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A DIGITAL WORLD OF EXPERIENCE

LEARNING IN CYBERSPACE

Training specialists on a virtual natural gas flowback unit

GREATER ACCEPTANCE OF MAJOR PROJECTS

Planning high voltage transmission lines digitally

NUCLEAR WASTE REPOSITORY

Experimenting in a virtual underground laboratory



Events 2014

February 4-5, 2014
Forum Automotive Logistics
Frankfurt/Main

May 19-23, 2014
CeMAT Expert Meetings
Hanover

March 13, 2014
Forum Spare Parts Logistics
Nuremberg

June 4-5, 2014
International Scientific Symposium
on Logistics, Cologne

April 10, 2014
Supply Chain Day
Domestic and Abroad

September 18, 2014
Forum Total Cost of Ownership
Hamburg

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BVL events:



May 6, 2014
Forum Chemical Logistics
Frankfurt/Main

October 22-24, 2014
International Supply Chain Conference
Berlin

» Greater acceptance of major investments?
Let us take even more advantage of
digital engineering's capabilities as a
decision making tool. «

Editorial

Dear Readers,

Implementing major investment projects while reconciling as many interests as possible has never been easy. Whether nature is being transformed or nuclear waste is being stored – there have always been protests from the affected public. These are not phenomena of the IT age and Web 2.0. Organizing and raising the public's political awareness is far easier in our digital world. Like-minded people form alliances and spread their views on the Internet in next to no time. This sometimes releases emotionally charged, wholly virtual storms. Projects are put on the defensive and their implementation may even be jeopardized.

Involving the Affected Public

Why aren't we taking far more advantage of the potentials of the increasing digitization of every area of life, though? Virtual reality for instance: It enables us to actively shape the future and simulate the progression of events or the impact of changes. Digital worlds allow many people to navigate a virtual space at the same time. Discussions are rendered objective, options and alternatives are discussed simultaneously and solutions, which the affected public is more likely to accept, are ultimately found faster. Lone pioneers

are already using digital engineering as an involvement-driven tool for their decision making. It will become even more accepted in the future.

Acceptance through Participation

The energy transition for instance: New infrastructures are needed to transport wind, solar or biomass energy wherever it is needed. The construction of new high voltage transmission lines is a sensitive issue. Where should they be routed? Where will they be least disruptive? The company 50Hertz Transmission GmbH already informs residents about a new transmission line's route during its planning. The response to the digital planning and presentation tool has been excellent – among both government agencies and the public.

Another facet of the example of the energy transition given: The nuclear power phase-out is continually confronting us with the question of where radioactive waste should actually be stored once and for all. In order to answer this question, experts have to experiment in underground laboratories. Such experiments can now be conducted digitally in the first virtual underground laboratory, named VIRTUS, which was also created at the



Prof. Michael Schenk,
Director of the Fraunhofer Institute for Factory Operation
and Automation IFF in Magdeburg. Photo: Dirk Mahler

Fraunhofer IFF. What is more, it enables experts on nuclear waste repository to present their findings understandably to the public. VIRTUS can help give people more confidence in researchers' work and greater understanding for decisions.

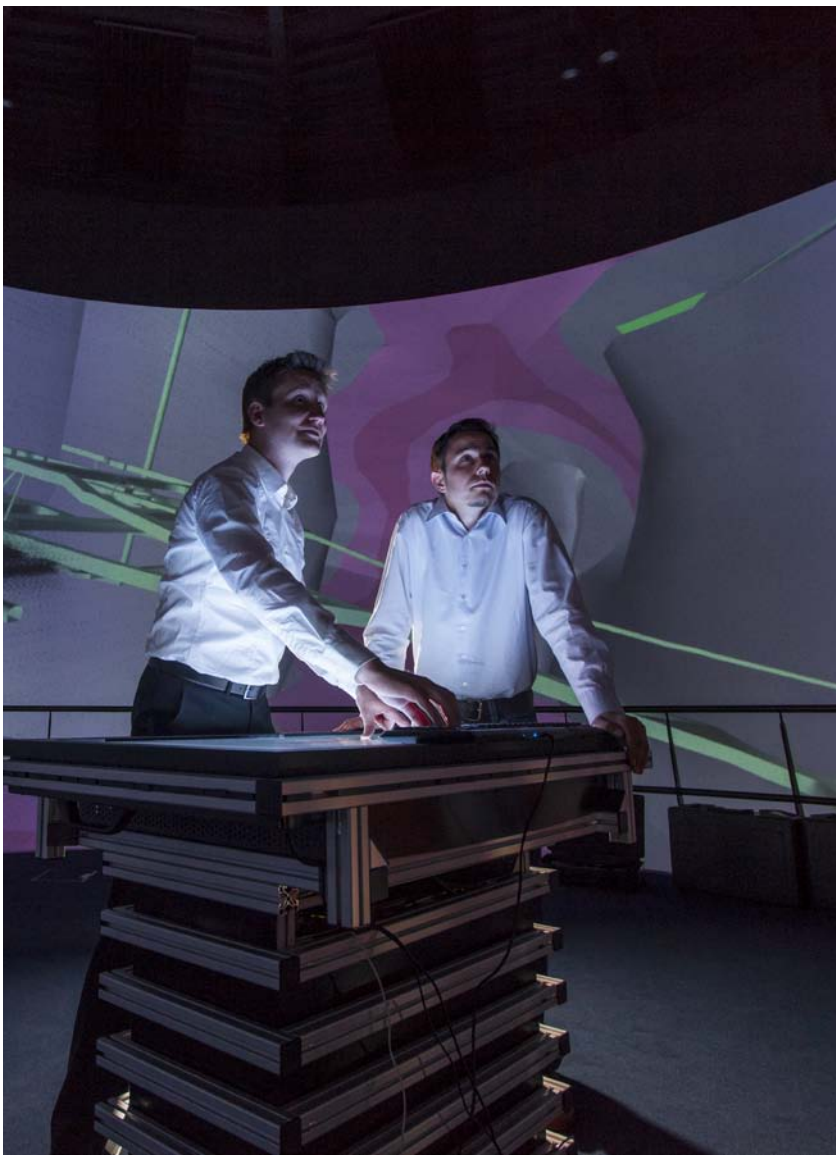
A Digital World of Experience

The digitization of the world in which we live and work is accompanied by many benefits. In this issue, you will additionally read how bed linens and hand towels are being given a digital identity and are thus no longer being lost track of in an industrial laundry. Or how clever digital logistics is being used to keep a watchful eye on security in logistics hubs. The digital world is providing us answers – let us take advantage of this progress.

Sincerely,

A handwritten signature in black ink, appearing to read 'M. Schenk'. The signature is fluid and cursive.

Michael Schenk



Searching for a Repository

Experiments in the first virtual underground laboratory, VIRTUS, are helping researchers in their search for a deep geological repository. Digital engineering experts recreated geological formations and technical systems from nuclear waste repositories in order to let different physical and chemical processes take place.

Researchers of nuclear waste repositories can use the virtual underground laboratory to show the public their findings clearly and understandably, thus making it possible to involve the affected public in decision making in the future. Learn how VIRTUS is helping the affected public gain confidence and understanding for the work of researchers of nuclear waste repositories.

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Planning High Voltage Transmission Lines Digitally

New transmission lines have to be erected if the energy transition is to be implemented. A novel tool helps route such lines optimally and analyze acceptance in advance.

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Virtually Trained Is Really Grasped

Fangmann Energy Services is training its operators to use flow-back units without any danger to them or the expensive equipment because they are training in virtual reality.

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Prof. Dieter Wegener, Vice President of Advanced Technologies & Standards at Siemens AG, on the challenges of Industry 4.0.



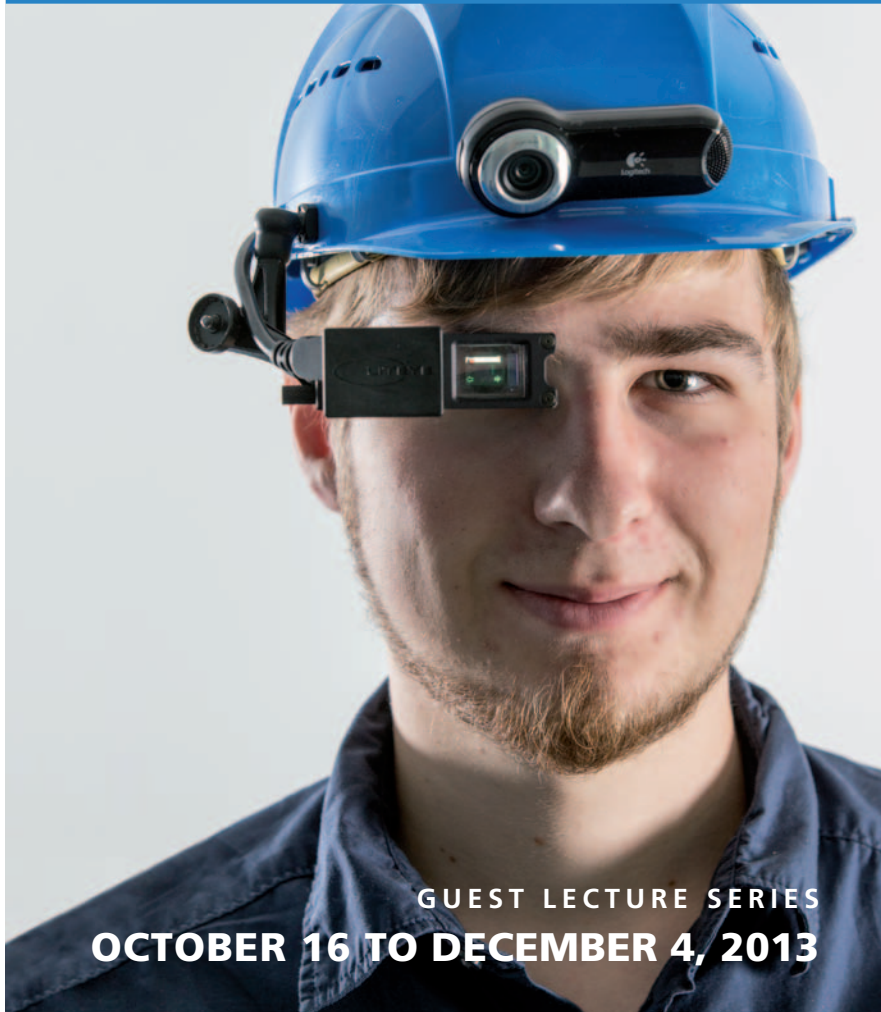
Sharp Minds

Who earned a doctorate? Who is new? Find out more about the people at the Fraunhofer IFF.



FRAUNHOFER INSTITUTE FOR FACTORY OPERATION
AND AUTOMATION IFF, MAGDEBURG

HUMANS AND MACHINES IN INTER- ACTIVE DIALOG



GUEST LECTURE SERIES
OCTOBER 16 TO DECEMBER 4, 2013

German Experts Will Be Discussing "Plant Engi- neering of the Future"

How can processes be organized more efficiently? What can be done about steadily rising energy prices? German experts will be discussing these issues at the Plant Engineering of the Future Conference in Magdeburg on March 6 and 7, 2014.

Rising energy and raw material prices, the need to reduce carbon footprints and anticipated utility fees are making it imperative to rethink energy consumption. High-energy industry in particular will have to adapt its processes for these new circumstances as quickly as possible in order to remain competitive.

Manufactures as well as builders or operators of process or power plants confront the challenge of organizing their processes more efficiently on a daily basis. Their partner, the energy sector is also having to prepare for change. This will require generating value adding synergies directly in and among different companies. Technical, organizational and technological innovations like those being developed in the ER-WIN innovation cluster will make it possible to achieve greater energy and resource efficiency.

Experts from industry and research will be discussing prospects, approaches, issues and trends related to these topics at the 8th Conference on Plant Engineering of the Future. The Fraunhofer IFF and its partners, the Association of German Engineers VDI, the German Engineering Federation VDMA, the German Chemical Industry Association VCI Northeast, the Industrial Initiative for Central Germany and the Zweckverband zur Förderung des Maschinen- und Anlagenbaus Sachsen-Anhalt FASA jointly host this industry get together every two years. (akw) ■



www.tagung-anlagenbau.de

"Digital Logistics"

Technologies at the 2013 International Supply Chain Conference

"Digital logistics" is the new buzz phrase in the logistics sector. Behind it is the widest variety of smart technologies intended to help digitize and monitor logistical processes in real time as fully as possible. They boost transparency, even in complex logistical systems and assure quality in and improve the controllability of every process.

Prof. Michael Schenk, Director of the Fraunhofer IFF, considers the broad use and refinement of such solutions to be an important key to improving efficiency among manufacturers and logistics providers. He nevertheless criticizes many users' often isolated use of them. The goal has to be to employ these technologies not only as local but also as cross-process and cross-company solutions. This would exploit the intrinsic value added even better.

"We have to make the different logistics zones, for instance in factories, hubs or transportation routes, smarter and link them on the information level even more," says the logistics expert. "That means, for example, tracking and documenting a complete supply chain end-to-end from the production of a product to its storage up through its transport to the final customer or even a repair shop. This will save significantly more time and money. We have successfully developed the technologies to do so."

Researchers from the Fraunhofer IFF will be presenting current examples of such solutions at the International Supply Chain Conference in Berlin on October 23 to 25, 2013. These will include a digital inventory management system for large outdoor storage facilities developed for Enercon, a wind turbine

manufacturer. The system is flexible and can be extended for a production facility or a construction site. State-of-the-art RFID applications, such as a superlight RFID wristband that provides assistance in manual work, will also be shown. A newly developed system that automatically scans the current volume of freight in a truck or warehouse is especially interesting for carriers. Logistics providers can use it to dispatch shipments better and even to offer new, flexible pricing. (mar) ■



www.bvl.de/dlk

An Air Freight Fingerprint

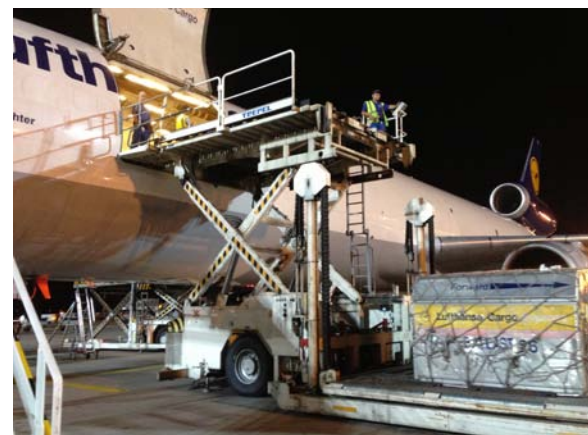
Since securing air freight chains is extremely important for air traffic security, preventing tampering with freight is a top priority. Although the security of the air freight chain is of primary importance, care must be taken not to interfere with logistical flows. Since established inspection attributes characterizing secure freight do not exist, though, shipments pass through new checkpoints time and again, are x-rayed, examined and inspected all over. This reduces the efficiency of logistics operations and increases their cost.

