety and Security Chief and Rescue Procedure Specialist, Pennsylvania / U.S.

“I’ve been working in the area of public safety for 43 years now. For my entire adult life, I’ve been involved with ways to protect and rescue human beings. It all started with an explosion in a coal mine when I was in the first grade. The explosion was so powerful that it shook all the windows of the school building. I’ll never forget that day, because that was the day I lost my father. In the beginning I didn’t even realize what a strong impact that had made on me.

Today I work in our regional hospital as the Director of Safety and Security—but that’s not all. I’m also the head of safety at the PA Task Force 1, a fast-response rescue team of the state of Pennsylvania, and a member of the Special Medical Response Team, which I co-founded 25 years ago. On these teams, I help make sure that we’re on the spot in complex emergency situations throughout the U.S.—whether it’s at Ground Zero or in the wake of Hurricane Katrina.

In particular, we’re experts when it comes to rescuing people who are trapped underground. To help locate them, we use tracking technology that enables us to “look into” mountains. And thanks to Dräger we always have air to breathe and gas-measuring instruments to detect hidden dangers. Today, we can do incredible things. And all the effort is certainly worthwhile. If you’ve drilled a very, very deep hole for days on end, and six or eight or nine people emerge from it alive—it’s hard to describe in words how good you feel.”
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Dr. Bettina Vadera, Medical Director, AMREF Flying Doctor Service, Nairobi / Kenya

"I came to Kenya for the first time when I was 18 — for six months of volunteer work at a mission station. I was trying to find out what I wanted to do with my life. Afterwards, I knew that I'd do something in the field of medicine, because it is needed all over the world. In the end, Nairobi has become my home. This is the base from which we operate the Flying Doctor Service. Our fleet consists of a number of short and middle range aircraft which I coordinate as the Medical Director. Depending on the distance, we also use jet aircraft — for example, when we repatriate patients who have become ill back to their home countries. This is good for our organization, AMREF Flying Doctor Service, because it enables us to finance our humanitarian missions. In a way, we're Robin Hoods of the air.

I was a flying doctor for seven years. You see a lot of the continent that way, not just the national parks. Our operational area extends to the East Africa Region, Ethiopia, the Congo, Somalia and the rest of the African Continent. There are many wonderful aspects of Africa that I have seen, but I have also witnessed the results of poverty and armed conflicts. Because this is the case, I'm sure we'll be needed for a very long time.

To support our work, we welcome guest medics as part of our Volunteer Physician Programme; Doctors who would like to spend their free time working as Flying Doctors (www.amref.org). Here we have anesthesiologists, intensive care physicians, and other specialists that would not be available in remote areas otherwise. And we have medical equipment that has to handle all sorts of challenges — for example, we always carry emergency ventilators with us, ranging from the Oxylog 1000 to the 3000. This equipment comes with us in the Cessna or it rattles through the bush in a Land Rover, but wherever it goes it has to function reliably. And Dräger always helps us if we have problems. We have never had them say, 'We'll take care of that in due time.' That would be a catastrophe."
A Rescue Tugboat for Special Deployments

A rescue tugboat for deployment in the North Sea is currently under construction at Peenewerft in Wolgast, Germany. The boat is scheduled to be launched in early 2011 and will replace the Oceanic, Germany’s only ocean-going salvage tug, which began operations in 1969. The boat, which will have a top speed of 19.5 knots (roughly 36 kilometers per hour), is being built by Arbeitsgemeinschaft Küstenschutz (Coastal Protection Working Group). It will be the first rescue tug in the world that is capable of operating under full gas protection to help damaged ships that are leaking toxic or explosive substances, for example.

In this case, an air supply system completely independent of the ambient air will be used to protect the entire crew inside the boat. Designed and built by Dräger, the fully autonomous system is able to provide sufficient protection against gas because it uses an air reservoir with no additional filtered air. Crew members can leave the safe interior of the boat via an airlock for outdoor deployments in chemical protective suits. Retention systems protect the airlock to minimize the risk of hazardous substances entering the boat.

MEDICA 2009: Healthy Growth

Since its debut in 1969, the MEDICA trade fair held in Düsseldorf, Germany, has been the world’s leading trade fair for medical technology. There will be no decline this year from the excellent participation figures of recent years, either. “We are expecting more than 4,000 exhibitors, with roughly 700 of them participating for the first time,” says Wilhelm Niedergöker, Managing Director of Messe Düsseldorf GmbH, which hosts the fair.

Considering the more than 135,000 visitors last year, Niedergöker points out the broad international scope of the trade fair. “Around 40 percent of the visitors came from abroad,” he says. At the fair they will be able to take a comprehensive look at the industry, which is currently in a phase of great opportunity. On the one hand, MEDICA is presenting itself as a classic trade fair, featuring process-oriented methods for the diagnosis and therapy of various diseases and all of the necessary solutions. But MEDICA is also addressing important intersecting aspects such as medical imaging and the integrative function of information technology (IT).

“Health care is in many respects in great shape compared to some other industries,” says Niedergöker, and offers an explanation as to why that is the case in Germany. “The second recovery package has allocated 4.7 billion euros for the modernization of community infrastructure. More than a billion euros of that should go to the hospitals, and a recent study estimates that almost half of that amount will be invested in medical technology.”

