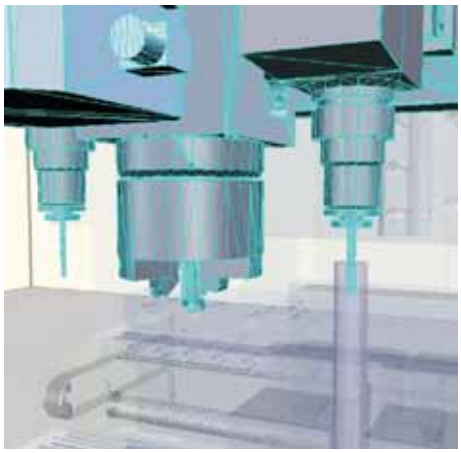
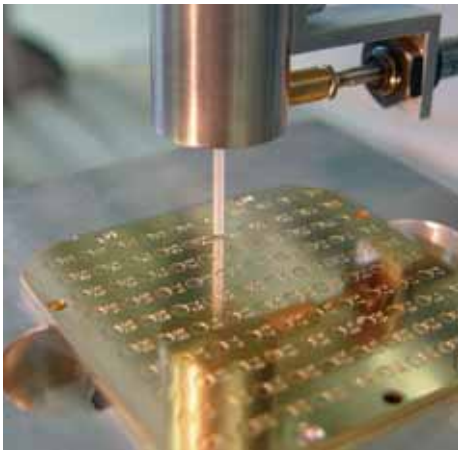
Fraunhofer
Institut
Fabrikbetrieb
und -automatisierung

Achievements and Results
Annual Report 2004/05





Achievements and Results
Annual Report 2004/05

Contents

Foreword

Dear Ladies and Gentlemen,
Dear Business Partners and Friends,

In this annual report you will find Fraunhofer IFF products and developments from the years 2004 and 2005. The foundation of our institute's success is its rigorous orientation toward our clients' needs and, based on this, our development of new products and services geared toward the market. At the same time, our researchers analyze technological developments and their innovation drivers. This enables us to develop new competencies at an early stage and to combine them with one another throughout the institute.

This strategic planning is a central management instrument at the Fraunhofer IFF. It has governed the development of the Fraunhofer IFF so far and will also shape its expansion through the Virtual Development and Training Centre (VDTC).

We were already using the PEO model in 1997 to orient ourselves toward the value added chain "Plan – Equip – Operate". This enables us to develop services and products along this value added chain.

Taking manufacturing in networks as our starting point, we devise solutions and services for cooperating enterprises, the management of supply chains and the organization of such networks.

A technology audit in 2004 put the strategic planning of the Fraunhofer IFF to the test. Eight external auditors employed the Fraunhofer-Gesellschaft's standard procedure to evaluate the institute's strategic plan. IFF researchers gave presentations on their areas of expertise and demonstrated their products and their services during inspections of our labs and testing facility.

The auditors gave the Fraunhofer IFF extremely positive overall marks. They validated its strengths and made recommendations for its future development. From the perspective of existing core competencies and the additional boost to its image from the VDTC, the Fraunhofer IFF has excellent potential for success in the future. The matrix of the core competencies identified in the individual fields of business were presented to the Advisory Board at its 2005 meeting.