Automatic systems that track freight status could help expedite transport and handling operations without sacrificing security. The development of such a system is the objective of the joint project ESecLog. The Fraunhofer IFF, the Federal Institute for Materials Research and Testing BAM are involved in the project; the Bremer Institut für Produktion und Logistik BIBA, Cassidian Airborne Solutions, Panalpina and Viaboxx. Lufthansa Cargo and NXP Semiconductors are supporting it as associated partners.

The partners intend to jointly develop a freight fingerprint information system that inalterably labels and monitors air freight shipments. The system will combine several freight attributes, e.g. volume, weight, RFID, etc., into a single digital shipment profile, thus producing a distinctive freight fingerprint that is systematically checked at various points in the air freight chain. This will make it easy to detect tampering with shipments early.

The freight fingerprint information system will additionally eliminate repetition of more involved x-ray scans and manual inspections. The ESecLog solution will thus contribute to integrating the inspection processes in logistical flows while simultaneously increasing security in the air freight chain.

The project, which started in May of 2013, will run for three years and is being funded by the Federal Ministry of Education and Research under the project reference number 13N12640. (mar) ■



In the future, air freight will be given a distinctive "fingerprint" that combines certain attributes of the freight such as volume, weight and RFID. This will make it possible to detect tampering with shipments automatically. Photo: Anna Mahler

Port Inland Conference in Magdeburg

On behalf of the Saxony-Anhalt Ministry of State Development and Transportation, the Investment and Marketing Corporation Saxony-Anhalt and the Saxony-Anhalt Logistics Initiative will be hosting a European Port Inland Conference in Magdeburg from November 20 to 22, 2013.

The conference is intended to draw attention to the importance of the Port of Hamburg's extensive inland region for functioning logistical operations and structures from Hamburg to Eastern Europe. Among others, topics will include the flow of goods and shipping capabilities of combined transportation from Hamburg through Saxony-Anhalt to Eastern Europe. It will focus on logistics companies, chambers of commerce and associations' collective interstate work.

The international conference is a platform for European logisticians and logistics companies and providers to exchange experience. The Fraunhofer IFF, a research provider for innovative solutions and technological developments for the logistics sector, will also be represented at the conference. Its director Michael Schenk will be chairing the workshop "Business and Innovation: Reasons – Growth – New Ideas" and will also deliver a presentation on the topic.

Saxony-Anhalt, a center of logistics, will also be presented at the conference as the Central German logistics hub. Options for combined transportation of shipments and containers from the Port of Hamburg inland and on to Eastern Europe will also be highlighted. (mar) ■



More information online:

www.investieren-in-sachsen-anhalt.de/Hafenhinterland-Konferenz

16th IFF Science Days in Magdeburg Producing More Energy Efficiently

The autonomous robot ANNIE was also presented at the 16th IFF Science Days. The Fraunhofer IFF's robotics experts use it to demonstrate current technical capabilities in assistive robotics.



Effectiveness and efficiency will be the keys to successful manufacturing in the future. As electricity and raw material prices keep rising, industrial manufacturers will have to consume energy and resources more efficiently. That was also the tenor of the Fraunhofer IFF in Magdeburg's annual research conference, the 16th IFF Science Days from June 18 to 20, 2013. Hundreds of decision-makers and experts from industry, research and academia gathered in Saxony-Anhalt's capital on this occasion.

At the three parallel conferences on digital engineering, logistics and human-robot cooperation, top speakers presented innovative projects and current examples of best practice collaborated on by research and industry. The extreme practicability of the new solutions and developments presented is typical of the IFF Science Days and a big plus that draws attendees to this conference at the Fraunhofer IFF year after year.

The conference consisted of over one hundred presentations and workshops and concentrated on such issues as: "manufacturing of tomorrow and capabilities of today" "technologies that will make robots part of everyday life" and "means to make logistics more secure, reliable and sustainable". One

general emphasis was "means for more energy efficiency in companies".

During the IFF Science Days, the Director of the Fraunhofer IFF, Michael Schenk stressed the role of new digital engineering tools. "In order to manufacture more energy efficiently in the future, we will have to use technologies and tools such as digital engineering even more purposefully and extensively. This will be extremely important for the development of low-energy plants or production control and siting based on factors such as energy and resource consumption."

The three main conferences were supplemented by a workshop on optical measurement and testing systems with the theme "Model-based Assembly Assistance" and by the meeting of the Cooperation in Plant Engineering Industry Working Group. This year, the latter focused on the use of mobile terminals to optimize processes of plant life cycles. (mar) ■



www.wissenschaftstage.iff.fraunhofer.de

More Women Are Earning Doctorates

More and more people in Germany have a college degree. The percentage of Germans that do rose from 10.5 percent in 2001 to 13.2 percent in 2011. This was the finding of a survey conducted by the Federal Statistical Office on behalf of the Federal Ministry of Education and Research.

The survey also found that women are taking increasingly taking advantage of opportunities for education. This is also evident among doctorates. Forty-one percent of the doctoral candidates under forty-five are women, nearly twice as many as in the group over fifty-five (twenty-two percent). In 2011, around 752,000 people in Germany had doctorates. Across all age groups, thirty-one percent were woman. Fifty-two percent or slightly more than half of those

with doctorates come from non-academic families.

Twenty-two percent of women across all age groups and twenty-seven percent under forty-five have doctorates in STEM disciplines. Another trend is strong: The percentage of women with doctorates in natural sciences and mathematics in the youngest age group is nearly twice as large as in the oldest age group (twenty-six percent to fourteen percent). "We will no longer be able to do without female creativity and innovativeness to this extent in the future," stressed Federal Minister of Education and Research Johanna Wanka. "Not only from the perspective of equal opportunity, but also in terms of the effectiveness of our research and business," said Wanka.

The study also analyzed the jobs of individuals with doctorates. Still too few women were working in research and development. In 2011, only around one quarter of the 99,300 individuals under sixty-five working in research and development were women. (akw) ■



The complete study online:

www.destatis.de/DE/Publikationen/Thematisch/BildungForschungKultur/ThemaBildungForschungKultur.html

If Need Be, Even with Children at the Office

Your child is getting sick; grandma and grandpa are indisposed at the moment. Actually, mom or dad would have to stay at home but that would just not be good today ... the Fraunhofer IFF has had a "parent-child office" for such cases since August. It is intended to make balancing a job and a family easier.

Four-year-old Leni is building towers out of colored blocks in front of a desk. Her mother, Beate Ziller is talking on the phone, going through her mail and completing her work at the desk, the only things that evoke an office. Children's books and stuffed animals, a child's bed and changing table – a complete children's room has been put together. A little mole smiles on the wall and Beate Ziller at her little girl. "Every parent has probably gotten a call and had to pick up a child but isn't finished here and has to take care of delegating to colleagues. We are now able to deal with such situations here much easier."

Director Michael Schenk is convinced that this investment is worthwhile: "We want to

The Fraunhofer IFF now has a "parent-child office". Beate Ziller and her daughter Leni have tested it. Photo: Viktoria Kühne



become more family-friendly. Our research managers should be able to balance their jobs and private lives more easily. That also makes us a more attractive employer. After all, we want to attract researchers and especially female researchers from all over. That,

together with the good daycare offerings, can already be an argument for Magdeburg.« (akw) ■



Festive atmosphere at the evening event: Dr. Eberhard Blümel from the Fraunhofer IFF EU Office, Undersecretary Hans-Joachim Hennings, Sabine Schenk, Director of IFB-PEP GmbH, and University President Jens Strackeljan.



Robotics experts talking shop: Roland Behrens and José Saenz from the Fraunhofer IFF's Robotics Systems Business Unit with attendees of the Human-Robot Cooperation Conference.



Dr. Harald Schmicker, CEO of H&B Omega Europa, with his wife Dr. Sonja Schmicker, CEO of Metop.

Impressions

of the 16th IFF Science Days from June 18 to 20, 2013



Dr. Dieter Traub, Engineering Manager at BASF, Harald Jedamski, Key Account Manager at ÖbVI Petersen, and Stefan Dolega, CEO of PKB Ingenieurgesellschaft.



Uta Rolland fascinated all the guests at the evening event in the Gesellschaftshaus with her red and spirited masked dance.



Dr. Tobias Reggelin recognizing Sascha Ziebarth and Til Hennies as the best graduates of the Institute of Logistics and Material Handling Systems ILM at Otto von Guericke University.



Dr. Christof Günther, CEO of InfraLeuna GmbH, Dr. Keith Ulrich, member of the Berlin think tank "Die Denkbank", and Prof. Hartmut Zadek from the Institute of Logistics and Material Handling Systems ILM at Otto von Guericke University Magdeburg.



Andrea Urbansky from Fraunhofer IFF with Ioannis Karathanassis from ICC Industry Consulting and Cooperation and his wife.



Dr. Richard Smyth, former Airbus vice president and now member of the Fraunhofer IFF Advisory Board with Prof. Klaus Richter from the Fraunhofer IFF



Birgitta Worrigen from the Federal Ministry of Transport, Building and Urban Development and Karl-Herrmann Fahsel from the Saxony-Anhalt Ministry of State Development and Transportation at the Reliable and Sustainable Logistics Conference.



Prof. Gerhard Müller, Deputy Director of the Fraunhofer IFF, and Michael Scholl, Director of Opel/Vauxhall Supply Chain at Adam Opel GmbH.



Björn Schwerdtfeger (right) presenting a new optical sensor to attendees of the workshop on Model-based Assistance and Inspection in Assembly.



Georg Serebranski from Fraunhofer IFF (right) explaining the practical benefits of RFID in industry logistics to Sabrina Gries from the University of Duisburg-Essen and Volker Krüger from the Gesellschaft für Wirtschaftsservice in Duisburg.

Steffen Walther, development engineer at KUKA talking with visitors to the exhibition.



Prof. Alois Knoll from the Department of Robotics and Embedded Systems at TU München (center) talking with other attendees of the Human-Robot Cooperation Conference.



Audience: The Safe and Sustainable Logistics Conference alone had 140 attendees.

Wolfram Schoor from Cassidian, Steffen Liefold from Otto von Guericke University Magdeburg and Otto Nicksch from RTT AG at the conference on Digital Engineering for the Planning, Testing and Operation of Technical Systems.



Challenges of Industry 4.0

Interview with Prof. Dieter Wegener, Vice President of Advanced Technologies and Standards in Siemens Industry Sector

The future of manufacturing is becoming more digital. The real and the virtual world will merge even more. Globally distributed production systems are being linked in order to intercommunicate automatically – Industry 4.0 is making companies more flexible and efficient. This change is not taking place overnight, though.

René Maresch

If you occupy yourself with the question of what manufacturing of the future will look like, you quickly come across the concept of Industry 4.0. The views of what this means still diverge often. Could you describe how you understand the concept of Industry 4.0?

Industry 4.0 was originally a German research initiative but there are now similar approaches in many other countries. Interestingly, the impetus for it came from the world of IT and not from the world of industrial automation. One goal of Industry 4.0 is to safeguard Germany's competitiveness and export potential in the long-term. The German government is espousing this cause and supporting relevant research with up to 200 million euros as part of its High-Tech Strategy. Siemens considers the topic to be very important, is contributing to the technical discussion and is working on refining its range of solutions in the direction of long-term trends subsumed under the buzz phrase of Industry 4.0. Cyber physical systems are key. They are highly complex, mechatronic manufacturing systems. They are linked by communications functions into a kind of "virtual market place" and execute manufacturing orders self-organized.

The switch from classic automated systems to globally interconnected self-organizing production units will not happen overnight. How should it be handled?

Industry 4.0 is a vision that can only become reality through gradual evolution, not virtually overnight through revolution. One prerequisite is the integration of the product development and the production process as well as the merging of the virtual and the real world. Industry 4.0 is focused on industrialized manufacturing equipment that is capable of self-organization. The development of the technologies needed for this will still take several years. Today, we assume we will start seeing the first distinctly Industry 4.0 installations around 2030.

You talk about the merging of the virtual and the real world as a prerequisite for Industry 4.0. What does that mean for production?

Data consistency can be considered the common thread of the evolution toward Industry 4.0. All relevant data between product development and production planning and between production planning and actual production

have to be transferred in both directions at any given time. We are pursuing this idea of the digital factory with our Digital Enterprise Platform, which already covers some important steps with its CAx and automated solutions.

This digitization of production will also expedite the integration of automated assistant systems such as robots, virtual manuals and the like in the everyday work routine – topics also being worked on intensively at the Fraunhofer IFF. What is your assessment of this development?

The advances necessary for industry 4.0 will also have a broad impact on the systems you mentioned since essential elements of the vision would be missing without them. We are already now attaining time advantages of around 50 percent with our software products, in product development for instance. The downstream systems on the shop floor have to become faster, too, because, ultimately, the entire value chain has to be optimized.



Photo: Dirk Mahler

» We will be mass customizing products with Industry 4.0. «

What role will people actually still play when the production life cycle is largely digitized in the future?

Humans will remain indispensable creative planners and decision-makers in an Industry 4.0 world. There's no doubt about that. But first of all, we will have to develop systems far enough that they are able to simulate "intelligence" described in a visionary manner.

What can companies gain from implementing Industry 4.0?

More efficiency in the use of any resource, substantially shorter time-to-market and higher flexibility are priorities. We will be mass customizing products with Industry 4.0.

What challenges still have to be met for the vision to become reality?

The bottom line is to refine already existing systems, to use them in the first place and, finally, to join them in a whole. The task will be to merge automated systems and IT and even self-organizing systems on all levels by means of appropriate (interface) standards for hardware and software.