MEDICA 2009 will be held in Düsseldorf from November 18 to 21. Dräger will be displaying its latest offerings at a stand covering 700 square meters in Hall 11/J39. The focus of its presentation will be on innovations and the virtual 3D planning of workstations.
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**Mobile Radio: Protective Distances Decrease Dramatically**

For a long time it was uncertain whether mobile radio devices could interfere with the electronics of hospital medical equipment. The present safety standard IEC60601-1-2 focuses on more distant transmission sources (radio, television or mobile radio transmission towers) and demands a preventive protective distance of up to 3.30 meters between the medical product and commercial mobile transmitters. This has led to a general ban on mobile telephones in many hospitals, but that could soon change. Dräger has developed a method for testing medical devices for their immunity against very close transmission sources. “Furthermore, our new test method is included in the draft of the planned standard for electromagnetic compatibility,” according to Gerd Matze and Jan Schommer, who led the effort at the Dräger TestCenter to develop the new method (see Dräger Review 97.1, p. 7). The new IEC standard is expected to be ratified in 2010 and implemented as national law by 2012.

The Dräger TestCenter began testing around 20 current Dräger medical devices according to this new method in spring 2009. “Depending on the mobile radio standard, such as GSM, UMTS, DECT, WLAN or Bluetooth, wireless communication devices can be taken to within seven centimeters (the limit required by the test conditions) of a medical device without any interference occurring. For only one device was this distance 80 centimeters,” said Matze in summarizing the results. That is a substantial reduction of the current limit of 3.30 meters and can open up new perspectives for wireless communication in hospitals. The results of the study, which indicate recommended protective distances based on the device and the mobile radio standard, will also be available to customers from fall 2009.

**Dräger: A Popular Employer too**

How popular is an employer? “trendence,” one of Europe’s leading personnel marketing institutes, asked this question in a survey of 200,000 students approaching graduation in 22 countries. “The trendence studies are very meaningful thanks to their large sample size and their validity,” says Sabina Ufferheide, International Employer Branding at Dräger.

According to the “trendence Graduate Barometer 2009,” Dräger placed 38th in Germany among engineering students. By way of comparison, the company ranks 226th in Germany in terms of sales (2008: 1.925 billion euros). In another trendence survey about the favorite employers among young professionals, Dräger placed in the top 50.

Dräger also scores well throughout Europe. The survey “Europe’s 500 Top Employers” places the company in the top third, although it is not among the 500 largest companies based on sales. Dräger has also been awarded the “Fair Company” seal of approval in Germany, which the Handelsblatt GmbH awards for the fair treatment of interns.
Fear is circling the globe faster than the virus itself. Pandemic—the word alone evokes a feeling of helplessness. However, rational analysis and careful preparation help to minimize risks.

“The world is now at the start of the 2009 influenza pandemic,” announced WHO Director General Margaret Chan in a statement to the press in Geneva, Switzerland, on June 11, 2009. “Further spreading is considered inevitable.” What had long been predicted has now come to pass, and many people have been vacillating between two opposing emotions ever since. On the one hand there is concern—to many the word “pandemic” implies a horrible plague. Constant references are made to the horrors of the Spanish flu of 1918, which virtually wiped out entire villages. Factories, schools, businesses, and government offices remained empty. Crops rotted in the fields and livestock starved in their stalls. Between 25 and 50 million people died worldwide.

On the other hand, many others are rubbing their eyes in disbelief—the “new flu” (Influenza A/H1N1) is mild in most cases and often requires no treatment at all. In light of these facts, many of the headlines are puzzling. Why are children with the new flu at a children’s hospital in Ravensburg, Germany, being treated by masked personnel in protective suits, and why are their entire families being placed under quarantine when the course of the illness is not much more than two days of diarrhea?

One reason for the confusion is that hardly anyone knows what the word “pandemic” actually means. Even the experts are not in total agreement.

Influenza A is classified into the subtypes 16 H and 9 N. A/H1N1 = “New Flu”
Race against the Virus

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An eight-member gene team

One reason for the confusion is that hardly anyone knows what the word “pandemic” actually means. Even the experts are not in total agreement. Jeffrey Taubenberger of the National Institutes of Health in the U.S. argues that the pandemic began 91 years ago. At that time a new type of virus that could also infect humans originated in birds. The Spanish flu pathogen established a virus dynasty that continues to exist today. According to Taubenberger, all Influenza A viruses that have adapted to humans are descendants of this one virus, including those responsible for pandemics as well as those responsible for the annual waves of flu.

One could essentially consider each virus to be a temporary team made up of eight gene segments. The members are constantly being replaced, so that each year the teams are made up of a new group of players. The genes are recruited from an enormous reservoir of infected birds, and thousands of variants have already been discovered. The pathogens of the seasonal flu resemble those from preceding years. A portion of the population is therefore immune, and it is primarily children and the elderly who become sick. Sometimes, however, viral evolution leaps forward and produces a new strain.

The current definition used by the WHO, whose pandemic alert system comprises six phases, was drafted on the basis of experiences with the avian flu in 2005. This new virus strain was not very contagious, but it was frequently deadly. According to the WHO, a pandemic exists when a new virus strain is spreading throughout the entire population in various regions throughout the world. In late May, however, WHO Assistant Director General Keiji Fukada announced that this definition would be changed. A primary criterion in the future will be that a pandemic represents a significant hazard potential for humans. “We are trying to walk a fine line between not causing panic and not being complacent,” says Fukada.

Is this a repeat of 1918?

Fukada described the core of the problem very succinctly. A new virus strain can be identified very quickly today using mathematical models support these measures, as do new methods of vaccine production. Protective measures in the workplace and at home can limit the risk of infection.