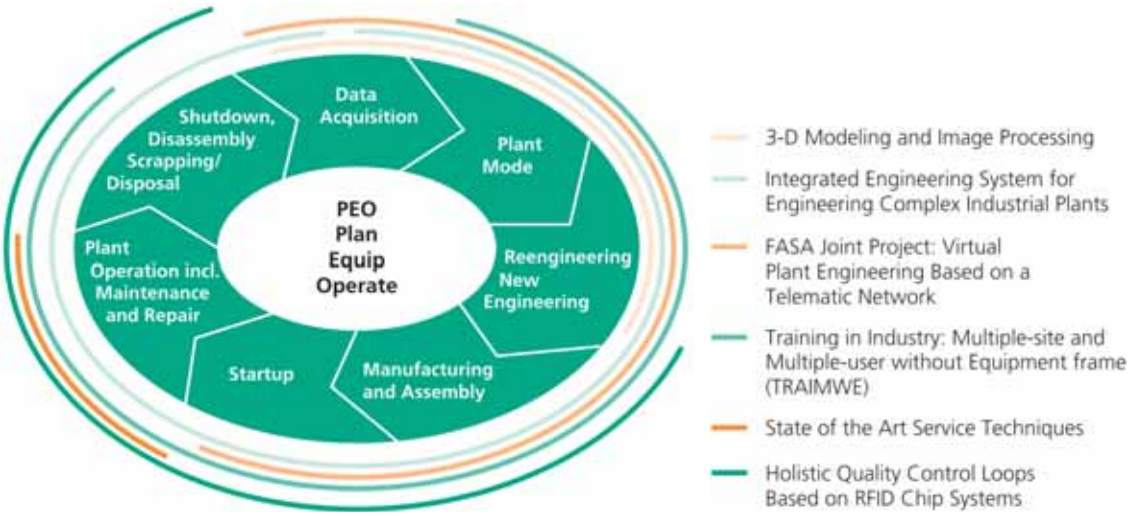


Figure 1: Since 1997, strategic planning at the Fraunhofer IFF has been oriented along the value added chain "Plan – Equip – Operate".

Close cooperation between Otto von Guericke University and the Fraunhofer IFF ensures applied basic research is transferred to applied research for industry. Moreover, we are superbly networked with the European and international research communities. The integration of the Fraunhofer IFF in teaching and training at the university supports active development of future researchers. Thus, the Fraunhofer IFF has already asumed a formative role for Magdeburg as a center of science and research and will continue to develop its image with its expansion through the VDTC. The symbolic groundbreaking for the VDTC took place in November 2004. The cornerstone was laid in June 2005 and the topping out ceremony in December of the same year marked the completion of the shell of the building. We are pleased to be able to inform you already that the ceremonial opening of the VDTC will take place on November 22, 2006.

We are proud that the VDTC was selected to be a location in the "Land of Ideas" on this day. The city of Magdeburg will simultaneously bring its "Year of Science" to a close on the same day with a festive event at the VDTC.

I wish you an engrossing and inspiring trip through two years of institute history with examples of applied research and international projects. We are confident that by rigorously updating our strategic approaches and implementing them in projects with our motivated staff, we have laid the foundation for further succesful collaboration with our clients.

Yours sincerely,

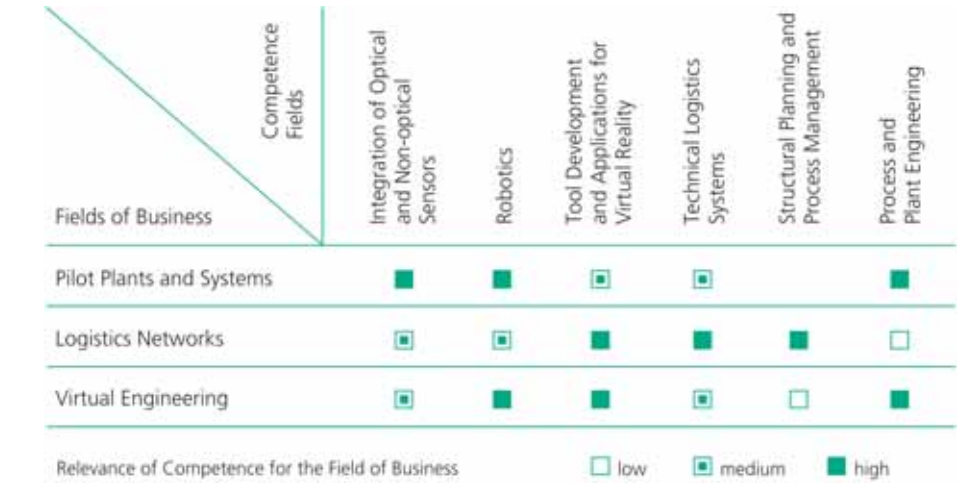


Figure 2: Matrix of fields of expertise and their significance for the defined fields of business.

Figure 3: View of the shell of the VDTC. The circular VR testing facility outfitted with a 360° projection system can already be made out in the foreground.

Prof. Michael Schenk
Director

Mission

The Fraunhofer Institute for Factory Operation and Automation IFF is an autonomous research organization in the Fraunhofer-Gesellschaft network.

As a regional, national and international partner, it endeavors to use its applied research work to make a contribution to the direct benefit of the economy and the advantage of society.

Technologically, the institute is geared toward conceiving, developing and producing innovative and customer-oriented solutions in the fields of

- Virtual Development and Training
- Logistics
- Automation
- Production and Plant Management

In the process, the Fraunhofer IFF works oriented toward the market and operates globally.