BRIEF CV

Prof. Dieter Wegener

- 1981 - 1986** Undergraduate degree in aerospace technology, TU München
- 1987 - 1992** Research manager, German Aerospace Center (DLR)
- 1992 - 1996** Consultant, McKinsey & Co
- 1994** Doctorate in engineering, Ruhruniversität Bochum
- 1996 - 2005** Manager, Siemens AG, Gas Turbine Development Manager, Power Generation Unit; Advisor to a member of the executive board, Siemens AG, Munich; development of global refinery business for its Industrial Solutions and Services Unit
- 2004** Member, Rotary Club Munich International
- 2005 - 2011** Chief Technology Officer, Siemens Industrial Solutions and Services Unit
- 2008** Adjunct Professor, Technical University of Denmark, Copenhagen
- 2011** Vice President Advanced Technologies and Standards, Siemens Industry Sector

Searching for a Nuclear Waste Repository ...

A nuclear waste repository has to seal in radioactive waste safely for over one million years. This is a tremendous length of time during which many physical and chemical processes take place, which researchers are presently studying in underground laboratories. A virtual underground laboratory from the Fraunhofer IFF is intended to simplify such studies in the future – and additionally increase public acceptance.

Steffen Masik

... with the Virtual
Underground La



Photo: Dirk Mahler

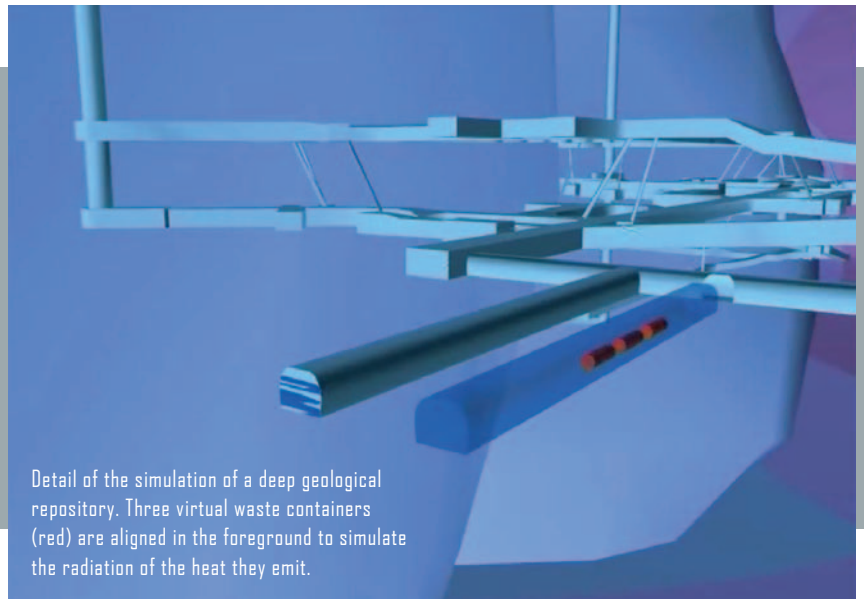
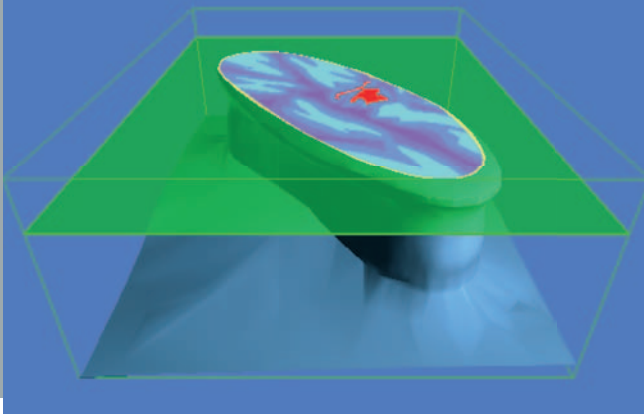
The nuclear power phaseout in Germany is a done deal and is supposed to be finalized by 2022 at the latest. Where should the radioactive waste produced be put, though? Solutions, i.e. suitable sites for nuclear waste repositories, have to be found as quickly as possible. This is not easy, though since waste is required to be sealed off from the biosphere for one million years. Before a potential site's suitability as a nuclear waste repository can be studied, the deep geological repository has to be designed for the given location. This means that researchers have to plan and study the nuclear waste repository together with the equipment modules and the stored waste. Various physical and chemical processes take place in a nuclear waste repository – the rock may be heated by the waste stored and gases may develop. The problem: These processes are very complex and interact.

Until now, researchers have studied such processes in underground laboratories such as the ones in Mont Terri in Switzerland or in Äspö in Sweden as well as in France and Belgium. Thus, time and again, German researchers have to pack their bags and travel to the underground laboratories for their experiments where they conduct studies, explore the necessary properties of a nuclear waste repository and test the quality of sealing systems. The period of a study is limited, though, because none of these tests can be conducted for more than a few years. A nuclear waste repository, on the other hand, has to seal waste off from the environment for one million years.

Laying Out and Studying Deep Geological Repositories Virtually

The most important nuclear waste repository research organizations – the Gesellschaft für Anlagen- und Reaktorsicherheit GRS, the Federal Institute for Geosciences and Natural Resources BGR and DBE Technology GmbH – are therefore developing VIRTUS, the first virtual underground laboratory in the world to supplement real underground laboratories. Researchers at the Fraunhofer IFF are in charge of the project's technical implementation. What exactly is behind the term virtual underground laboratory? Unlike real underground laboratories, this laboratory only exists in the virtual world, i.e. in computer visualizations. All of the conditions, whether the types of rocks in the soil or the physical or chemical processes that take place in a deep geological repository, are represented realisti-

A cross section of a salt dome reveals its geological structure.



Detail of the simulation of a deep geological repository. Three virtual waste containers (red) are aligned in the foreground to simulate the radiation of the heat they emit.

cally in the virtual laboratory. This enables researchers sitting at their desks to perform virtual experiments in a realistic scenario. In the virtual underground laboratory, they can study and assess the chemical and physical processes that take place in a nuclear waste repository and thus also review the plans and sites for nuclear waste repositories down to the minutest detail.

In a first step, the researchers recreate a site's geological formations. Since concrete sites for nuclear waste repositories do not exist yet, they work with a generic model – rock formations are structured realistically but do not recreate any real site. After all, the first task is to develop the system and to test VIRTUS's performance on the basis of initial calculations. Users can lay out a virtual deep geological repository in this rock formation. They have a great deal of freedom in the process. They can specify the depth, area, height and width of the repository. They can also import a repository complex created beforehand. Users may also specify the locations of boreholes and adits in which radioactive

waste will be stored. So far, two plans have been studied – storage in vertical boreholes or in horizontal adits. The VIRTUS system can be instrumental in any decision made about which plan is ultimately preferred.

Studying a Deep Geological Repository – from One's Desk

Once they have created "their" repository complex, researchers can commence their studies – just like in a real underground laboratory. They can select an area of the deep geological repository. A special interface transfers the location selected and the repository data to a simulator, which computes, for instance, rises in temperature in the repository caused by the radioactive waste. The results are imported into VIRTUS and visualized. They can be displayed as an isotherm, i.e. a line connecting locations of equal temperature. Users can also display cross sections of the rock together with the temperatures there. Or they can view the development of temperature in a particular location over time: How high will the temperature be in

one week, one year, one hundred years? Much more than just temperature can be simulated: Mechanical stresses and thus the probability of crack formation can also be computed. Researchers can closely examine permeability to water or other liquids and gases. Is any groundwater or seepage entering, too? In order to be able to simulate this for the future reliably, too, the researchers examined past developments and transferred them to the future.

As different as the simulations and research findings may be, they have one thing in common: They can all be visualized in the virtual underground laboratory so that correlations and developments over time can be detected quickly. It has been possible to present simulation results three-dimensionally but never in the overall context. VIRTUS, on the other hand, displays the calculations together with the geological model. "VIRTUS visualizes the computed thermal, hydraulic and mechanical processes in a nuclear waste repository as well as their complex interactions," says Klaus Wiczorek, who works in the division



VIRTUS enables us to show the public our findings understandably and thus helps win people's confidence in our work and develop understanding for decisions.

Klaus Wieczorek, Gesellschaft für Anlagen- und Reaktorsicherheit



of nuclear waste repository safety research at GRS and is heading the VIRTUS project. Users can "walk" through the deep geological repository, click on their location and compare the findings there with findings from other locations in the repository.

Researching Hand in Hand

All of the organizations and researchers involved in the search for a nuclear waste repository will be collaborating and every project partner will have access to the data sets. A researcher in Hamburg will thus be able to see what a researcher in Munich has simulated. Once a potential site has been identified, a central preprocessor ensures that every calculation is based on the same model – thus preventing anyone from fudging the numbers. This model is based on a site's geology. The individual rock strata are specified to correspond with reality. The virtual repository complex is thus the same for everyone: The materials out of which it is built as well as its shape and depth are specified. This enables researchers to compare their studies.

Increasing Public Acceptance

Another advantage of VIRTUS is that it presents the complex interrelationships in a nuclear waste repository so understandably and clearly that laypersons can comprehend them. The public can "fly" through three-dimensional salt domes virtually, past repository complexes and adits filled with containers containing radioactive waste. "VIRTUS enables us to show the public our findings understandably and thus helps win people's confidence in our work and develop understanding for decisions," says Wieczorek. Events attended by larger numbers of people could conceivably be held in the VDTC's Elbe Dom and allow them to examine the workings of a nuclear waste repository and the simulation results.

Collaborating in the Project

A total of four research partners are involved in the VIRTUS project. While the BGR is providing the geological data and models for VIRTUS, the staff at DBE Technology GmbH

are contributing their know-how in the planning of nuclear waste repositories. GRS is lead managing the project. Its staff, like those at BGR and DBE Technology, have many years of experience experimentally researching and modeling coupled processes in nuclear waste repositories. Fraunhofer IFF has the job of presenting the results of analyses virtually and interactively, i.e. developing the actual VIRTUS software platform and thus the central component of the virtual underground laboratory. VIRTUS is still in development at present. A first prototype is supposed to be accessible by the public at the end of April.



Steffen Masik
Virtual Interactive Training Business Unit

Phone +49 391 4090-127
steffen.masik@iff.fraunhofer.de



Photo: Dirk Mahler

High Voltage Transmission Lines: Planned Digitally and Accepted More Readily

Since wind turbines operate primarily in northern Germany but the majority of the electricity is used in southern Germany, new electric transmission line routes are needed if the energy transition is to become reality. A novel tool is helping plan these line routes optimally and analyze acceptance of them in advance.

Andreas Höpfner



The tool facilitates understanding and transparency. You can't hide power lines, but the public trusts you when you put your cards on the table and they are informed about an electric transmission line's route beforehand - and you are also able to demonstrate that a lattice tower virtually disappears from view before a mountain.



Oliver Britz, Departmental Manager at 50Hertz Transmission GmbH

Away from nuclear energy to renewable energies – the energy transition is in the offing in Germany. Most citizens are welcoming this development since renewable energies are far more sustainable and greener than nuclear power. Erecting wind turbines and building new power plants will not be enough, though. The infrastructure will have to be right, too. Quite concretely, there have to be new electric transmission lines because wind turbines operate primarily in northern Germany but the majority of the electricity is used in more densely populated, more industrial southern Germany. For northern Germany, this will mean building industriously and erecting numerous new extra high and high voltage transmission towers. Where will such line routes run best? Where will they be least intrusive? From where will they be visible? This planning task is growing increasingly complex as planners endeavor to make as little impact as possible on residents with line routes, to preserve forests and to avoid protected areas. At the same time, they have to try to reconcile security of supply, cost effectiveness and environmental compatibility in holistic concepts. In short, it is a complex undertaking.

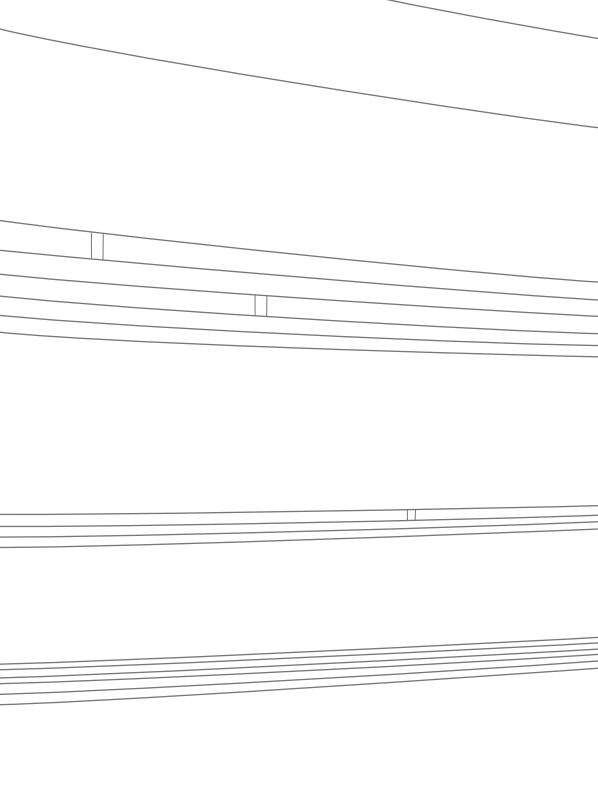
50Hertz Transmission GmbH, which operates large segments of the extra high voltage grid (380/ 220 kV) in northern and eastern Germany, would like to break new ground in such planning. They contracted researchers at the Fraunhofer IFF to develop a planning tool, which is helping them. Based on virtual reality or VR for short, it is helping them plan electric transmission line routes graphically and respond to the existing challenges optimally. Planners can select, place and later even move transmission towers and thus put up electric transmission lines and plan their routes in a virtual simulation of the respective landscape. Another advantage is the capability to analyze the visibility of electric transmission lines – long before the transmission towers have been erected.

A Virtual Environment Corresponding to Human Perception

A virtual environment is an outstandingly suited medium for this work because its form of representation comes closest to human perception. It therefore generates the same understanding from all viewers and has an identical impact on them. Everyone pictures a verbal description or site plan or map of the

route of overhead electric transmission lines somewhat differently and imagines the outcome differently. This is different in a virtual environment in which viewers see a photorealistic setting that is true-to-scale. They can freely select their perspective, flying like an eagle over the landscape or “standing” at freely selectable locations. Certain tools help them find their bearings. A click of the mouse, for instance, causes signs with place and city names to grow out of the ground like small flags.

Before an electric transmission line route can be planned, though, the situation onsite must first be modeled – in other words, a virtual model of the landscape must be generated. This model is composed of several single components such as ground and soil, buildings, vegetation and other relevant objects. What is the landscape like? Where are hills, forests or rivers and lakes? Where are houses or cities located? Our researchers draw on geospatial data such as digital terrain models to create the environment model. Realistic simulation of vegetation, e.g. forested areas, is important especially in national projects. The researchers do this by analyzing digital surface models DSM and digital terrain mod-



A virtual landscape. The interactive model makes it possible to plan the location of high voltage lines optimally.



els DTM. While a digital surface model models the earth's surface with all of the objects located on it, i.e. houses, trees and bridges, a digital terrain model only represents the natural surface of the earth.