ABSTRACT The WHO considers the “new flu” (Influenza A/H1N1) to be a pandemic, a worldwide threat. Precautionary planning helps to counter panic. Mathematical models support these measures, as do new methods of vaccine production. Protective measures in the workplace and at home can limit the risk of infection.
molecular diagnostics, but how dangerous it actually is cannot be reliably determined until much later. Only after many people have become ill can anything be said about the mortality rate. The virus could undergo further mutation at any time. And the “new flu” could already be dangerous for countries with inadequate health systems.

Planning helps avoid panic

There are a number of reasons why it is unlikely that the catastrophe of 1918 will be repeated, however. At that time, hundreds of thousands of malnourished people were crowded together in cramped conditions and under great stress in battlefield trenches and troop transports. “Those are ideal conditions for propagating an influenza virus,” says Tim Brewer, who develops global health programs at McGill University in Montreal, Canada. Pre-existing conditions such as tuberculosis made many people back then particularly susceptible.

Many countries considered the disease a sign of weakness that had to be concealed from their wartime enemies. The pandemic became known as the “Spanish flu” because censorship of the press was less strict there and the King of Spain ultimately made his illness known to the public. Today international agreements allow the WHO to take a proactive role in many countries—either to gather information or to offer assistance. “There’s much better coordination on the global level to respond to these kinds of episodes, if we compare the situation in 2009 with the SARS outbreaks of 2003, let alone with 1918,” says Brewer. Of course there is also a world of difference between the current state of medicine and that at the time of the Spanish flu. Nothing was known about influenza viruses in 1918. The most commonly used remedies to combat the disease were bloodletting, quinine derivatives, opium, and whiskey. Today physicians have antiviral medicines, vaccines, antibiotics, and ventilators at their disposal. Yet the question remains: Will there be enough for everyone? The hospitals have prepared as best they can for a rush of patients. “We have prepared for the separate care of influenza patients and other patients,” reports Susanne Huggett, who is forging plans at the Asklepios hospitals in Hamburg in the event of a pandemic. “We have stockpiled medicines, protective clothing, and disinfectants.” It is particularly important to protect hospital staff against infection. “We’ve been conducting training classes since 2006,” says Huggett. “We want to avoid a panic by carefully explaining to our staff how they can protect themselves. Not even an FFP3 mask can help if you don’t put it on properly.”

A pandemic could result in the hospitals being faced with a large number of patients requiring artificial ventilation. The Deutsche Gesellschaft für Pneumologie (German Society for Pneumonology) has long warned that intensive care units would not have sufficient capacity to meet the demand for artificial ventilation. The pneumonologists recommend that the hospitals make preparations in advance of an epidemic.

Up to 100,000 new influenza viruses can be produced in one host cell.
emergency use of simple ventilators such as those used for the in-home ventilation of people suffering from chronic lung diseases.

The U.S. states have stockpiled ventilators since this warning was issued. The expected requirements must be taken into consideration when choosing the devices, however. The units must be as inexpensive as possible, of course. They must be simple to use in mass deployment, and they must also remain functional in the event of a loss of the gas or power supply. “At the same time, it must be very easy to set the machine for the ventilation of the pulmonary patients to avoid damaging the lungs,” explains Jan Evers, an intensive medicine product manager at Dräger. The Dräger device best meeting these requirements is the Savina, which supports invasive and non-invasive ventilation using ambient air. Even lighter and thus more mobile is the Carina non-invasive ventilator, which only offers limited monitoring, however. Another important consideration is that all gas-bearing parts can be replaced in order to avoid cross-infection.

Pandemics in the computer

To estimate the resources required in the event of a pandemic, scientists have been trying for years to simulate their probable course. “The critical factor here is the basic reproduction number \( r_0 \),” says Markus Schwehm. He developed the simulation program “InFluSim”—which is now available online—at the University of Tübingen and founded a consulting firm. The \( r_0 \) indicates how many people on average will be infected by one sick person. If the number is greater than one, the virus will continue to spread and the infection will get out of control. The Spanish flu had a \( r_0 \) of approximately 2.5. “Initial estimations of \( r_0 \) were at 1.5,” says Schwehm. The simulation suggests that in this case propagation can be stopped with relatively simple measures. According to Schwehm, these include hand hygiene and the general avoidance of contacts. The simulations have shown travel restrictions to have hardly any effects at all, since “there are far too many infections without symptoms.”

Schwehm has some doubts about the low \( r_0 \). “I believe that it is actually 2.5, at which value we have no chance to stop the propagation.” Just what course the pandemic will run also depends on another crucial factor that the pandemic researchers are carefully monitoring. How many of the infected persons develop any symptoms at all, and how many die? So far, Schwehm assumes that 75 percent of all people will eventually become infected with the “new flu.” Many won’t even notice anything, but will still be able to infect others. A quarter of the population would then get ill and exhibit serious symptoms; one in 200 persons would have to be hospitalized with complications, and 16 percent of these would probably die.

But it doesn’t have to be this way. According to a telephone survey conducted in late May, six percent of the residents of New York reported having flu-like symptoms in the past few weeks. If this >
is the new pandemic, it would mean that it is running a much milder course than expected. “That would be good news,” says Schwehm, “because it would mean that the pandemic is already well advanced and will soon come to a stop. But I need better data before I change this parameter.”