To meet the demand for holistic solutions, it is integrated in an international research network of partners from the research and business communities.

Work at the Fraunhofer IFF is actively supported by a network of associated university educators and leading industry representatives so that internal creativity and external impulses ensure the exchange of knowledge and experience is ongoing.

The Fraunhofer IFF actively represents its interests in national and international bodies in its professional fields and thus significantly shapes the processes of innovation in the state of Saxony-Anhalt.

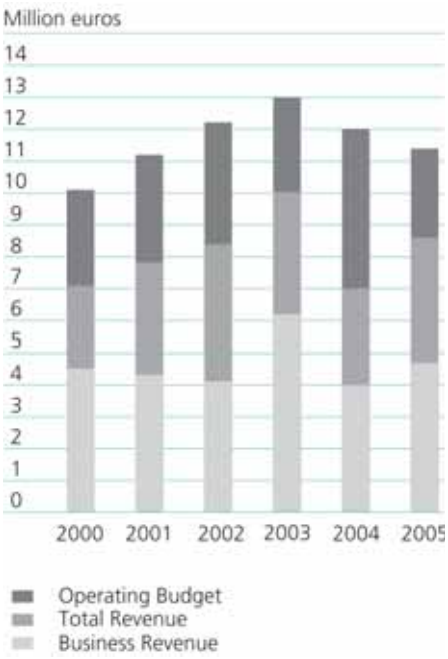
As a research service provider based in Saxony-Anhalt, one important concern is the development of future generations both for regional business and for demanding positions in research. Thus the Fraunhofer IFF fulfills a valuable social responsibility.

Striking a balance between economy and ecology as well as implementing rules of best scientific and technical practice are the basis of our entire staff's work and an individual responsibility.

Our researchers' combination of technical-technological expertise and soft skills are reflected in the quality of our products and services.

Our researchers work in interdisciplinary teams and cooperate closely with our clients. Such collaboration is typified by mutual trust, integration as partners, practical application and user orientation.

The Institute in Numbers



Operating Budget and Earnings Trend

In 2005, expenditures in the operating budget totaled 11.4 million euros. Total revenues were 8.6 million euros. Business revenues totaled 4.7 million euros.

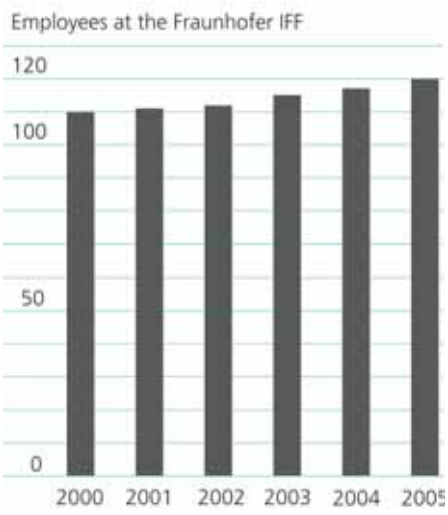
Investment Budget

Investments totaling 4.1 million euros were made in 2005.

Facilities

The Fraunhofer IFF in Magdeburg uses 5,000 m^2 office space and high-tech EDP laboratories and conference rooms. A testing facility of 1,300 m^2 houses and provides technologies – virtual reality, industrial image processing, robotics, alternative energy production, rapid prototyping – for research and development.

The hardware and software at the Fraunhofer IFF encompass tools and environments for the application of geographic information systems, for idea generation and assessment, for information and communications management, for interactive factory and system engineering, for multimedia communication and for software development.



Personnel Development

At the end of 2005, 120 researchers were working at the Fraunhofer IFF. Our researchers are predominately engineers and industrial engineers. Degree holding computer scientists, mathematicians, physicists and business people ensure our work is interdisciplinary.

Education and Training

Over 270 student assistants and interns support the institute's work.

In 2004, twenty-two Diplom theses and two doctoral dissertations were supervised at the Fraunhofer IFF, mostly in collaboration with Otto von Guericke University Magdeburg. In 2005, nineteen Diplom theses and one doctoral dissertation were supervised.

We offer internships for institutions of continuing education and high schools.

Advisory Board

The advisory boards of the individual Fraunhofer Institutes support the institute's management and the Fraunhofer-Gesellschaft's executive board in an advisory capacity. Members are individuals from the scientific community, the business community and public authorities.