Electric Transmission Line Routing – Thought through Entirely

Planning can begin once a virtual environment model has been created, i.e. the landscape in which an electric transmission line is supposed to be routed has been reproduced virtually. Users can select the desired transmission towers from a catalog of components and place them in the environment. The transmission towers correspond to reality down to their details. Not only are there different transmission tower designs, e.g. suspension or dead-end towers, but their components can also be configured differently. How many line systems is a tower supposed to suspend? Are aircraft warning spheres needed? How many insulators will be needed and how long should they be? Planners can enter all of this in the software. They

can position and freely move the transmission towers and enter and change an electric transmission line's route and features. The transmission towers' material properties are also freely selectable. Furthermore, if desired, the program displays safety zones and electric transmission line corridors – viewers thus see at a glance whether the safety zone around a transmission towers is large enough or whether the electric transmission line route has to be moved a bit. Stored alternative plans can be imported into the environment model anytime. The program not only displays the accurately detailed electric transmission line route in a realistic environment but also makes it possible to measure distances. How high above the ground is the cable? How far apart are the individual transmission towers? A simple click of the mouse, and the software displays requested data to the user.

Acceptance Analysis

The public is usually not happy about overhead electric transmission line routes – they often have reservations and fears that the

landscape will be disfigured and the view will be marred by lines and transmission towers. Another one of the program's distinctive features covers precisely this point: It automatically analyzes the areas in which and the extent to which a certain electric transmission line route would alter the appearance of the landscape. Thus, long before the content of planning has been translated into reality, the program evaluates planned electric transmission line routes and visualizes their pros and cons, for instance, when the degree of visibility of electric transmission line routes and their impact on the landscape are important. To do so, the software calculates the appearance of an electric transmission line route from every point in the environment and adds this information to the overall picture: Color coding indicates the locations and areas from which new transmission towers are visible or not. Users can enter a weighting of visibility: They can specify, for instance, the distance a tower must have so as not to affect the field of view adversely. In addition, users can assume any position – they can, for instance, "stand" on their own



balcony at home or their property with a click of the mouse and see the impact of the electric transmission line route from there. How disruptive is it? How visible is it from there? What do compensatory measures such as planting trees accomplish? The program provides different tree species– from chestnut to ash through linden and poplar – which users can “plant” virtually. The size of the trees can be set as a function of their growth curves. A renewed analysis examines the impact of these measures.

New Options for Public Involvement

Individual citizens as well as different government agencies have different interests: Whereas some would like to harm forests as little as possible, others are primarily interested in the landscape. Still others push to have high voltage lines installed as low as possible so that they do not endanger the flight of birds all too much. The new virtual representation makes the development and presentation of different alternatives to government agencies – as well as the public – quite

conceivable. The system certainly enables the public to obtain a more objective view, thus generating entirely new options for public involvement. “The tool facilitates understanding and transparency,” says Oliver Britz, a departmental manager at 50Hertz Transmission GmbH. “You can’t hide power lines, but the public trusts you when you put your cards on the table and they are informed about an electric transmission line’s route beforehand – and you are also able to demonstrate that a lattice tower virtually disappears from view before a mountain.” The staff at 50Hertz Transmission GmbH have already discussed segments of electric transmission line routes together with forest management agencies as well as other government agencies and optimized one tower location or another in order to preserve forests and natural regions and, naturally, also to circumvent residential areas as best as possible. They have also used the system at informational events in order to involve the public and to visualize intended electric transmission line routes for them. The researchers intend to upgrade this technology in the future so that it also represents electri-

cal and magnetic fields. The response to the novel planning and presentation tool from both government agencies and the public has been very good. This technology’s potential is its particularly clear form of presentation. Britz stresses this, too: “The VR solution developed is a well proven means to present plans realistically. After all, being able to view such an electric transmission line route realistically is already something different than always just talking about it.”



Andreas Höpfner
Virtual Interactive Training Business Unit

Phone +49 391 4090-116
andreas.hoepfner@iff.fraunhofer.de

Virtually Trained Is Really Grasped



Gas no longer flows out of watered-in natural gas wellbores. Mobile flowback units furnish a solution. Since their operation is not without dangers, though, workers must know exactly what they are doing. In the future, they will be able to train the assembly and operation of such a unit in a virtual scenario without endangering themselves and the expensive equipment.

Tina Haase





Staff can view any detail of the unit in the control center anytime.

Even natural gas wellbores age: Flow paths often clog over time. Wellbores also become watered-in. Standing water's high density makes it so heavy in a wellbore that the pressure in a deposit is insufficient to transport the liquid to the earth's surface. As a result, the wellbore is "dead". Natural gas no longer flows out. Mobile flowback units furnish a solution: They vent and dewater wellbores and thus allow natural gas to flow again. Fangmann Energy Services GmbH & Co. KG developed a mobile flowback unit that does this: "We installed the entire unit modularly on trailers," says Steffan Gerdes, CEO of Fangmann Energy Services GmbH & Co. KG. "The mobile design enables us to have short set-up times, reach a particular well site quickly and position the units optimally for the site conditions in short time, connect them with one another and begin dewatering. That is a huge advantage over our competitors' conventional, commercially available units." The inclusion of a scrub-

ber is another advantage of the mobile unit. Whereas previous units usually had to burn off the natural gas that flowed out during dewatering, the gas can now be purified so that it can be conducted directly to the treatment system. That is much more environmentally compatible.

Concomitant with the development of the mobile flowback unit, researchers from the Fraunhofer IFF created a training scenario in collaboration with experts from Fangmann Energy Services GmbH Co. KG. The unit's 3D design data served as the basis for the development of several learning modules for the interactive learning application. What makes it special is that it enables staff to move freely on the well site, interconnect the unit's individual parts and operate all of the control valves – and do all that on a computer without endangering themselves and the expensive equipment because training takes place on a virtual rather than a real

unit. It reproduces the real system in every detail. After all, work with a mobile flowback unit is not without dangers: Pressure is high and explosive gases can escape. Safe work and accident prevention therefore have top priority. The unit may only be operated by specially trained staff.

The virtual learning environment has a modular design, thus enabling users to systematically access user-specific educational content in seminars and to retrieve information as needed when they are working. In the first module, users first explore the work environment and the equipment – safely, of course. They can examine the unit's components in detail. Knowledge and understanding of the unit's design and working principle is the prerequisite for safe unit operation and therefore constitutes the basis of the learning application. In the second module, technicians learn the procedures they need to set up a site and to commence operating a unit safely.



Our staff training is taking on a new quality. Virtual training is conducted very understandably. The three-dimensional representation enables staff to become familiar with the unit in space and more or less immerse in it.



Steffan Gerdes, Manager of Fangmann Energy Services GmbH & Co. KG

Best practice procedures prepared by technical experts demonstrate the correct execution of operations clearly and comprehensibly. The visualization makes correlations visible, which would not be visible in reality – for instance, the set-up of a flare and the mechanical and electrical processes that take place inside of it.

Once the individual parts of the unit have been positioned correctly and the mechanical and measurement systems interconnected properly, the unit has to be started up. The process flow diagram used to do this employs standardized symbols to indicate connections of individual tanks and control valves. Which symbol corresponds to which piping or which control valve? This question is answered quickly with the 3D model of the unit. The process flow diagram and the 3D model are also logically interconnected. Users can click on a control valve on the process flow diagram and see the effect of their action in the virtual model.

The fundamental advantage of virtual training is the ability to learn operations safely anywhere and anytime. What is more, the visualization improves communication among staff members because they are all picturing the same thing: A picture says more than a thousand words. Interactivity enables users to develop educational content on their own, thus boosting understanding of educational content. This makes work on the job safer because staff have not only memorized operations but also already acquired their first experience with the unit on the virtual model. This knowledge is retained and can be retrieved, even in critical situations. Gerdes is thrilled: "Our staff training is taking on a new quality. Virtual training is conducted very understandably. The three-dimensional representation enables staff to become familiar with the unit in space and more or less immerse in it." The virtual unit is not just intended for staff training. Fangmann Energy Services GmbH

& Co. KG is also planning to use it to retain experience employees acquire when using the mobile unit. "Thus, the wealth of experience will also be secured when staff members depart," says Gerdes, pleased. Staff can also clearly explain dewatering operations to clients in the virtual environment.



Tina Haase
Virtual Interactive Training Business Unit

Phone +49 391 4090-162
tina.haase@iff.fraunhofer.de

Improving Market Position through Effective Site Planning





Planners developing a new site such as a port or an industrial park, have to keep their eyes on a lot: logistical processes, spatial planning and the future energy requirements. A virtual tool helps coordinate these items optimally and thus enables companies to use their resources more efficiently in the long-term and consolidate their market position.

Andreas Höpfner

In a large operation, such as a port, each of the different employees has an eye on a different process: The logisticians make sure that the right items are brought to the right place at the right time. Building contractors take care of building projects. And power engineers optimize energy requirements, organizing processes to consume as little energy as possible. The work of planners is different: They have to stay focused on the big picture. They have to locate buildings optimally, organize future flows of goods efficiently and obtain a good energy footprint.

This is also the case in Haldensleben Industrial Port operated by UHH Umschlags- und Handelsgesellschaft Haldensleben mbH. At present, it has two locations. A new premises, the south port, being developed for this purpose, is supposed to be added in 2014. Planners are needed before the new port premises can be built, though: What is the best arrangement of buildings so that future operation runs as smoothly as possible? How should pedestrian and vehicular areas be laid out? This planning is anything but simple because of busy freight traffic in the port: bulk goods, pallets, big bags and container have to be transported, specifically on rails, roads or waterways. Getting goods to the right place at the right time is not enough. Rather, freight traffic must run as efficiently as possible in order to save money and resources. Moreover, expansion projects like the impending one in Haldensleben have to be completed during ongoing operations but may not disrupt them.

“Building” Buildings, Allowing Flows of Goods to Flow – by Clicking a Mouse

A novel tool is making planners’ work in this situation easier. “Virtual Site Planning”, developed by researchers at the Fraunhofer IFF,

enables them to view the development projects in the port area holistically. The planners at UHH Umschlags- und Handelsgesellschaft Haldensleben mbH can see both the existing port areas and the new lots in virtual space in this tool – and can use this as the basis to integrate new buildings or structures and erect the south port virtually. What would only be possible in the real world much later – namely only after construction – functions here and the representation is realistic. Buildings can be built and moved and their size and shape can be changed virtually with a few clicks of the mouse. The planners can integrate and alter virtual route networks and check the function of the flow of freight on these routes. To this end, the tool models architectural structures, logistical plans and transported items such as big bags, containers, pallets and bulk goods virtually. And it analyzes which of the virtualized options is most advantageous. What is more, users can define and assign the specifics of the operational processes.

Planners have an object catalog at their disposal to construct buildings virtually. It contains the individual 3D models of different buildings, such as industrial buildings or office and commercial buildings. The planners can import them into the complete model and scale and customize them. Trees and vegetation can also be selected from the catalog and placed in the terrain with the click of a mouse. Street lighting, vehicles and model people round out the object catalog.

The virtual world opens many options for the planners: They can modify and optimize objects and routes dynamically. And they can change their location and their view at any time, for instance, they can use a bird’s-eye view to view the entire area being planned or “stand” anywhere in the virtual model.



We are striving to make our virtual site planning system a holistic system that covers and thus optimally coordinates every domain, specifically the domains of spatial planning, logistical processes and energy efficiency.



Andreas Höpfner, Fraunhofer IFF



Port premises of UHH Umschlags- und Handelsgesellschaft in Haldensleben. The real conditions provide the foundations for a precise, virtual interactive 3D model of the entire area and its surroundings onsite created on the computer. ...

By clicking the mouse, they receive additional information on open lots, architectural structures or defined routes. How expensive are the plots? How many square meters do they cover? What infrastructure exists? Information on maximum building heights or soil conditions can also be imported from the

existing property databases into the virtual 3D model and displayed. Planners are not required to use a specific device to first create their "virtual work" and then present it to clients: Both standard laptops and stereoscopic 3D displays like those used at trade shows are suitable.

Holistic Model: Spatial Development, Logistical Processes and Energy Efficiency

Models that single out just one aspect of development and optimize it independently from others – only improving logistical



... which serves as the basis of simplified spatial planning, for instance. Planners are able to move in it freely, objects and roads can be modified dynamically, additional information can be integrated and processes can be visualized.

processes for instance – usually do not do much because the individual operations in a plant or port are mutually dependent. The researchers are therefore striving to make their virtual site planning system a holistic system that covers and thus optimally coordinates every essential domain, specifically the domains of spatial planning, logistical processes and energy efficiency. UHH's planners have already used the virtual site planning system to tackle space and logistical processes. In a next step, the researchers now intend to incorporate energy efficiency, too. After all, energy and raw materials are some of the major price drivers in industry and thus a significant economic factor.

Companies that want to safeguard their market position and to continue to remain competitive, too, have to operate energy efficiently. In the process, various points, such as alternative energy sources that companies could use, have to be considered. Which are suitable and under what conditions? How

can production facilities be operated with maximum energy efficiency? Can corporate or manufacturing clusters be formed with operators in the immediate vicinity, who can coordinate their energy footprints and thus cut costs? In the future, the virtual site planning system will enable companies to consider such points during planning. The tool helps, for instance, determine whether the installation of a small decentralized power plant such as a wind turbine is worthwhile. Or whether a cogeneration plant would be more expedient. Conceivably, different companies could also combine their energy requirements. The virtual site planning system is also supposed to incorporate such an approach. The tool is being upgraded for energy efficiency in the newly established ER-WIN innovation cluster in which the Fraunhofer IFF and numerous manufacturers are pooling their expertise.

The researchers are additionally planning to place their concepts for virtual site plan-

ning on a regional and national footing. One example: Since the UHH Umschlagshandelsgesellschaft Haldensleben, which runs Haldensleben port, is a subsidiary of Rhein-Umschlag GmbH, the results will be applied to the company's network in order to be able to use resources with maximum efficiency there, too.