There is one thing that Schwehm has not yet considered in his simulations: the development of vaccines. “First they said that the pandemic would be over before the vaccine could be developed,” he says. But that could change if the course of the pandemic is slowed and the vaccine is developed quickly. The Centers for Disease Control (CDC) in Atlanta, Georgia, U.S.A., distributed seed viruses to vaccine manufacturers throughout the world in May. These are now being inoculated into chicken eggs, where the vaccine is produced. Vaccinations against the “new flu” are scheduled to begin in Europe and the USA in fall 2009.

Vaccine from cell cultures

In past years a lot of money was invested to expand production capacities and to develop faster methods. One major pharmaceutical manufacturer is now producing a portion of the vaccine in cell cultures rather than chicken eggs. The regulatory approval processes for vaccines produced in this way are still more time-consuming, but the technology could prove to be the wave of the future. Despite the tremendous effort, vaccine production would bump up against its limits in the event of a pandemic. Global capacity lies between one and two billion doses per year. The vaccine does not protect against the seasonal flu virus; it is therefore advisable to vaccinate against the seasonal flu as well, if available. The need for flu vaccinations would also increase if the new influenza virus were to mutate and become more dangerous.

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But the vaccination does not offer complete protection. It may well be that the “new virus” continues to be harm-
less and the seasonal flu is neglected in favor of the new vaccine. It is also possible that the virus will mutate, render-
ing the vaccine ineffective. The only way out of this dilemma is a universal influenza vaccine that is effective against
all strains of the virus. A group at Har-
vard Medical School reported an initial
breakthrough in animal trials in Febru-
ary 2009. The researchers produced an-
tibodies that attack a genetically stable
portion of the virus molecule.
The road from a breakthrough to a
universal vaccine is a long one, so in-
fluenza viruses will probably still be
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The mild course of the new pandemic
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ary progress. 

Further information online, including:
www.draeger.com/98/pandemic

Can you plan a pandemic?
HARTMUT SCHMIDT, Strategic Marketing
at Dräger, talks about the opportunities presented
by careful planning.

What does a manufacturer of medical technology have to do in
the event of an influenza pandemic?
We have to be in a position to react as quickly as possible. During the SARS
epidemic and at the beginning of the “new flu,” for example, we delivered large
numbers of ventilators and masks all over the world in the shortest time possible.

How are the needs of the customers changing?
A guaranteed ability to deliver needed equipment becomes increasingly
important during a pandemic. Today there is also a greater demand for robust
ventilators. If a major pandemic results in large numbers of patients
needing to be treated in other hospital wards because the intensive care
units are overfilled, there may not be an oxygen supply available, and
there may not even be a reliable power supply. In such situations we would
need ventilators that have an independent air supply and long-life
batteries for the treatment of seriously ill patients. The ventilators also
have to be easy to use, because in the event of an emergency they
may have to be operated by laypersons following a doctor’s instructions.

Where do you see the greatest problems?
In the event of a global pandemic, the challenges will tend to be of a
logistical nature rather than being due to a shortage of ventilators.
We may be able to withstand the first wave of a pandemic, but if the supplies
of medicines and protective equipment are used up and are not replenished
before a (possible) second wave hits, things could get tight.

The greatest danger is that the infrastructure could begin to partially
collapse. A quarter of the world’s population could be sick at the
peak of a pandemic. This means that 25 percent of the truck drivers,
ship captains, warehouse workers, etc. would not be available to work.
An average supermarket only has food stocks that would last for 24 to
48 hours. It is conceivable that the power and water supplies could
collapse. And in this environment we as a manufacturer would have to
retain our ability to supply products—worldwide.

How can we prepare for this eventuality?
First, companies and private individuals should take the various protective
measures to try to avoid infection as much as possible. Companies must review
their supply chains and configure these to make them as robust as possible.
This could mean having more than one supply channel, for example. Furthermore,
planning scenarios should be used to rehearse which decisions have to be
made in certain situations. Finally, you can’t really plan for a pandemic or any other
catastrophe. You therefore have to have predefined management staffs, i.e.
people who are trained and empowered to decide in the event of an emergency
what needs to be done in each specific situation.
Quantifying the Quality of Care

Healthcare is big business: it costs a lot of money. Critical care is the place where a lot of that money is spent. That’s why healthcare managers are scrutinizing that particular part of the business. As a result, hospital INTENSIVE CARE UNITS are being pressured to provide evidence of the quality of care they provide.

ACCORDING TO Dr. Tim Gould, an intensivist – a physician who specializes in the care and treatment of patients in intensive care – and consultant at the Bristol Royal Infirmary (BRI) in Bristol, England, “The government is starting to want to see value for money. Also, a lot of intensive care organizations in different countries now have to come up with quality outcome measures that can be used to quantify how good an intensive care unit is in terms of value. One measure is mortality, but the government also wants to see metrics regarding patient safety and quality of care.”

Long realizing the value of research, Dr. Gould wanted to be able to look at certain patient groups to see if various steps the ICU was taking – or not taking – had an effect on outcomes. He also realized that it’s virtually impossible to do that kind of research on paper.

Moving away from paper

The BRI installed Infinity Omega patient monitoring systems at every bed in the 16-bed General ICU and deployed the Innovian clinical information system from Dräger.

Innovian replaced the ICU’s manual charting, which consisted of a big A3 paper chart at the foot of every bed – one per day, per patient. If a patient had a four-week stay, the records were spread across 28 individual charts. Using that data for research was virtually impossible.