Chairman of the Advisory Board
Prof. Burghard Scheel

Vice-Chairman of the Advisory Board
Prof. Uwe Dombrowski
Director, Institute for Production Engineering and Corporate Research (IFU), Technical University Braunschweig

Mr. Guido Brassart
Managing Director, Georg Maschinentechnik GmbH & Co. KG

Ms. Susanne Clobes
Federal Ministry of Education and Research, Department of Production Systems and Technologies

Mr. Manfred Doese
Division Manager of Production Automation/Logistics, Siemens Demantic AG

Dr. Udo Häfke
Managing Director, Innovations- und Gründerzentrum Magdeburg GmbH

Dr. Klaus Hieckmann
Managing Partner, SYMACON Engineering GmbH

Prof. Albert Jugel
CEO, Dräger Safety AG & Co. KG a.A.

Mr. Volker Oesau
Managing Director, Danzas AEI GmbH

Prof. Klaus Erich Pollmann
President, Otto von Guericke University Magdeburg

Dr. Barthel Schröder
Vice President Technical, Volkswagen AG

Dr. Peter Transfeld
CEO, ÖHMI AG

Dr. Wolfgang Twardziok
Member of the Supervisory Board, SCHIESS AG Aschersleben

Dr. Dinnies Johannes von der Osten
Managing Director, IBG Beteiligungsgesellschaft Sachsen-Anhalt mbH

Dr. Joachim Welz
Head of Department of Science, Higher Education and Research, Saxony-Anhalt Ministry of Education and Culture

Mr. Reinhard Wiegand
Managing Director, AEG Kondensatoren und Wandler Holding GmbH

Prof. Peer Witten
Member of the Board of Directors, Otto-Versand Hamburg

Prof. Dietrich Ziems
Chair of Logistics, School of Engineering, Otto von Guericke University Magdeburg

Guests at the Advisory Board Meeting 2005

Dr. Frank Büchner
Manager of Region East, Siemens AG

Mr. Peter Claussen
Plant Manager Leipzig, BMW AG

Dr. Hans-Jürgen Hühne
Deutsche Telekom AG, Central-East Office

Mr. Thomas Zernechel
Head of Coroporate Logistics, Volkswagen AG

Competencies

Virtual Development and Training VDT	Dr. Eberhard Blümel
Virtual Interactive Training VIT	Ms. Heike Kissner
Virtual Development VD	Dr. Steffen Strassburger
Virtual Prototyping VP	Dr. Rüdiger Mecke
Data and Information Management DIM	Dr. Martin Endig
Harz Regional CC Virtual Engineering Products/Processes	Ms. Christine Braun
Central ViVERA Office, Virtual Network of Competence for Virtual and Augmented Reality	Mr. Marco Schumann

Logistics Systems and Networks LSN	Mr. Holger Seidel
Prodution Logistics and Factory Systems PFS	Mr. Holger Seidel
Material Handling Engineering and Systems MFT	Dr. Klaus Richter
Identification Systems and Logistics Networks ISL	Mr. Helmut Röben
International Competence Center Logistics ICCL	Mr. Ralf Opierzynski
Information Logistics IFL	Dr. Ina Ehrhardt

Automation AUT	Dr. Ulrich Schmucker
Intelligent Sensor Systems ISS	Mr. Dirk Berndt
Robotic Systems RS	Dr. Norbert Elkmann

Production and Plant Management PAM	Dr. Gerhard Müller
Process and Plant Engineering PAT	Dr. Lutz Hoyer
Product Design and Modeling PGM	Dr. Mirko Peglow
Product and Process Management PPM	Ms. Susan Gronwald

Encounter – Experience – Learn:
Human and Machine in Interactive Dialog

Dr. Eberhard Blümel
Division Director VDT

Virtual Development and Training VDT

- Virtual Interactive Training VIT
- Virtual Development VD
- Virtual Prototyping VP
- Data and Information Management DIM
- Harz Regional CC Virtual Engineering Products/Processes
- Central ViVERA Office, Virtual Network of Competence for Virtual and Augmented Reality

Project Reports

Integrated Provision of Information as the Basis of Modern Decision Support

Motivation

According to the International Red Cross 2004 World Disasters Report, the consequences and impacts of natural disasters for inhabited regions have risen sharply in recent years. This has resulted in new, more extensive and more complex tasks which have to be dealt with in situation and policy centers.