Andreas Höpfner
Virtual Interactive Training Business Unit

Phone +49 391 4090-116
andreas.hoepfner@iff.fraunhofer.de

At a Glance: More Security at Logistics Hubs





Whether in ports, giant warehouses or other handling facilities: The tremendous flows of goods often make it difficult for logisticians to know what is going on. The “virtual bird’s-eye view” will help them in the future. This is the first technology to present a complete view of complex and confusing premises and in real time at that.

Olaf Poenicke

Major ports are worlds unto themselves: Ships are loaded, cargo is unloaded, containers are brought from point A to point B, cranes are operated – and, amidst all of the hustle and bustle, the workers and, above all, the staff in the port control center have to know what is going on. Where are which ships docked? What is the status of storage facilities; how full are they? Which rail and forklifts can be used? This is the situation at the Port of Magdeburg, too. It extends along fourteen kilometers of riverbank and has more than 230,000 square meters of outdoor and more than 8,000 square meters of indoor storage space. Using five rail vehicles, the port railroad transports container and other cargo from ships to storage facilities and vice versa. The network of rails covers fifty-four kilometers.

Creating Smart Logistics Zones

Employees in control centers are only able to know what is going on with technical support. In the future, hubs such as the Port of Magdeburg will become so-called “smart logistics zones”. The goal is to use technical support to organize logistical processes particularly robustly and reliably. Although events at different locations in the port are filmed by cameras and these videos flicker on numerous monitors in the control center, they only deliver a fragmentary picture because each of the cameras only furnishes its own perspective. The next step will entail smart solutions that combine various sensor systems and thus create smart logistics zone.

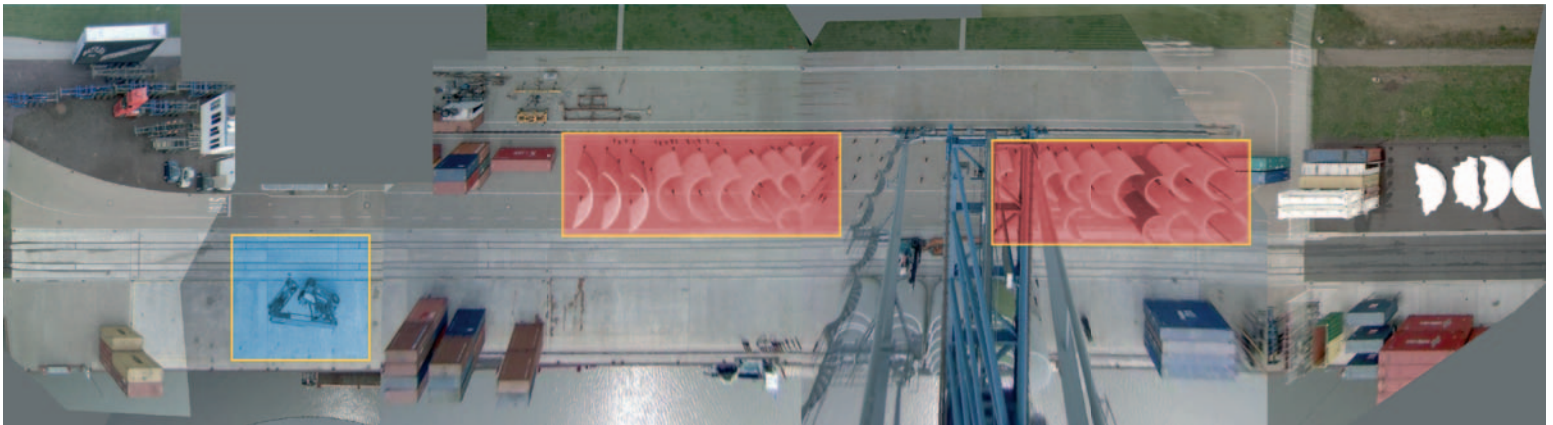
One such a solution is the “virtual bird’s-eye view”, which provides port staffers an overview of events in a port at a glance. This technology combines individual camera images to give users an overview of the port premises in real time, refreshed twice a second. The system was developed by researchers at the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg. At present, the researchers are testing and optimizing it at the Saxony-Anhalt Galileo Test Bed, more precisely the Hanse Terminal of Magdeburger Hafen GmbH, which is part of the test bed. Later, it could be extended to other port areas.

Basis: Algorithms and a Virtual Model

The heart of the system are special image processing algorithms: They adjust the individual camera so that they produce one coherent complete image without skewing or sudden shifts caused by other perspectives. The algorithms rectify the perspectives of the individual camera images and assemble them into a virtual bird's-eye view without overlap.

virtual port, users can add virtual cameras, adjust their heights and viewing angles and view the images they would generate. The researchers apply the algorithms to the camera images in this simulation, thus matching the individual "pictures" to one other just like real images. The virtual model thus displays the exact image real cameras would capture – and the number of cameras necessary to map the entire port premises can be tested.

enables users not only to see the number of different forklifts driving through the premises but also to identify and precisely locate them with optical markers. The researchers initially developed this marker-based localization tool, named MarLO®, for an aluminum plant and are now modifying it for conditions in the port. The aluminum plant had wanted to scan items entering and leaving storage precisely. Previously, the control center had



Virtual bird's-eye view in Magdeburg's Hanse Terminal: One the Saxony-Anhalt Galileo Test Bed's locations.

This improves not only the logistics and facilitates automatic tracking of material flows but also improves industrial and occupational safety. For instance, hazards can be marked in the complete image.

If staff are supposed to obtain a complete virtual view of the port, then the researchers first have to assure that the cameras are located correctly and capture every angle. That is why the researchers created a virtual representation of the Hanse Terminal in a first stage of development. In and of itself, this is an established approach and state-of-the-art: The researchers created a three-dimensional map from two-dimensional maps and CAD material. Then, they checked the real premises for places to mount cameras. Which towers, cranes or walls are suitable? At what height could cameras hang there? The researchers are able to place cameras optimally in a virtual reality model they created. In the

Where must the cameras be located? What is their optimal angle to the ground? Do containers or cranes block their view? The researchers have installed a total of seven cameras in the Port of Magdeburg. Since the cameras are placed very high up, seven suffice to obtain a good, complete image of the terminal premises. The staff in the control center have also been using the virtual bird's-eye view. The virtual bird's-eye view additionally serves as a development environment, upon which other applications build – for instance, marker-based localization of equipment, storage facility fill levels or motion detection in restricted-access areas. Thus, benefits for users are being added constantly.

Image-Based Localization of Forklifts and Co.

Marker-based localization is one example of an application tool. The virtual bird's-eye view

instructed forklifts which load to pick up next. This information was displayed on a small control panel in the cab. The researchers additionally applied a two-dimensional code to the vehicles – similar to a QR code familiar from Internet links in printed newspapers or magazines. The cameras recognize coded vehicles. They thus also register and can localize vehicles. Together with the information on which loads the forklifts are to transport on their forks, the system knows exactly when which load was put where. This will make it possible in the future to automatically record and document material flow processes in such storage facilities.

Determining Warehouse Utilization Exactly

Which storage facility still has how much space? Where can more containers be put? Staff in the port control center see this in

the virtual bird's-eye view. For instance, they can tell how many wind turbine parts are in a storage facility. If they need even more precise information on inventory, another tool helps, which is also based on the virtual bird's-eye view. It specifies, for instance, that storage facility A is forty percent full at the moment while storage facility B is eighty-seven percent full. Returning to the example of the wind turbine parts, which are frequently stored and loaded in the Port of Magdeburg, the system can automatically count how many such parts are located in which storage facility. Once it has been taught a little, it recognizes the shapes of elements.

Urban AR: A Control Center to Go

Researchers are currently developing another tool in the project "Urban AR" that will enable staffers to get their bearings amidst the confusing hustle and bustle on the port premises. AR stands for augmented reality. Employees can see the virtual bird's-eye view on a tablet computer they have with them and thus find out about activities in the port premises. They could, for instance, also mark any spot indicating themselves and thus use the system as a navigational aid. When users use the camera integrated in a tablet to film their environment, a container for instance, the system additionally inserts

In the Port, a Steel Mill, a Bus Depot, and, and, and ...

The virtual bird's-eye view can be used in many more places than just the port, though. The virtual bird's-eye view will be able to make employees work easier in the future anywhere anything has to be moved from point A to point B on large premises. In addition to applications in the port and the metalworking industry, there are also plans to use this novel tool in mass transit as well: Employees would be able to see immediately which buses and streetcars are parked where in a depot. And it would certainly be useful to security personnel if they could use the



The virtual bird's-eye view also serves as a development environment upon which other applications build – for instance marker-based localization of equipment, storage facility fill levels or motion detection in restricted-access areas.



Olaf Poenicke, Fraunhofer IFF

Cation: Danger! Identifying Restricted-Access Areas

Hazardous cargo arriving at the port must be stored separately. The Port of Magdeburg's Hanse Terminal has approximately 2,800 square meters designated as a hazardous material storage area. That is why another tool analyzes movements in the hazardous area: when something, an employee for instance, moves in the restricted-access area, its marking in the virtual bird's-eye view blinks, thus warning colleagues in the control center, who can take any appropriate measures necessary.

other information automatically: It displays the contents of the container, for instance. When an employee points the camera at a storage facility, the system overlays its capacity on the picture taken. This technology even helps when bulky shipments are being put somewhere. If an employee is uncertain whether it will fit into a storage facility's free space, the software will determine this in the future and give the employee relevant information. According to the plan, the researchers intend to be using "Urban AR" in the port for the first time in no less than a year.

virtual bird's-eye view to take in the situation at major events and concerts at a glance.



Olaf Poenicke
Material Handling Engineering and
Systems Expert Group

Phone +49 391 4090-337
olaf.poenicke@iff.fraunhofer.de

RFID in Laundry Logistics: An Identity for Bedsheets, Hand Towels and Co.

Commercial laundries send twenty to fifty tons of linens through their washing systems day after day. Maintaining an overview is difficult. RFID chips on hand towels, bedsheets and bathrobes are supposed to help in the future. They will enable commercial laundries to cut their energy consumption by up to ten percent.

Dr. Frank Ryll

Logisticians bring container after container – filled to the brim with soiled hand towels, bedsheets and bathrobes – into commercial laundries. An industrial laundry frees an enormous quantity of laundry of dirt every day: Large operations manage to launder between 50,000 to 100,000 items per day. The mountains of laundry largely come from hospitals and hotels. If you consider the difficulty families' often have sorting children's socks back into the right closet after washing, you can easily imagine the logistical challenge faced by commercial laundries. Think, for example, of the many small hotels on the coast of the Baltic Sea: When they give their bedsheets and hand towels to a commercial laundry, it sends every hotel's linens through the washing system separately. Often, though, the few hand towels and sheets do not fill a washer drum, which holds approximately 50 kilograms. If different hotels' laundry items were put in the drum together, though, it would be difficult to tell them apart again after sorting, washing, drying and pressing and to match them to the particular owners. After all, one bedsheet usually looks like another.

RFID Tags Make Sorting Easier ...

Radio frequency identification or RFID tags provide one solution. Such tags are supposed to replace barcodes in the long term. A reader can identify any laundry item with an attached RFID tag: The RFID chip contains a number, which delivers further information through the IT system – for instance, whether it is a hand towel or a bedsheet, which client the laundry item belongs to and how often it has already been laundered. The reader and the RFID tag can even be located several meters apart.

RFID tags help track laundry items continuously in the entire industrial laundry process: From delivery to sorting, washing, drying and pressing up through distribution. "The use of RFID tags in an industrial laundry primarily serves to create a closed cycle," says Lothar Kühne, Coordinator of the Laundry Innovation Network. "Rather than ending in the industrial laundry, this cycle includes the laundry cycle at a client's facilities, too."

The tags have already become established for custom laundry: Whereas nurses' scrubs, pants and shirts used to be labeled with a name-

plate or a barcode, an RFID chip does this now. Flatwork, i.e. bedsheets, hand towels, bathrobes, duvet covers, in short, the linens familiar from hospitals and hotels, is a different matter for which there has not been any RFID solution until now.

Researchers from the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg now want to demonstrate that RFID tags are also suitable for flatwork – and to optimize the components accordingly. Other companies are also involved in the project: Deister is delivering the antennas and RFID chips and Nordhäuser Palettenbau is providing the laundry containers, which are well-suited for RFID. Quadus is developing the IT solutions for the industrial laundry process. Researchers from Otto von Guericke University in Magdeburg are also involved. After all, the potential is substantial: If every laundry item were outfitted with an RFID chip, the laundry items from smaller hotels could all be put in a drum together. This could cut energy use up to ten percent. "RFID tags make it possible to organize autonomous laundry logistics with the goal of utilizing equipment efficiently and eliminating double loading," says Kühne.



Photos: Dirk Mahler

... and Reveal What Is in a Container

That is not the sole benefit arising from the RFID tags, however. Linens, packed in cloth bags, are delivered in containers. Around 200 laundry items are in one container. If the linens come from hospitals, the laundry's employees are allowed to open the cloth bags but not to touch the linens – germs, which could be hazardous for employees, might adhere to bedsheets and hand towels. It would be absolutely expedient to sort the linens or at least to know which laundry items they are. After all, terry hand towels are run through a different wash program than bedsheets. Until now, employees have relied on their experience and estimated how the laundry may be composed. Their accuracy rate of seventy to eighty percent is not particularly high, though.

If every item were outfitted with an RFID tag, however, containers would reveal their exact contents to readers – without having to open them. The accuracy rate is usually eighty to eighty-five percent because not every RFID tag is scanned, especially in large containers. The researchers were, however, able to raise the accuracy rate to ninety-nine percent because they read the tags from several points: First, they read tags once in the container, where they are already ninety-five percent

certain what it contains. They read the tags again when the container is emptied and its contents proceed along conveyors to the washing system. Since they scan different items rather than the same one every time, they raise the accuracy rate to approximately ninety-nine percent. There is a third measurement point after laundering. This third measurement is precise: Rather than being read out in a big pile, the laundry items come out of the mangle one after the other. The accuracy rate is therefore 99.99 percent – this makes it possible to read out virtually every laundry item and place it on the appropriate customer's pile.

Challenges and Development Work

RFID chips have already become established for customized textiles but much development work is also going into paving the way for tags in flatwork. In a first step, the researchers examined the industrial laundry process more closely: What information is needed where? Another critical issue: Commercial laundries are veritable landscapes of metal. Metal and wireless systems are difficult to bring together because metals reflect or deflect the radio waves sent out by RFID tags. The researchers therefore recreated parts of an industrial laundry in a laboratory and used them to optimize the technology. Optimiza-

tion is largely completed. At present, tests are being run at the industrial laundry Textilpflege Stralsund.