Now, Innovian automatically gathers data from bedside devices, including patient monitors, ventilators and fluid devices. “We’re documenting more data than ever before and we don’t have to worry about capturing that data,” says Dr. Gould. “The system automatically calculates patient scores to evaluate severity of illnesses.”

Comprehensive data capture

Eighteen months ago, Dr. Gould set up a critical care research group whose mission is to evaluate how the ICU complies with certain factors that have been set up as benchmarks of quality – such as specific care bundles for pneumonia patients.

“Although we do these things in our every day practice, we need to be able to prove that we do it,” says Dr. Gould. “Innovian’s database capability makes it very easy to generate reports describing our compliance with a particular treatment strategy. The data capture is incredibly comprehensive and efficient. You can look at groups of patients with different conditions and see how well you do against national averages. It’s a good way of confirming that the strategies, treatments and way we work here deliver good quality results.”

Supporting patient safety

Because prescribing of drugs can be a risk factor for patients in intensive care, Dr. Gould and his team have configured Innovian to include parameters of the drugs typically prescribed for ICU patients. By having a sophisticated prescribing system that contains a protection mechanism, the ICU can improve patient safety by reducing errors in transcription or drug dosages.

While Innovian was not designed to check drug interactions, Dr. Gould states, “The fact that Innovian lists the drugs in a pull-down menu format where they are written correctly with the appropriate dosage has improved the quality of our prescribing – compared with it being my handwriting on a paper form.”

Innovian is Web-based, so the staff can access the system from anywhere in the hospital – and even beyond. “If you’re on call from home in the middle of the night and need to look at something that’s not quite right with a patient, you can have

ABSTRACT Hospitals today are under increasing pressure to quantify the care they deliver. A visionary intensivist and critical care consultant in the UK is using Innovian, a clinical information system, as a springboard to create research that helps his ICU address quality, safety and costs.

“Although we do these things in our every day practice, we need to be able to prove that we do it,” says Dr. Gould. “Innovian’s database capability makes it very easy to generate reports describing our compliance with a particular treatment strategy. The data capture is incredibly comprehensive and efficient. You can look at groups of patients with different conditions and see how well you do against national averages. It’s a good way of confirming that the strategies, treatments and way we work here deliver good quality results.”

Supporting patient safety

Because prescribing of drugs can be a risk factor for patients in intensive care, Dr. Gould and his team have configured Innovian to include parameters of the drugs typically prescribed for ICU patients. By having a sophisticated prescribing system that contains a protection mechanism, the ICU can improve patient safety by reducing errors in transcription or drug dosages.

While Innovian was not designed to check drug interactions, Dr. Gould states, “The fact that Innovian lists the drugs in a pull-down menu format where they are written correctly with the appropriate dosage has improved the quality of our prescribing – compared with it being my handwriting on a paper form.”

Innovian is Web-based, so the staff can access the system from anywhere in the hospital – and even beyond. “If you’re on call from home in the middle of the night and need to look at something that’s not quite right with a patient, you can have
Innovative technology at the point of care

The dual-screen Infinity Omega solution combines an Infinity Delta vital signs monitor with a medical-grade workstation that brings networked information – such as clinical applications, lab values, and DICOM images – to the point of care. Innovian is a Web-based clinical information system that can gather data from bedside devices in critical care and perioperative care environments and document care-related activities. This allows the ICU to compare patient status by analyzing vital signs and lab values together with patient care activities that physicians and nurses provide.

Because Innovian is Web-based, data captured in the perioperative environment can also be accessed in the critical care area.

Learning from history

Dr. Gould believes that anyone who is running an intensive care unit has a responsibility to run as safe and as good a unit as possible. “Being able to look back at the activity in your unit using the database is very powerful because you have a very good description of what you’re doing day to day, week to week, month to month with patients and their outcomes. You can target specific disease groups and look at those in more detail.”

What’s the bottom line? “By ensuring that you have standardized, best-practice care for every patient, you will improve the overall quality of outcomes for patients. In addition, if you use a clinical information system to its full potential, it will allow you to improve the quality of care that you deliver to your patients,” explains Dr. Gould.

Kathie Peck

all the information on hand to help with decision making,” says Dr. Gould.

Innovian also makes archived data easily accessible to physicians. “In a ward round in the morning, I can look at an event that happened in the night which the senior registrar was concerned about,” says Dr. Gould. “Or if a patient has outstanding problems, I can look at the archives to see the patient’s medical history. Very comprehensive data is available to describe those kinds of episodes, so I can get a clear picture of what went on long after the event.”

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Kathie Peck
Commitment for the Long Term

Pre-Development at Dräger is an extensively networked high-level scientific thought factory where new TECHNOLOGIES ARE DEVELOPED AND EVALUATED, with a keen sense for the needs of future users.

Hot topic: A core temperature sensor, which is simply taped onto the skin.
DR. KAI KÜCK TAKES A BOOK

off the shelf and points to the cover image, which depicts what looks like a pattern chart, and asks us what we think it is. It’s a graphic visualization of a railroad schedule. Welcome to the world of the head of Pre-Development at Dräger, where a broad spectrum of innovations are born from the creative and often astonishing ideas of the team members.

About 40 scientists work here, many of them with doctorates. And about the same number are graduate students working on their advanced degrees: “We also place great importance on collaborating with renowned universities, institutes, and laboratories worldwide,” says Dr. Kück. But he also stresses that all of his colleagues bring with them their own networks, which they nurture not only by attending scientific congresses.