In particular, this necessitates technical support of emergency management staffs that are dependent, among other things, on the performance of the hardware and software systems used. This not only includes the integration of planning spanning all phases of action throughout the entire cycle of an emergency but also interorganizational decision support and the involvement of government, the business community and the public. In addition, the systems used must provide support in most or the broadest possible range of emergency situations caused by nature and by humans.

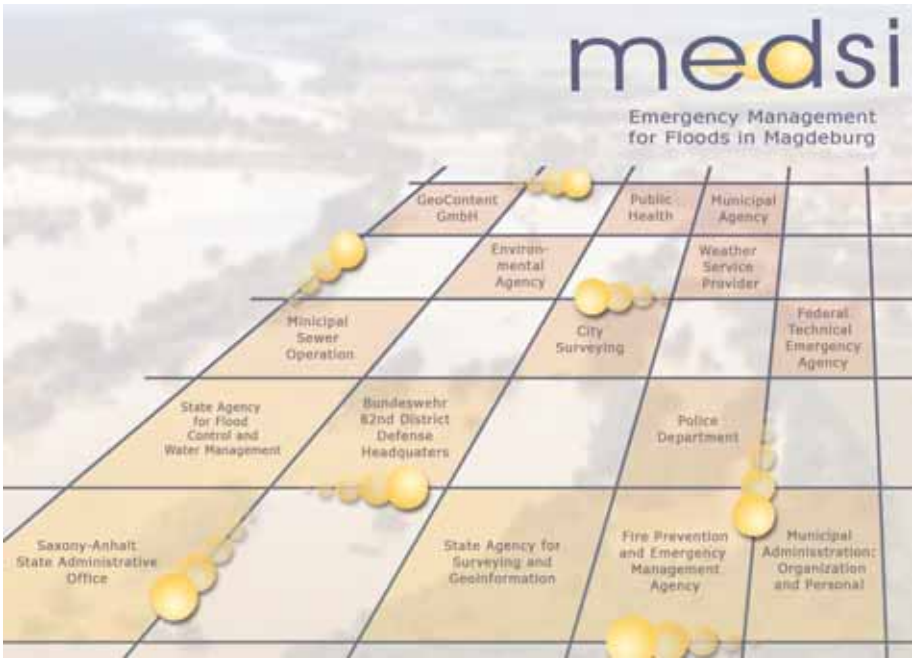


Figure 1: Local MEDSI project partners.

Inadequate exchange of information between the authorities involved and their emergency management staffs as well as between relief workers and their staffs were just some of the problems when the Elbe flooded in 2002. In order to be able to counteract these shortcomings, new IT solutions are needed now in the fields of emergency planning, emergency logistics and emergency management.

This is where the research project "Management Decision Support for Critical Infrastructures" (MEDSI) fits in. The project was funded by the European Union's 6th Framework Programme.

The objective of the project was to conceive and produce a prototype of a standardized software system to integrate and systematically provide information. This system is intended to provide support to noticeably improve necessary emergency staff decision making and will consequently provide support to better monitor and reduce potential and present risks. Different real emergency scenarios served to validate the project results.

Approach

The project started with a detailed requirements analysis of specific application scenarios that the proposed solution is supposed to support in the future. To this end, a series of specific cases of application were specified based on concrete emergency scenarios and all relevant user groups were identified. This basis was used to derive the generalized cases of application to be supported and the relevant system components.

At the same time, the necessary spatial data infrastructure was defined. It consists of different elements such as

- A map server to manage the necessary maps,
- A feature server to manage objects on the basis of layers and
- A special GIS to manage spatial data in native formats (shape format).