Attaching the RFID tags to laundry items is another challenge. While scrubs and pants have small care labels to which chips can be attached inconspicuously, bedding and sheets usually do not. Moreover, hotel operators often do not want guests to see the labels at all. Until now, employees have ironed the ten centimeter long and one and a half centimeter wide tags onto linens – much like iron-on patches used to jazz up T-shirts or hide holes in pants. In the meantime – under the supervision of the Sächsisches Textilforschungsinstitut – first research findings are available on methods to integrate the tags directly when the textiles are being manufactured. Trials are already running at the facilities of a textile manufacture also involved in the research project. What is more, other Chinese companies will very likely soon recognize a need and likewise start integrating RFID tags when textiles are manufactured. The tags hold up well to laundering: This was found out by the Hohenstein Institut, contracted by the Fraunhofer IFF. It laundered and pressed linens with chips hundreds of times and found that the RFID chips are more durable than the laundry items.



The special RFID chips hold up better in numerous wash cycles than laundry items. In the future, they will grow so small that they disappear in the seams of towels and bedsheets.



An RFID reader is mounted above the conveyor. Here, pressed and folded laundry is scanned once more and can be properly sorted.



RFID tags make it possible to organize autonomous laundry logistics with the goal of utilizing equipment efficiently and eliminating double loading.



Lothar Kühne, Coordinator of the Laundry Innovation Network

A Fully Automated, Green Commercial Laundry: A Vision of the Future

At present, employees sort clean linens by hand: laundry items with RFID tags go past the reader. It displays the clients to which the items belongs and the employees place the laundry items on the respective piles. A sorting robot is supposed to do that in the distant future – researchers at the Fraunhofer IFF are working on this together with their colleagues at BTU Cottbus and the company Waretex. After all, the more hands handle linens, the likelier it is that germs remain on them – for instance, because an employee has a cough. That can lead to problems, particularly with linens that later land on hospital beds.

Fully automated sorting would be expedient for soiled linens, too, and would allow sorting both hospital and hotel linens. Whereas hospital linens may not be sorted at all at present, hotel linens have long been sorted by hand. This also entails a certain health risk. Moreover, it is becoming increasingly difficult to find employees for hard and monotonous industrial laundry work. Thus, automating these processes as much as possible is important for more than just health reasons.

“The basis for automation is RFID technology. Robots can only operate usefully when they know which laundry item they have in front of them,” says Kühne. RFID technology also holds much potential for “green” commercial laundries, i.e. environmentally friendly com-

mercial laundries with optimized energy and wastewater use. “We are pursuing a holistic approach: Robots, logistics and energy efficiency forming an integrated whole,” says Kühne. The RFID project will conclude at the end of the year. It will still take a while longer, though, until RFID and automation can be combined in a commercial laundry.



Dr. Frank Ryll
Logistics and Factory Systems Business Unit

Phone +49 391 4090-413
frank.ryll@iff.fraunhofer.de

Promenade at the Port of Science

A Stroll with Magdeburg Mayor Lutz Trümper

The streets in Magdeburg's Port of Science come to life afternoons. Small groups of hungry researchers take their lunch break. It is idyllic and peaceful there: The Elbe flows through its floodplain and past people out for walks with their dogs and baby carriages. Lovingly restored revolving cranes, rails and railroad cars tell of days past. Today, research is anchored here. Whereas cargo was handled in the former commercial port, knowledge is handled there today. The city of Magdeburg still has a lot planned there.

Anna Mahler



Mayor Lutz Trümper.
Photo: Landeshauptstadt
Magdeburg.

Port of Science Vision

The Elbe's lush, green floodplains spread out on one bank. The old port basin frames the peninsula on the other bank. New, modern buildings with lots of glass gleam in between. Magdeburg Mayor Lutz Trümper takes time for a stroll. We meander along the Elbe heading north, following bicyclists on the West Elbe Cycling Route. We come to a stop in the middle of the Port of Science. Two giant, old grain silos loom skyward before us. Stylish lofts with windows looking out onto north Magdeburg like hundreds of eyes are supposed to be built here one day.

Dr. Trümper tells me that the Port of Science is supposed to become part of an elegant urban neighborhood with residential and office buildings. Right away, I start imagining pictures to his descriptions: The residents stroll along prettily planted promenades. Among them are many researchers, hurrying to their jobs at a research institute, a spin-off or another research-driven company.

Cafés and restaurants next door, athletic and recreational activities. The Port of Science is supposed to become Magdeburg's hot spot for sharp minds one day. A neighborhood with maritime flair, that offers research organizations, spin-offs and research-driven companies an inspiring long-term berth.

"The idea for the Port of Science extends far beyond the premises of the former commercial port. Additionally, we consider Sandtorstrasse on the opposite side with the Fraunhofer IFF's main building and the Max Planck Institute as well as the entire campus of Otto von Guericke University to be part of this," says Trümper, explaining the dimensions of the huge urban planning project. "Back then, in 2001, we were still calling the project the research park. At that time, we held talks with the Fraunhofer IFF on its planned expansion. Its director, Prof. Schenk, brought the phrase Port of Science into play. He was right. After all, it was a port and there were enough research parks. So that's what we did."

River Pioneers

The capital city of Magdeburg has made a good start: The former commercial port has become the Port of Science. The concept set forth in a two-stage "master plan" was adopted. Construction finally began in 2004: The Fraunhofer Institute for Factory Operation and Automation erected its expansion facility, the Virtual Development and Training Centre, where it chiefly pursues research in digital engineering. "That was the spark. Fraunhofer acted as a source of inspiration, a magnet. Once the start had been made, other collaborative partners, other companies and research organizations, which wanted to be close to the flair of the spirit of research and progress, also turned up. The rest will surely be coming: cafés, restaurants and everything that entails," says Trümper. The opening of the VDTC in 2006 was followed by the next opening in 2007: Two old grain silos were converted and reopened as the "Denkfabrik". Today, it is home to the Institut für Automation und Kommunikation



How the entrance area of the Port of Science is supposed to look one day. Graphic: SMAQ with HL-Landschaftsarchitekten Berlin

ifak among other organizations. In 2009, another new building, the Elbe Office, opened and is home to part of GETEC and Telekom, among others. In 2010, Otto von Guericke University, ifak and the Fraunhofer IFF jointly opened the Saxony-Anhalt Galileo Test Bed, a state-of-the-art development laboratory for applied logistics and transportation and one more silo in which future technologies are being developed.

The Port of Science is already lively and full of people several times a year. On the Long Night of Science, arguably the most prominent event, research organizations open their doors to inquisitive visitors. Hundreds of visitors stream out of blue Science Buses at the hub of the smartest night of the year. The space before the large port basin is full of tents in which knowledge and bockwurst are served entertainingly. Thousands of people stroll from one institute to the next and experience the adventure of research. The Long Night is over, though, and quiet returns to the Port of Science for the time being.

The Achilles' Heel of the Urban Renewal Project

The Port of Science has developed well until now – just as planned. Not much new has happened recently, though. Is the urban renewal project stagnating?

We regard the two large, imperial era silos in front of us. Not renovated, they are conspicuous in the midst of the cultural heritage property. An investor is in the starting blocks but the building code is proving problematic: A permit to build apartments is not foreseeable at present. We hear the reason: a constant deep rumbling before the two silos. The rumbling drifts over from the Magdeburger Mühlenwerke day and night. The difficulty when a site that has evolved over many years is now supposed to be used differently becomes evident: This was always a commercial zone in north Magdeburg and the mills have rumbled to this day without disturbing any residents.

That is the Achilles' heel of the Port of Science: If a solution to reduce the noise is not found, the idea of residences in the old grain silos will probably have to be abandoned. City life will only settle in with people, and the rumbling is thus holding back the Port of Science's revival. Commercial use of the two hulking buildings is hardly imaginable. They are far too large. At the most, one or the other entrepreneur might locate on the bottom two floors. Ideally, this would be somebody dealing closely with research. Trümper and I move on.

Living History Museum for Industrial Heritage

The northern Port of Science, on the other hand, is already significantly closer to its intended use. Under the open sky and quite as envisioned, the planners' ideas for attractive recreational activities are visibly becoming reality. One already runs into tourists here. They are looking for the "Gustav Zeuner", the only surviving chain steamer on the Elbe. The



A research biotope: the VOTC at Magdeburg's Port of Science. Photo: Anna Mahler

riveted steel ship resides in the old port basin. Together with the GISE GmbH, the Verein zur Förderung der Magdeburger Hafengeschichte had it restored just like it had done with the Hoppe family's two revolving cranes and small vertical-lift bridge from 1893. They keep the memory of the commercial port's past alive with technical nostalgia. The "Magdeburger Eisenbahnfreunde" in the neighborhood give historic trains a new home. Creaking and puffing machines traverse the

rails in the Port of Science from time to time. Part of a cultural heritage collection, they are supposed to be preserved as far as possible.

The mayor would like to see the recreational activities increased, thus making the premises livelier. "But that will have to be done with private investors alone. We will probably not be putting money into more athletic facilities in Magdeburg," he explains. Apparently, that is not a problem though, because a canoe rental is already interested in a lot on the bank right behind the Galileo Test Bed. Once the old asphalt plant there has disappeared, there will be plenty of room for water tourism.

Elbe flooded the entire area quite recently. The water was 1.90 m deep in the research center's underground garage in June of 2013. Cresting at 7.50 m, the floodwaters were higher than in 2002 and nature displayed its power. Ducks squatted on the sandbags. Fish swam by my feet when I photographed the flooding here, tramping in rubber boots. Major damage did not occur. After all, the engineers and architects had adapted the building to the conditions of the terrain. The VOTC is thus safely located in the middle of the port like a pearl on a velvet cushion.

At Charles-de-Gaulle-Platz, we follow the rails further southward. The planners have again left some more room for nature here. Huge lavender bushes grow between the rails. Butterflies and bumblebees swarm among the countless small blossoms facing the sun. The Port of Science is a brilliant green. The Elbe floodplains give it its distinctive character.




For information on the "Gustav Zeuner", visit: www.kettendampfer-magdeburg.de

The Magdeburger Eisenbahnfreunde website: www.mebf.de

Research Biotope

We turn southward. Our stroll takes us along the port basin next to the Denkfabrik and the Virtual Development and Training Centre. The



Fraunhofer acted as a source of inspiration, a magnet. Once the start had been made, other collaborative partners, other companies and research organizations, which wanted to be close to the flair of the spirit of research and progress, turned up. 

Dr. Lutz Trümper, Mayor

When the Excavators Start Rolling Again

If everything goes as planned, the excavators will start rolling in the south part of the Port of Science next year. The lots and the old silos behind the Elbe Office have been sold to an investor. The silos are supposed to be converted. New buildings for offices and some apartments are supposed to go up on the open plots on the bank of the Elbe.

Having nearly reached the end of our stroll, we arrive at the current entrance to the Port of Science on Sandtorstrasse. All sorts of cars and trucks race by toward the industrial area and highway entrance in north Magdeburg. The street cuts the area off from the university campus, the Max Planck Institute and the Fraunhofer IFF's main building. As it is now, the Port of Science is waiting for the city to build a connecting road, which

will bring together what belongs together. A roundabout named Sandtorplatz has been drawn in the master plan. Until quite recently, an electrical substation still hummed along on the large field here at the entrance. Now, it is a brilliant green. The color sends a signal that everything is still possible here – enough space for future rerouting of roads or even other developments.

I now want to know how long it will take until the master plan for the Port of Science is implemented and the area has been redesigned. "As far as the former commercial port up to here at Sandtorstrasse is concerned, that is, the first stage of development, it will probably still take ten years," estimates the mayor. "But surely even up to twenty years will pass until the plan is implemented in its larger dimension. The current debate about the higher education budget in Saxony-Anhalt may well scare investors away," Trümper fears. "Until recently, we had no lack of interested parties. If the site is questioned now and we abandon our good prospects, we are going to need to be even more patient."

Magdeburg: Closely Linked with Technology and Engineering Earlier and Today

Time to say goodbye to one another. Trümper shakes my hand and pauses briefly: "Magde-

burg has always known how to keep renewing itself. Even when there were setbacks in its history time and again. Yet the city never lost its close ties to engineering and applied sciences. This is still a world famous center of mechanical engineering, even though the companies have changed and bear different names. A university shaped by engineering, a Fraunhofer Institute for production engineering, numerous other research organizations and the manufacturing industry are closely interlinked. This idea can also be transferred to the Port of Science – knowledge is raw material used by engineering." Trümper convinces me with his confident smile.