Pre-Development. It sounds like the kind of ivory tower where everyone pursues their particular interests. “Creative freedom is important,” asserts Kück, but he also emphasizes that this work at Dräger should be as goal-oriented as possible “even though there are instances when two apparent dead-end streets combine to form a superhighway.” He notes that failing is part of the innovation process: “One of my jobs is to recognize dead-ends as early as possible and to stop such projects promptly.”

Working at the interface

Concentrating on what is essential gives a sense of direction: “We can’t just develop perfect technical concepts—we’ve also got to substantially improve the way our customers can work with technology.” And the results must be supremely reliable, because Dräger always deals with the most important issue of all—human lives. With his training in the U.S., Kück is thoroughly proficient both in practice—especially as a result of his work in operating rooms—and in theory.

“Most of our activities,” he says, “take place at the interface between actual technology research and product development.” Pre-Development therefore precedes classic “research and development,” which is followed by prototypes, production, and market introduction. It’s a process that takes several years on average—sometimes more, sometimes less.

Few companies are still investing in this kind of department. “That’s the advantage of a family-owned business,” says Kück, referring to former fellow college students in positions elsewhere, who often have to plan their research projects in line with the next set of quarterly or halfyearly figures. “Our work is a long-term investment that takes time.”

What timeframes is he talking about, for instance in medical technology? And what will the future look like in ten or 15 years? The acquisition of patient data, its processing into information, including the incorporation of clinical expertise, and its visualization—those are essential points that together will result in exponential development. “In that area we’re all just at the beginning.”

In this context, the purpose of contact-free acquisition of vital signs for example is no mere engineering objective to be attained for its own sake; it is a commitment to freeing doctors, nurses, and other caregivers from routine tasks, and to make the recovery process of patients faster, easier, and more dependable. “An intensive care unit will look quite different,” Kück predicts. “You’ll see less technology because many developments are realized at the software level and disappear, you might say, into the equipment.”

Focusing on what is essential

The task of driving this change across an entire industry can only be accomplished by means of a multidisciplinary approach. From this perspective, even an apparently simple question has complex consequences. Like: Should a company develop a proprietary system or one that complies with generally accepted standards, including some that still need to be defined? The answer matters all the more because it impacts the future. In Kück’s analogy: “We don’t want to keep improving mechanical typewriters while still being unaware that in the real world they’re being replaced by computers.”

In the SmartPilot View (market introduction slated for 4Q 2009), which provides a realtime view of the course of anesthesia (refer to Dräger Review 97.1, pp. 18-19), Dräger is already providing a look at a future when patient data is consolidated and visualized in order to optimally adapt anesthesias to each patient. This isn’t merely a technological challenge. That’s because the new technology must
Understanding how others work—that’s usability

> do more than just tie in smoothly with established and proven therapies; it also must be extremely reliable and deliver significant progress. That can only be achieved if the equipment is easily or even intuitively usable. This is where the psychologist Maral Haar comes in—a profession one wouldn’t necessarily expect in a company with a strongly technical focus.

Usability: Ask and understand

“I have to understand how others think and work,” is how she describes her interest in her specialty—as a discipline as well as in her present work, in which she sees herself as “the users’ advocate.” Her main concern is practical usability of products and work processes. “To evaluate that, I visit future users at their jobs and watch them at work.” That’s how she learns what the job “looks like in the user’s head,” and “not only how users perceive their tools in general but also what objectives they pursue.”

Maral Haar’s studies encompass which information the anesthesiologist needs at a given point in time, and which information that could be technical visualized would only distract from the intended use. The simplified and convenient display of the SmartPilot View, right down to the arrangement of individual windows and their colors, is the result of many such observations and iterations.

How does she deal with different users and varying requirements? “First I try to find a common denominator for different user groups, such as nurses, medical specialists, or anesthesiologists. That works to a certain point. Ultimately it’s the majority of the users who decide when the possibilities of configuration or alternative user interfaces have been exhausted.” There are many things to consider. Asians for instance have smaller hands than Europeans, which impacts the shape, spacing, and tactile properties of control elements such as keys.

This is where the touch screen has advantages, because it can be configured by means of software. Another point is that the appearance of the human-machine interface can be changed to suit the situation. In engineering jargon it’s called “context-sensitive.” Are there gender-specific differences? “Men have generally a higher level of technical affinity,” says Haar. Which means women, on the other hand, utilize and evaluate technology more pragmatically, according to its relative usefulness.

A hot topic

Dr. Jochim Koch likes to combine technical and scientific enthusiasm with pragmatism. A mechanical engineer by training, he has an HP-25 pocket calculator on his desk that dates back to his student years. It was the first programmable hand-held computer—perhaps a reminder that creative ideas originate mainly from thinking, observing, and trying things out. “This sensor for instance,” he says, taking a rather inconspicuous object hanging from two cables out of a box. “It’s something you can’t simply get by googling.” It measures the core temperature of adults—simply and reliably via skin contact (“non-invasively”). In February this technology was tested in earth orbit, and more tests are planned on the International Space Station (ISS) this fall, including for possible applications in a future Mars mission (see Dräger Review 97.1; p. 7). It’s the impressive evolution of an idea that was first hatched in an incubator.