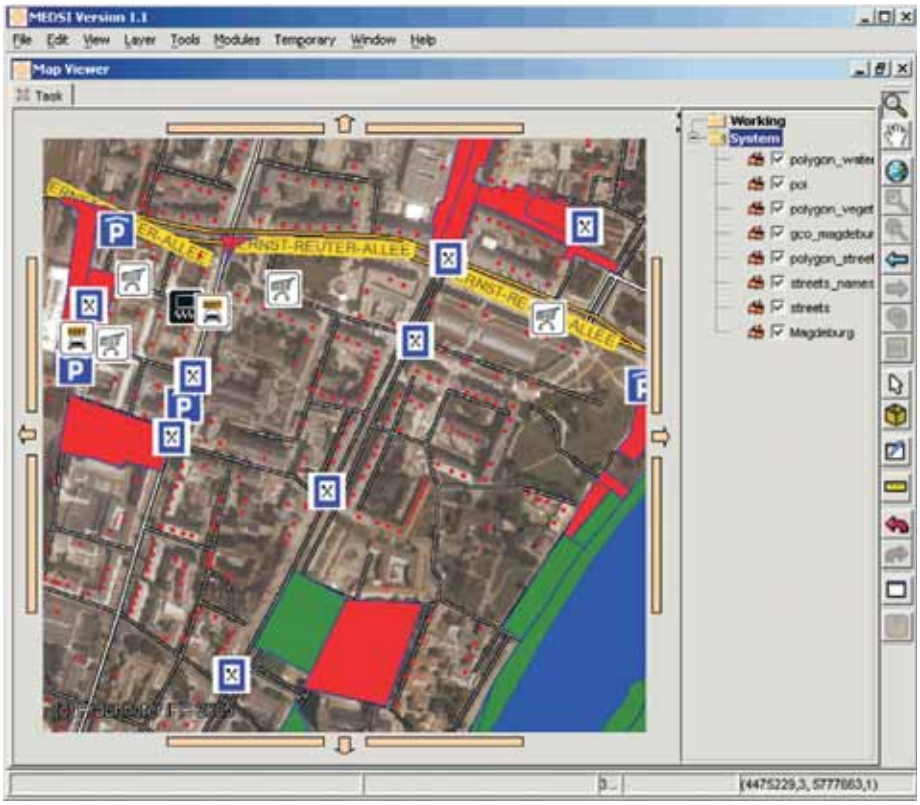


Figure 2: MEDSI prototype screenshot: View management.

In addition, the system architecture was concretized. Based on this preliminary design, a first prototype was implemented, the spatial data infrastructure configured and all technical prerequisites for the prototype created.

The prototype's software and data infrastructure was tested on the application scenario "Magdeburg – Elbe Flood 2002" as an example and validated by another application scenario "Holon – Chemical Spill" in Israel under regionally specific conditions of use.

Results

The outcome was a MEDSI prototype that has the fundamental functions of the system designed. This prototype demonstrated that the approach to the integrated provision of information developed is both feasible in terms of software engineering and realistic in the application domain of emergency management.

The integrated provision of information for decision support alone makes it possible to take an initial step toward modern decision support today. Existing collections of information will have to be built upon. This is essential, particularly to secure investments made, above all in the public sector.

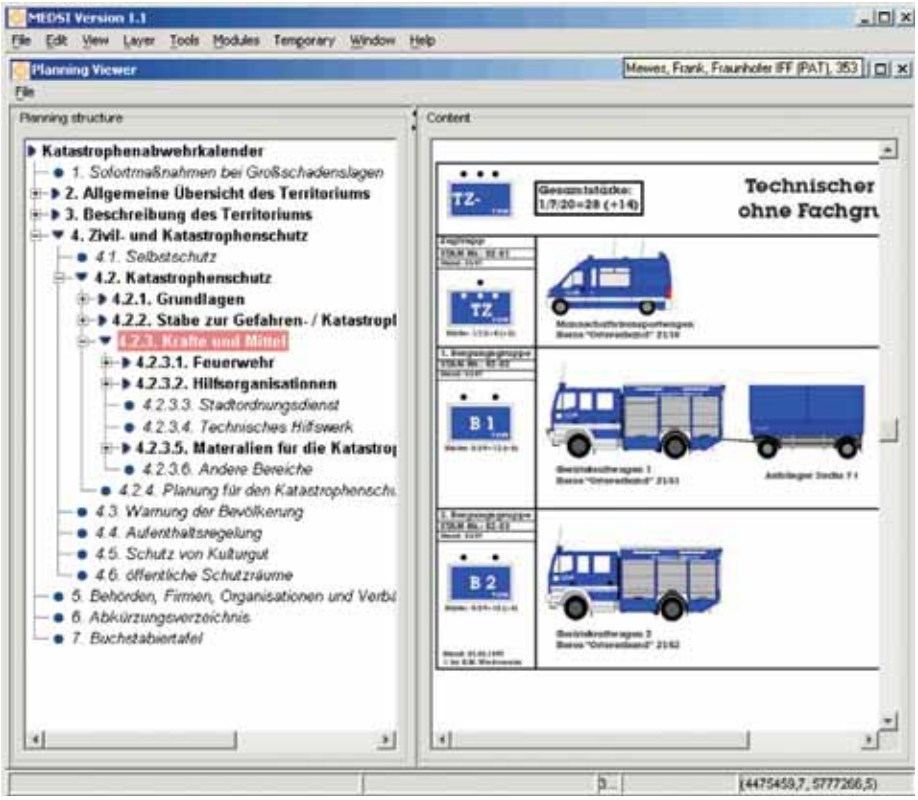


Figure 3: MEDSI prototype screenshot: Planning module.