Dr. Dieter Scheidemann

Dezernat für Stadtentwicklung, Bau und Verkehr der Landeshauptstadt Magdeburg

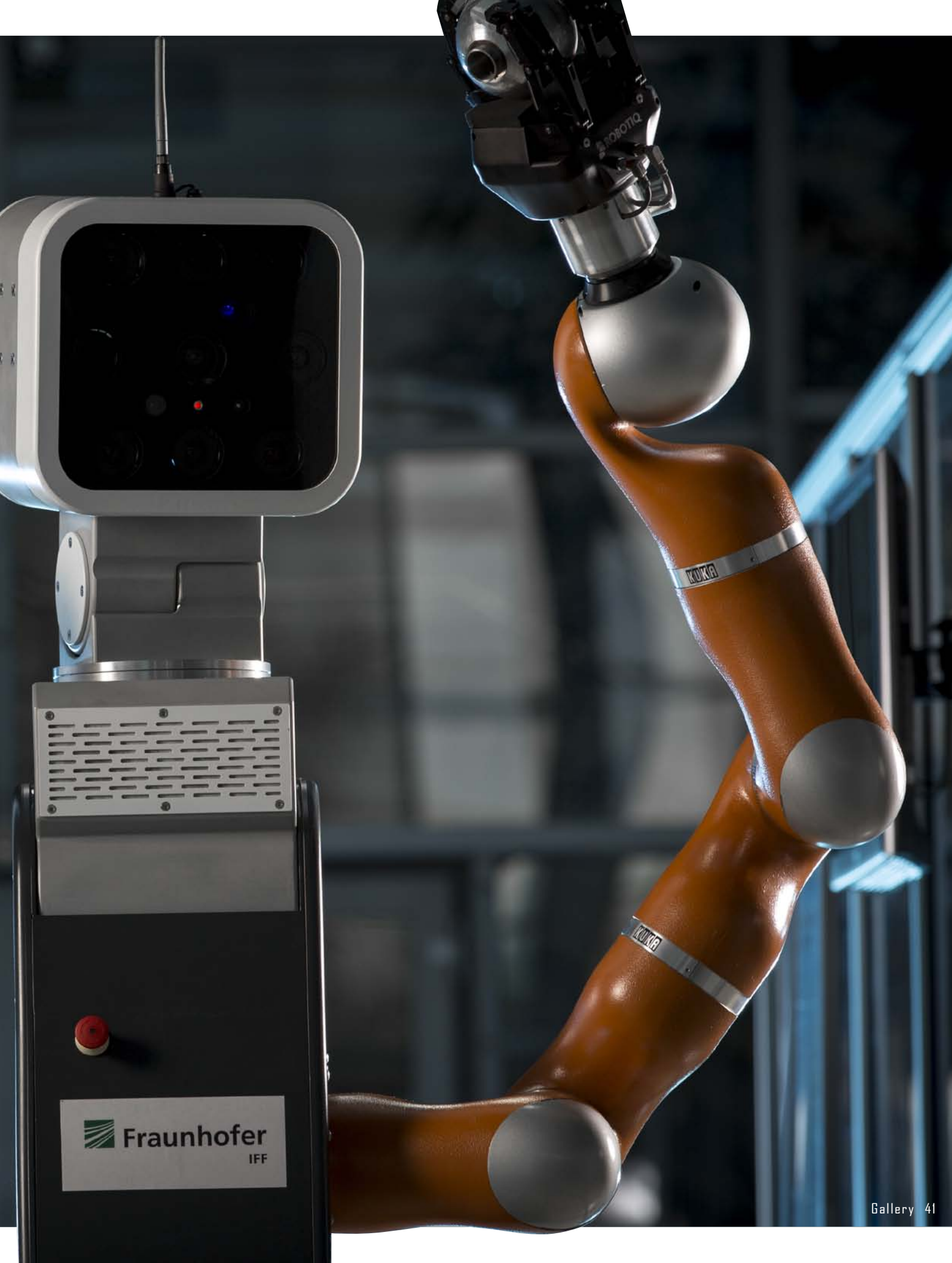
An der Steinkuhle 6 | 39128 Magdeburg


Phone +49 391 540-5440

dieter.scheidemann@br.magdeburg.de

Alexander Schaefer is convinced that robots will be even more versatile in the future than they already are today. Then, we will work even more closely together with them in many areas of life - in industry, healthcare and even in everyday life. Together with his colleagues in the Robotic Systems Business Unit, the young engineer is working on the development of new, complex robotic systems.

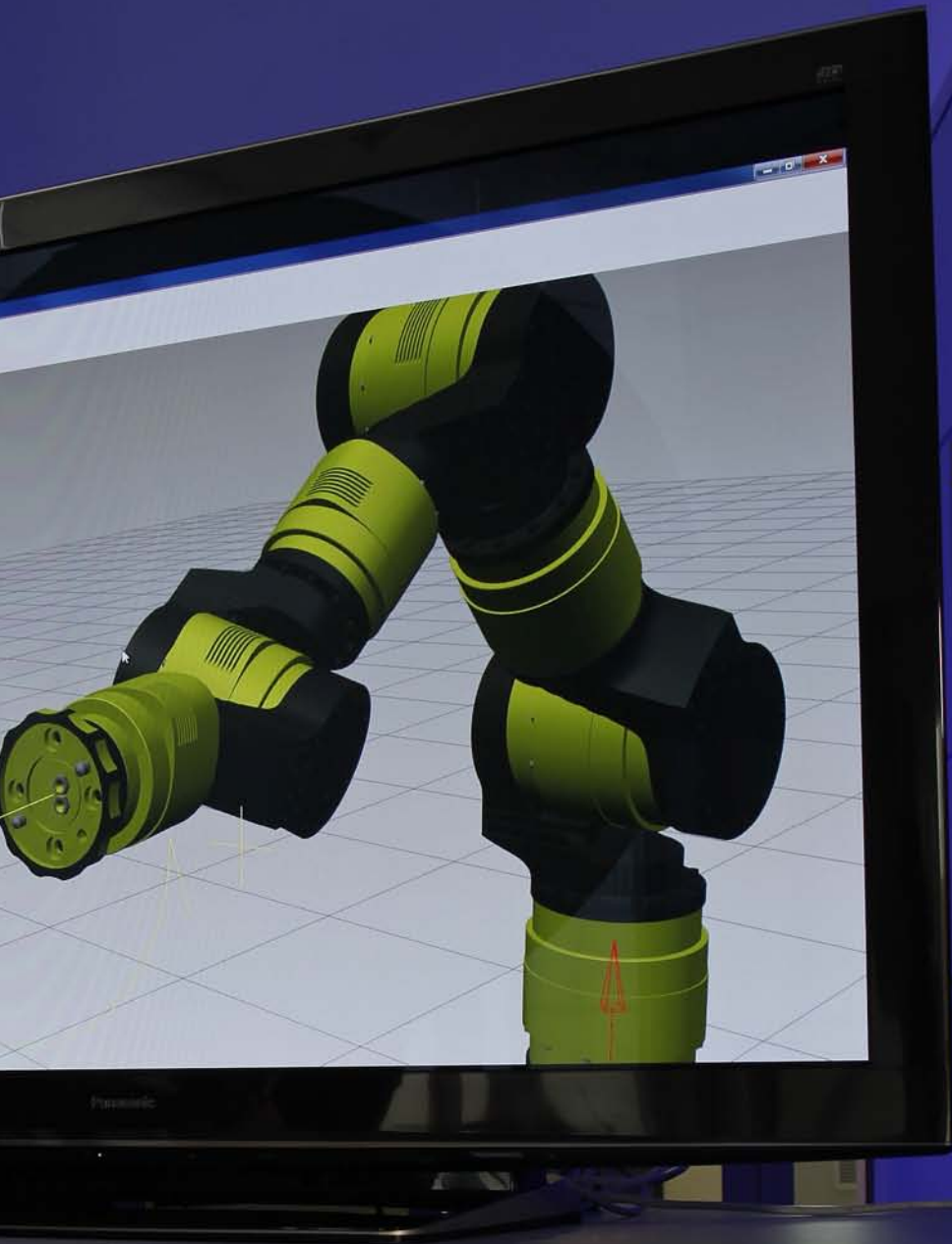




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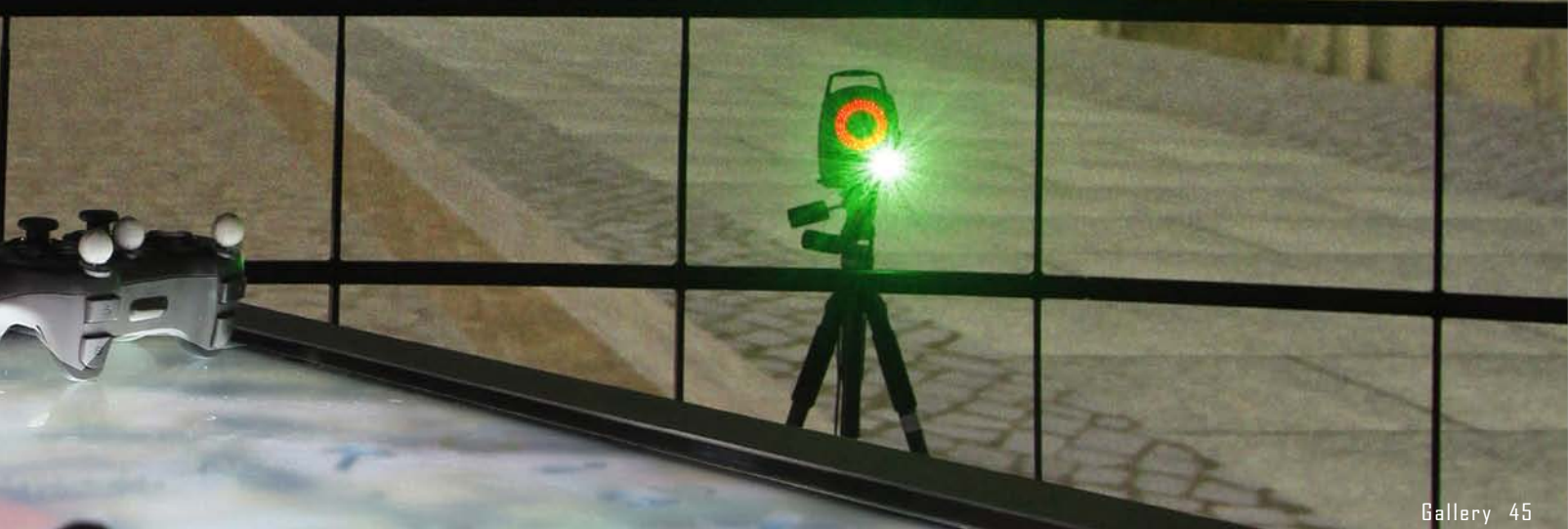
A man, Eric Bayrhammer, is sitting on a bench in a virtual reality environment. He is wearing a grey sweater over an orange collared shirt and blue jeans. The background is a blue-lit wall with a grid pattern and a large screen displaying a 3D model of a green robotic component. The screen also shows a toolbar with icons for 'Anwendung', 'Steuerung', 'Kollisions', 'Licht', and 'Info'.

Eric Bayrhammer from the Virtual Engineering Business Unit is well versed with the methods and tools of virtual product development. Together with his colleagues, he developed a virtual configuration and test environment for modular robotic systems for Schunk.



Nicole Mencke is a specialist in so-called computational visual-istics and the virtualization of ur-ban structures at the Fraunhofer IFF in Magdeburg. Among other things, the engineer collaborated on virtual transmission line plan-ning for 50 Hertz Transmission GmbH.





Eyk Flechtner: A Planning Specialist in Demand

Eyk Flechtner is essentially one of the Fraunhofer IFF's veterans. The manufacturing engineer witnessed the founding of the institute in 1992 as a student assistant. He still remembers well how the founding team of around thirty set itself up in a small, dilapidated building on Martinstrasse in Magdeburg and commenced its work. "All in all, the work conditions were quite adventurous in the beginning. But it improved very quickly," recalls the now forty-four year old. After earning his degree early at Otto von Guericke University, the newly-made engineer started working full-time at the Fraunhofer IFF in 1995. His Diplom thesis dealt with the organization of process flows in plants, a topic that has never lost its hold on him at the Fraunhofer IFF.

Eyk Flechtner just returned from one of his biggest projects in recent years. He was involved in the planning and construction of a new factory for Carl Zeiss Meditec AG in Oberkochen in Baden Württemberg for three years. A logistics expert, he also worked on analyzing and developing processes and planning the factory and facility. He can now

add this experience to his portfolio, which includes other unique projects such as the construction of the Fraunhofer IFF's Virtual Development and Training Centre VDTC. He acted as the construction supervisor, coordinator and primary contact for all aspects of its planning. Another of his favorite projects was a city logistics concept for the city of Magdeburg. "That was about optimizing downtown delivery traffic. We devised comprehensive concepts to plan and reduce traffic. The project lasted several years and was very multifaceted. That was a lot of fun for me," reveals Flechtner.

Unfortunately, the father of two daughters doesn't have much time for hobbies these days. When he's not traveling the world for the Fraunhofer IFF, he prefers spending his free time with his family. A passionate model builder, he used to develop and build fully functional model ships, planes and cars all on his own. He started during the GDR. That was even more difficult than today. "Models have to function," he says firmly and fully the engineer. "But, above all, getting the remote controls for vehicles was a real task at that time.



Eyk Flechtner (right) is a factory and process planning specialist. Here, he is discussing optimizations of product flows in a plant with Norman Scheider, Director of Logistics at Salutas Pharma GmbH in Barleben. Photo: Dirk Mahler

And what does the future hold? "At present, we are planning a lot with different partners at home and abroad. There will be one major project or another again." The planning specialist will surely also be in demand again. (mar) ■



Dr. André Naumann enjoying the traditional doctoral initiation at the monument to Otto von Guericke following his successful defense. Photo: Privat

A Doctorate in Magdeburg Beats Building Rockets

That is probably what Dr. André Naumann was thinking when he enrolled at the university in Magdeburg. Dr. André Naumann is now an expert on communications in smart grids and the requisite interfaces. After all, that was the topic of his dissertation, which he successfully defended at Otto von Guericke University in September of 2012. The

newly-made doctor and researcher has been working at the Fraunhofer IFF since January of 2013 where he is intensively researching electric vehicle networks and electrical grids.

André Nauman grew up in Sassnitz. He started studying electrical engineering at the university of applied sciences in Wilhelmshafen in 2003. He completed a parallel training program in mechatronics at EADS in Bremen. "A very exciting time," recounts Naumann and tells how he worked on the upper stage of the ARIANE 5 carrier rocket and also performed pneumatic tests on it.

André Naumann wanted to earn his doctorate, though. So he came to Magdeburg in 2007 to enter the electric power systems program. Upon completing his Master's, he earned his doctorate under Prof. Zbigniew A.

Styczynski as he had planned. "The move to Magdeburg was a good decision," says Dr. Naumann, pleased. "At the Fraunhofer IFF, I can pursue research on a great team and in a still young field. That is what I wanted – ARIANE, on the other hand, is already a finished product.«

In his free time, Dr. Naumann enjoys jogging along the Schrote. He likes all the green and the "airiness" of the capital. "it's quite different in Bremen – much closer together," explains the young doctor. He still returns to his home in Rügen now and then, at least for one vacation each year. How fortunate that he always has something from home with him the rest of his time in Magdeburg – his girlfriend came with him and is studying medicine at Otto von Guericke University. (akw) ■

Professor Michael Schenk Now New Chairman of the Fraunhofer Group for Production and Member of the Fraunhofer-Gesellschaft's Presidential Council

The Fraunhofer-Gesellschaft's Group for Production is getting a new chairman. Prof. Michael Schenk, Director of the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg will hold this position from October 1, 2013 to September 30, 2016. In this function, Professor Schenk is also a member of the of the Fraunhofer-

Gesellschaft, and thus involved in issues of Fraunhofer policy and helping to implement the executive board's decisions.

Seven Fraunhofer Institutes collaborate in the Fraunhofer Group for Production to collectively advance production-driven research and development. Pooling the individual

institutes' diverse expertise and experience gives clients from industry, retail and service sectors holistic solutions from one source. The Fraunhofer Group for Production specializes in product development, manufacturing technologies, manufacturing systems, production processes, production organization and logistics. (mar) ■

Dr. Przemyslaw Komarnicki Is Full of Energy

Przemyslaw Komarnicki thinks of two things right away when he hears the German word "Netz", which means net and grid: Soccer and his job at the Fraunhofer IFF. No wonder, for the engineer from Poland is a passionate soccer player and is responsible for the topic of electric grids at the research institute in Magdeburg. He came to Magdeburg to earn a dual Diplom degree in electric power engineering from Otto von Guericke University Magdeburg and Politechnika Wroclawska, one of the largest polytechnical universities in Poland.