“We’ve been monitoring the body temperature of babies for quite a long time, using sensors taped to the skin over the liver,” says Dr. Koch. But whenever the incubator was opened, the skin temperature would drop. If this data is used to trigger other actions and alarms, then such fluctuations must be taken into account. In conjunction with universities and hospitals, Koch and his team therefore proceeded to develop a kind of dual sensor: One sensor that’s affixed to the skin is separated by a thermally insulating layer from another, external sensor. “We can use this device to measure skin temperature and ambient temperature simultaneously.” Short-term effects due to the ambient temperature can be corrected with software.

So far, so good. But it seemed doubtful that this approach would also work on adults, who have an insulating layer of fat that interferes with such measurements on the abdomen. There is urgent demand among customers, however, to replace the existing invasive measurement techniques with a non-invasive method.

Koch places an engineering model of such a device on the table and talks about the development work that has
June testing illustrates the potential of the principle of “non-invasively” measuring skin temperature. In February this technology was tested in earth orbit, and more tests are planned on the International Space Station (ISS) this fall, including for possible applications in a future Mars mission (see Dräger Review 97.1; p. 7). It’s the impressive evolution of an idea that was first hatched in an incubator.

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Koch places an engineering model of such a device on the table and talks about the development work that has been progressing, in earth orbit and in the hospital. “By the end of May, a technical paper about this progress—with Dr. Oliver Kimberger of the Department of Anesthesia, General Intensive Care and Pain control, Medical University of Vienna, Austria, as the principal author—had been published in the renowned British Journal of Anesthesia,” says a pleased Koch, a coauthor of this study, which demonstrates the statistical reliability of the measurements and their consequent practical usefulness in routine clinical use.

But medicine isn’t the only area of application. “After all, we don’t just create medical technology but safety technology as well,” notes Kück. “Take firemen, for example,” adds Koch. “Monitoring their core temperature while in action would be a very important contribution to their personal safety and health.” But though the basic concept is the same, very different problems need to be solved for this application—such as providing an effective way of mounting the sensor under a fire helmet, without impairing functionality.

Unlimited potential
“Our strategic long-term effort—the measuring, processing, and distribution of patient data—will be shaping medical technology in the future, and in my view it will continue to provide innovation potential that’s not likely to be exhausted in the next decade or two,” Kück concludes. Which also means that hospitals will be changing once again—for the people who work there and for the patients, as well as on the cost side. “That’s a correlation we never ignore in any innovation,” he adds. “And we stay on the lookout for whatever else may be coming up. So we’ll always be able to supply technology that’s as advanced as it is reliable—and that creates more leeway for practicing the art of medicine.”

Nils Schifffauer
Communicative: wireless data exchange between accessory (here: flow sensor) and medical device.

Convenience Plus Control
You can enhance the operating safety of technical devices by eliminating the possibility of mismatches. For products within its Infinity series, Dräger now offers RADIO CHIPS that check the compatibility of the accessories and can accelerate processes in the operating room and in intensive care.

ABSTRACT RFID is an established technology already in widespread use for the short-range transmission of information. Dräger uses an advanced version of this technology that has been adapted specifically for use in medical equipment in a growing number of products from the Infinity series—for greater safety and simpler handling.
SOMETIMES IT’S THE LITTLE things that greatly enhance the operating safety of technical devices. One proven example is the brake pedal of an automobile, which is mounted a few centimeters higher than the gas pedal. This difference in height prevents the driver from stepping on both pedals simultaneously, so the driver cannot accelerate when he really wants to brake. This “feature” could be a life-saver in a critical situation.

It is just as important to avoid mismatches in medical technology. Ventilators and anesthesia devices should always be operated in parameters that ensure optimal patient care and support specific features of the accessory, even if the patients are constantly changing. Doctors and caregivers therefore must pay careful attention even when simply operating the devices.

In light of this, Dräger has developed a system that enhances both the convenience of operation and the control opportunities. The system is based on radio frequency identification (RFID), a technology for the contact-free identification, routing, and tracking of goods and other objects via radio signals. The Dräger RFID system essentially comprises of two components: a radio chip that is glued to the accessory and a central RFID module in the ventilator or anesthesia device that controls the exchange of data between the device and the accessory and forwards the data read to the device software for processing.

RFID is already a proven technology for certain applications, and is used for such things as counting herds of cattle in South America or the identification of freight containers on ships and trains. The retail sales industry is attempting to optimize its merchandise logistics with the help of RFID.

A new type of RFID
Medical technology poses its own set of challenges. In these applications, the RFID technology must ensure the security of the data and also that the RFID device will not interfere with any of the medical technology used in a hospital. It must also fulfill important handling requirements to facilitate operation of the device to the benefit of the patient and to optimize workflows.

Dräger uses its Infinity ID technology to implement wireless communication via RFID between the therapy device and the accessory without additional cables. “This type of data transfer allows us to offer the user new functions that help to enhance the operating convenience and safety of the device,” says Andreas Otto, Product Manager for Lifecycle Solutions at Dräger.

The use of RFID technology offers numerous advantages. Doctors and nurses previously had to adapt the ventilators or anesthesia devices used for the in-hospital transport of a patient to the acute needs of the patient. The ID technology reduces the effort associated with this because the radio chips of the Infinity ID breathing circuits periodically store the operating parameters as described in the next paragraph. When changing devices, these data are transferred to the next device as soon as the RFID breathing circuits are connected. Furthermore, the ID technology also makes it possible to check the proper fit between accessory and device from a number of viewpoints:

configuration: The system automatically recognizes which accessories are being connected and adjusts its operating parameters accordingly. In this

RFID—the future is now
The RFID system from Dräger uses the lowest possible power output of 200 milliwatts at 13.56 MHz. According to Dräger project manager Gerd Wotha, “That is sufficient to establish a reliable connection in the absolute closest range of just a few centimeters.” The system complies with all current medical and electrotechnical standards, and makes an entirely new range of functions available to the user, such as checking the compatibility of device modes and the attached accessories.
Outlook

Safety is the top priority—and RFID technology also offers enhanced convenience

> way for example the device can automatically offer to start the humidification mode when special humidification circuits are connected.