"It was hard but worth the effort," sums up the engineer, who, in 2004, was one of the first to earn a dual Diplom degree from the universities in Magdeburg and Wroclaw. Upon graduating, Przemyslaw Komarnicki found an ideal employer for himself in the Fraunhofer IFF, but not only because of the institute's soccer team that allowed him to pursue his passion with his new colleagues. "It was also an excellent opportunity to combine innovative research and concrete practice," he says.

Since the young researcher is full of energy, it is no surprise that he started working on his doctoral dissertation right after starting his

Together with his team, Dr. Przemyslaw Komarnicki developed the test version of the new, smart charging station for electric vehicles at Magdeburg's Port of Science. Photo: Viktoria Kühne



job at the Fraunhofer IFF. Naturally, it dealt with energy, specifically "Applying Highly Precise Synchronous Measurements to Improve the Operation of Distribution Grids." The talented researcher completed it and finally held his mortarboard in his hand when he was just twenty-seven.

Today, the now married family father, is a recognized expert on reliable integration of renewable energies in electrical grids. Together with his colleagues, he is developing new models and control systems for smart grids. The team primarily specializes in the development of energy management systems

for supply infrastructure convergence. The concept they developed is so good that Magdeburg now enjoys an outstanding reputation nationwide as the center for research on electrical vehicle networks.

Dr. Komarnicki has returned to Otto von Guericke University Magdeburg. Among other things, he heads the Grid Protection and Equipment Group in the Department of Electrical Grids and Alternative Sources of Electricity. (mar) ■

HawkSpex Reveals Plants' Hidden Insides



Hans-Christian Klück developed a small and flexible hyperspectral camera. The camera delivers an overview of many ingredients present in plants. Photos: Dirk Mahler

Earlier, it was just corn to him but, today, Hans-Christian Klück has to smile when he bikes past a cornfield. The young researcher knows much more about corn since he has been working at the Fraunhofer IFF. He has often used a hyperspectral camera to look inside corn, wheat or other crops and analyze their nutrient content. Now, he has even developed a compact hyperspectral camera of his own.

Everything began with his Diplom thesis when Hans-Christian Klück came to the Fraunhofer IFF as a student assistant in 2010. At that time, the native of Wittenberg was still pursuing an undergraduate degree in electrical engineering at Otto von Guericke University. At the Fraunhofer IFF, he worked in the Biosystems Engineering Expert Group on the Agrover, a test vehicle equipped with hyperspectral cameras. Fraunhofer researchers drove it over fields used for farming to take spectral pictures of different crops. The data were evaluated later and delivered findings about the condition of plants, their water and nutrient content or fungus infestation.

Since commercial hyperspectral cameras can only be adapted to specific customer requirements to a limited extent and are also quite expensive to buy, the researchers resolved to develop a system themselves. It was supposed to be easier to use and, above all, more flexible and have individually configurable functions. The outcome is called HawkSpex and has been patented: A small hyperspectral camera distributes light continuously in order to focus its spectral bandwidth on a digital camera's detector chip. The data recorded are transmitted to a computer and can then be evaluated. HawkSpex weighs about three kilograms and fits in a ladies' shoebox. The hyperspectral system can be installed in production facilities more easily and, above all, less expensively so that constituents can be analyzed automatically.

"At the Fraunhofer IFF, I especially like that my work is always focused on a practical application. Our clients come primarily from agriculture and plant research. That is why we are very often underway outdoors, on fields or even in greenhouses," says Hans-Christian Klück, who visibly enjoys his work. (akw) ■

Young Researcher:

Sebastian Möser Is Managing a Major Project with LANXESS

"Only if the client comes back, was a project really good." Sebastian Möser, thirty years young and project manager at the Fraunhofer IFF, is convinced of this. He and his team evidently did a good job collaborating with their partner LANXESS: They developed and built in record time a new plant that produces reverse osmosis membrane elements for a water treatment system. They are now working on their third major development for the specialty chemicals company, a fully automatic system that trims the filter elements. All of this is being used at its new facility in Bitterfeld. Their collaboration may even go further in the future: "There are still many processes that we can change sustainably with our methods," says the engineer with certainty.

Born in 1983, Sebastian Möser comes from Dessau. He came to Magdeburg to study mechanical engineering, specializing in design and development. He completed his mandatory internship in the development division of microscope manufacturer VEECO Instruments in Santa Barbara, California. Back in Magdeburg, he wanted to return to research and thus started as a student assistant at the Fraunhofer IFF in 2007. His Diplom thesis took him abroad again, though: Sebastian Möser worked for machine tool manufacturer Hilti in Liechtenstein. Sebastian Möser soon found his way back to Magdeburg in 2009. This time, he returned to the Fraunhofer IFF as a research manager in its Virtual Engineering Business Unit and earned his Master's degree while working on projects. "Managing research with LANXESS, I was quickly entrusted with great responsibility in an industry project. You can only get such an opportunity at Fraunhofer," explains the young researcher proudly.



Sebastian Möser with the equipment that manufactures membrane filtration elements. LANXESS contracted its development.

Sebastian Möser has other talents, too: He spends his Saturdays restoring classic American cars with his father. Junkers that arrive at the two tinkers' garage, are soon turned into gleaming gems. The two have already earned the license plate designation of "H" for classic for three of their restored cars. They couldn't part with any of them, though, and Sebastian Möser himself drives a classic car, a perfectly restored 1967 Mustang. (akw) ■

A New Process Engineer at the Fraunhofer IFF

The members of the Fraunhofer IFF's Process and Plant Engineering Business Unit have received reinforcement. Dr. Nico Zobel, previously at the Technische Universität Berlin, has been on business unit manager Matthias Gohla's team since August 2013.

The native of Berlin is working here on concepts for the recovery of energy from waste. In particular, the challenge of obviating the tar it contains interests the researcher. One idea is to burn in a motor the tar produced during gasification. Doing this requires developing special processes, though. The new technology could be applied to recover energy from household waste, sludge from sewage treatment plants or chicken manure. "The Fraunhofer IFF is the perfect place to develop such processes. It has automated gasification plants to do so. Neither universities nor companies have such research plants to this extent," says Dr. Zobel, pleased about his new place of employment. "I can do what I want to do professionally optimally here."

This made leaving home easy for the process engineer. After all, he has spent the longest period of his life here. Born in 1976, he grew up in Berlin. He started his undergraduate studies in process engineering at the technical university there in October of 1997. He traded the air in Berlin for the usually sunny skies of Chicago for two semesters. He easily could have continued studying in America but he came to appreciate Europe from far away and was happy to return. "Berlin is a cosmopolitan city and doesn't have to hide, either culturally or in any other respect. I prefer Germany, we're more down-to-earth.," says Dr. Zobel, describing his experiences.

He wrote his Diplom thesis at Daimler Chrysler in Ulm in 2003. The young researcher returned to process engineering to earn his doctorate at the Technische Universität Berlin. At the same time, he was working at the Fritz Haber Institute. Upon completing his degree in 2007, he remained at the university. He was actually contemplating an academic



Dr. Nico Zobel is enjoying his new work in the Process and Plant Engineering Business Unit.

career until he met Dr. Matthias Gohla, manager of the Fraunhofer IFF's Process and Plant Engineering Business Unit, in Magdeburg, who brought him to the Fraunhofer Institute.

In the meantime, the researcher has moved into an apartment in Magdeburg-Stadtfeld with his wife and three children. The family especially enjoys the high quality of life: "We would never have been able to afford an apartment in Pankow as big the one we have now. What is more, there is much less traffic and far fewer people are on the streets. The children are enrolled in a newly renovated daycare center nearby. Our biggest boy likes his school very much," says Dr. Zobel, raving about his new home. (akw) ■

Fraunhofer IFF Staffers Fight the Flood

Impressions from June 5 to 9, 2013

A flood surge like none the residents of the capital had ever experienced approached Magdeburg in June of 2013. Forecasts were corrected upward daily and sometimes hourly. With a high water mark of 7.50 m, this flood far surpassed the so-called flood of the millennium of 2002.

The need for much preparation for protection became clear very quickly. One of the endangered areas was the Port of Science where the Fraunhofer IFF's Virtual Development and Training Centre VDTc is located.

The water level rose rapidly from Thursday, June 6 onward. The fire department set up its command center on the employee parking lot behind the VDTc. The central sandbag filling station for all of Magdeburg

was located a little further north, behind the Denkfabrik. The emergency response teams were not enough, though: Masses of water approached far too quickly. The bed of the Elbe River had overflowed on its east bank.

A circular email from institute management and diverse posts in social networks brought many volunteers. Countless helpers, including many research managers from the Fraunhofer IFF, students from Otto von Guericke University and volunteers from other nearby research organizations filled thousands of sandbags together.

On Friday, June 7, the VDTc had to be evacuated toward 10 a.m. Facility technicians stayed behind and protected and watched over the building around the clock. So much

water had seeped through the sandbags by early evening that emergency response leaders vacated the entire premises. From then on, it was very quiet in the Port of Science. The high water mark was reached there on Sunday. The VDTc and the Denkfabrik were completely surrounded by water and the area was cordoned off. Then, the dams near Fischbeck and Aken broke. This catastrophe for the people living there was the all-clear for the VDTc. The water steadily receded. Paths, streets and lawns covered by a brown crust of dried sludge began appearing on Monday. Cleanup commenced immediately. The 16th IFF Science Days, the Fraunhofer IFF's annual conference and showcase of its work, started just a few days later on June 18 as if nothing had happened. (akw) ■



Wednesday, June 5: Briefing on the preparations to protect the VDTc from flooding: Fire safety supervisor Frank Mewes, Marek Myszor from facility management, Thorsten Kelm, in charge of protecting electrical systems, and Marcel Wipper, in charge of protecting computer systems.



Countless helpers, including many research managers from the Fraunhofer IFF, students from Otto von Guericke University and volunteers from other nearby research organizations filled thousands of sandbags together.

Thursday, June 6: Marcus Kögler and Ling He filling sandbags.





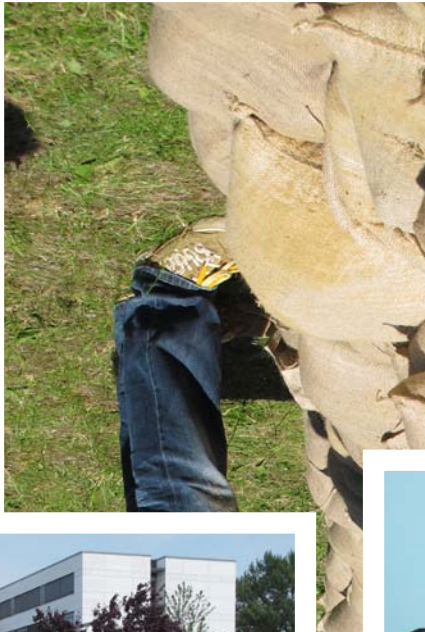
Josephine Herpich, Vadym Bilou, Marco Franke and Oliver Wienert lent a hand.



Thursday, June 6: Many of the Fraunhofer IFF's research managers and student assistants, including Thomas Seidl, Rüdiger Mecke, Torsten Böhme, Andriy Telesh and Henry Schöning, helped fill sandbags.



The Fraunhofer IFF's research managers and student assistants secure the VOTC's underground garage's openings toward the Elbe against flotsam with sandbags. Andriy Telesh and Gunnar Strauss were there along with some thirty other helpers.



The entrance to the VOTC's underground garage. The water in it reached around 1.90 meters on Sunday.



Sunday June 9: High water mark in the Port of Science. The VOTC and the Denkfabrik were fully surrounded by water. Serious damage in the VOTC was prevented, though.



The facility technicians secured the seemingly abandoned VOTC around the clock. In teams of two, Lutz Winzerling and Marek Myszor switched off with Frank Grabolle and Maik Dähne (not pictured).

All people are named from l. to r. | Photos: Anna Mahler, Annelie Mrawetz

The Record Flood of 2013

Impressions of Magdeburg's Port of Science from June 5 to 9, 2013

Editorial Notes

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Prof. Michael Schenk

Sandtorstrasse 22 | 39106 Magdeburg | Germany
Phone +49 391 4090-0
Fax +49 391 4090-596
ideen@iff.fraunhofer.de
www.iff.fraunhofer.de

Editorial staff: Anna Mahler, M.A. (akw);
René Maresch, M.A. (mar);
Dr. Janine van Ackeren
presse@iff.fraunhofer.de

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10/2013 Fraunhofer Institute for Factory Operation and Automation IFF

Outlook

Meet up with researchers from the Fraunhofer Institute for Factory Operation and Automation IFF at these events.

October 16, 2013

2nd Electric Vehicle Day, Magdeburg

October 16 – December 4, 2013

10th Virtual Reality Guest Lecture Series, Magdeburg

October 23 – 25, 2013

30th International Supply Chain Conference, Berlin

November 7, 2013

20th Cooperation in Plant Engineering Industry Working Group Meeting, Frankenthal

November 7 – 8, 2013

11th Plant, Occupational and Environmental Safety Conference, Magdeburg

November 7 – 8, 2013

2013 International Conference on Virtual and Augmented Reality in Education, Puerto de la Cruz, Teneriffa

November 20 – 21, 2013

Optical 3D Measurement Systems for Quality Assurance in Production Seminar Series, Magdeburg

November 20 – 22, 2013

Hafenhinterland-Konferenz, Magdeburg

November 21, 2013

18th VDI Symposium: Energiewirtschaft und Umwelt, Gardelegen

November 26 – 29, 2013

EUROMOLD Trade Fair, Frankfurt am Main

November 28 – 30, 2013

12th Annual CURAC Conference, Innsbruck

December 10, 2013

Final ValueSec Conference, Brussels

February 25 – 27, 2014

LogiMAT International Trade Fair, Stuttgart

March 6 – 7, 2014

8th Plant Engineering of the Future Conference: Efficiency in the Factory and Plant Life Cycle, Magdeburg



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8TH PLANT ENGINEERING OF THE FUTURE CONFERENCE

EFFICIENCY IN THE FACTORY AND PLANT LIFE CYCLE

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MARCH 6 AND 7, 2014, MAGDEBURG