- **Compatibility:** Because the use of incompatible accessories can result in device faults, the system automatically signals whether the accessory can be used with the device. An optical and/or acoustic alarm is issued if this is not the case.

- **Mismatch:** Mismatched breathing circuits can put the patient’s health at risk. The system therefore checks whether the circuits are connected to the device in the proper configuration. An optical and an acoustic alarm are issued if a mismatch is determined.

- **Replacement:** Today replacement intervals for accessory components are usually monitored manually using paper and stickers. The system allows the date of first use to be stored on the radio chip and a replacement reminder can be issued before the expiration of a predefined interval.

**Convenience and control**

In the fourth quarter of 2008, Dräger introduced the ‘Evita Infinity V500,’ the first ventilator equipped with ID technology. The first anesthesia device with this extended function, the Primus IE (Infinity Enabled) with a new software package, is scheduled to follow one year later. Available accessories include corresponding CO₂ absorbers and water traps in addition to the breathing circuits. Product manager Otto appreciates the significant economic advantage offered by the ID technology, which enjoys patent protection. “We are the only vendor offering this level of convenience and control on the basis of RFID technology.”

Frank Grünberg

Enhanced communication: Thanks to RFID, accessories and medical device are “aware” of one another.
SALES IN GERMANY

HEADQUARTERS:
Dräger Medical Deutschland GmbH
Moislinger Allee 53–55
23558 Lübeck, Germany
Tel. +49 180 52 41 318*
Fax +49 451 882 2002
www.draeger.com

* within Germany: 0.14 euros/min from Deutsche Telekom fixed-line phones

EAST
Dräger Medical Deutschland GmbH
Antonstr. 14
01097 Dresden
Tel. +49 351 80 702 0
Fax +49 351 80 702 41

SOUTH
Dräger Medical Deutschland GmbH
Vor dem Lauch 9
70567 Stuttgart
Tel. +49 711 72 593 0
Fax +49 711 72 593 98

WEST
Dräger Medical Deutschland GmbH
Im Teelbruch 103
45219 Essen
Tel. +49 2054 104 0
Fax +49 2054 104 206

AUSTRIA
Dräger Medical Austria GmbH
Perfekstraße 67
1230 Wien
Tel. +43 1 609 04 0
Fax +43 1 699 45 97

SWITZERLAND
Dräger Medical Schweiz AG
Waldeggerstraße 38
3097 Liebefeld Bern
Tel. +41 31 978 74 74
Fax +41 31 978 74 01

EUROPE NORTH / CENTRAL
Dräger Medical AG & AG Co. KG
Moislinger Allee S3-55
23558 Lübeck, Germany
Tel. +49 451 882 0
Fax +49 451 882 2080

EUROPE SOUTH
Dräger Medical S.A.S.
Parc de Haute Technologie d’Antony 2
25, rue Georges Besse
92192 Antony Cedex, France
Tel. +33 1 46 11 56 00
Fax +33 1 40 96 97 20

ASIAPACIFIC
Dräger Medical South East Asia Pte. Ltd.
25 International Business Park
# 04-27/29 German Centre
609916 Singapore
Tel. +65 65 72 43 88
Fax +65 65 72 43 99

MIDDLE EAST, AFRICA,
CENTRAL AND SOUTH AMERICA
Dräger Medical AG & Co. KG
Dubai Healthcare City
P.O. Box 505108
Dubai, United Arab Emirates
Block A-102, 1st floor
Tel. +971 4 36 247 62
Fax +971 4 36 247 61

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Precision Light with the New Dräger Polaris

A surgeon needs a natural color spectrum that should also illuminate the operating field without shadows. The new Dräger Polaris LED light delivers on these requirements to allow a look into the depths.

Its 108 light-emitting diodes (here: the Polaris 700) emit light with a color temperature of 4,600 Kelvin. A phosphor layer on the semiconductor ensures the production of “cold light” (without a long-wave infrared component), which is then focused through a lens. Each reflector contains a pair of LEDs. The sum of the individual beams forms a cylinder of light with a depth of illumination of approximately 1,100 millimeters and a variable diameter between 220 and 290 millimeters. This enables the light of each LED to be focused on the operating field so that multiple surgeons can work above it simultaneously without a significant loss of brightness in the field. Furthermore, the smaller LEDs are significantly more energy efficient than conventional light sources. The slight amount of dissipated heat is transferred gradually to the environment through the top of the housing.

The surgical light (shown here without the supporting system and camera) comprises a Cardan suspension, a smooth, seamless casing with electronic, mechanical, and optical assemblies, a control and lighting unit, a controller, and a sterilizable handle. A power supply unit accepting 24 V AC/DC and from 100 to 240 V AC connects the unit to the hospital power supply. Microprocessor-controlled electronics help to ensure that the light switches back on from standby mode without delay. Precision light shines down onto the operating field—in bright, natural colors and to the full depth required.