Outlook

The MEDSI approach very clearly differs from other approaches: It builds upon existing collections of data. The operability of this idea was demonstrated during the project in concrete, ongoing examples.

A complete and always up-to-date information base for decision support including potential simulation modules is a long-term goal that will be challenging to achieve. MEDSI however takes an initial step in this direction.

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Collaboration

- GeoContent GmbH
- GISAT s.r.o. – Geoinformation Company, Czech Republic
- INESC Porto, Portugal
- Intergraph computer Services, Romania
- Intro solutions, Turkey
- Municipality of HOLON, Israel
- Temida, Slovenia
- T-Soft, Czech Republic
- GRUPO APEX, Spain

VR Based Educational Module for Qualifying Pilots

Motivation

Systematically training pilots as well as teaching knowledge needed for action are the foundation of safe air trafic. The demands on pilots are growing steadily. At the same time, new possibilities must be created that lead to effective and cost effective education, qualification and training from a business perspective. That is why Lufthansa Flight Training GmbH in Frankfurt a.M. and the Fraunhofer IFF jointly developed a virtual reality (VR) based educational module for pilots. The educational module is used in training to to obtain type rating and replaces the physical airplane. The objective is to increase flexibility in the training syllabus while simultaneously reducing the time and effort needed for training.

The so-called "walkaround" that is part of preflight inspection was selected from the multitude of sophisticated contents for pilot training as the VR educational module, because it places great demands on the representation and quality of the image. In reality, a pilot walks around the aircraft in a time slot of approximately ten minutes to visually inspect all components and to identify and eliminate possible defects. The Airbus A320 has twenty-one inspection points with approximately 180 components that have to be visually inspected (e.g. tire damage according to size, type and position). This procedure is completed before the pilot's preflight check in the cockpit.

Figure 1: Full view of the virtual educational module. The depiction of ground personnel and a panorama view of Frankfurt Airport enhances the realistic impression.

Approach and Results

In order to meet pilots' high demands, all relevant surfaces of the aircraft were systematically digitally photographed and converted into dimensionally accurate textures suitable for representation in the 3-D model. The model of the Airbus A320 created is unique since even the rivets in the fuselage were modeled accurately down to the last detail.

Based on the Fraunhofer IFF VDT platform's basic design, an appropriate concept was developed in which pilots can complete eight lessons in a structured form. Pilots begin with an introduction to the 3-D world and familiarize themselves with movement in the 3-D environment and the potentials of interaction. After viewing descriptive presentations, pilots can independently conduct an interactive preflight check walk-around. More than sixty sources of errors were integrated in this subsequent lesson as examples from which a maximum of ten are randomly selected and preset on the aircraft before the lesson starts. Consequently, every time the lesson is restarted, pilots always find modified configurations of errors, which they must detect, inspect and assess.

Depending on the level of difficulty, the system indicates whether a decision made was correct. In addition, pilots can view the errors they overlooked afterward.

The expert knowledge integrated and presented in the module covers the conditions of the components and surfaces – from an open flap to potential defects and errors and up through definition of the optimal viewpoint and standpoint – and has been incorporated iteratively in the various lessons.

In order to increase users' acceptance, the corporate design for the navigation in the course module was made to match Lufthansa Flight Training's design. Since conventional user interfaces previously only moved on a 2-D plane, one task was adapting the graphic user interface to the new interactive tasks. It was possible to develop a prototype solution that links the conventional web interface with the virtual application.

Figure 2: Full view toward the aircraft nacelle.
Figure 3: Detail of the underside of the nacelle with labeling, seals, rivets and diverse traces of wear.

Figures 4 and 5: Examples of potential defects during the interactive walkaround: Extreme partial tire wear (left); collision damage on the radome covering (right).

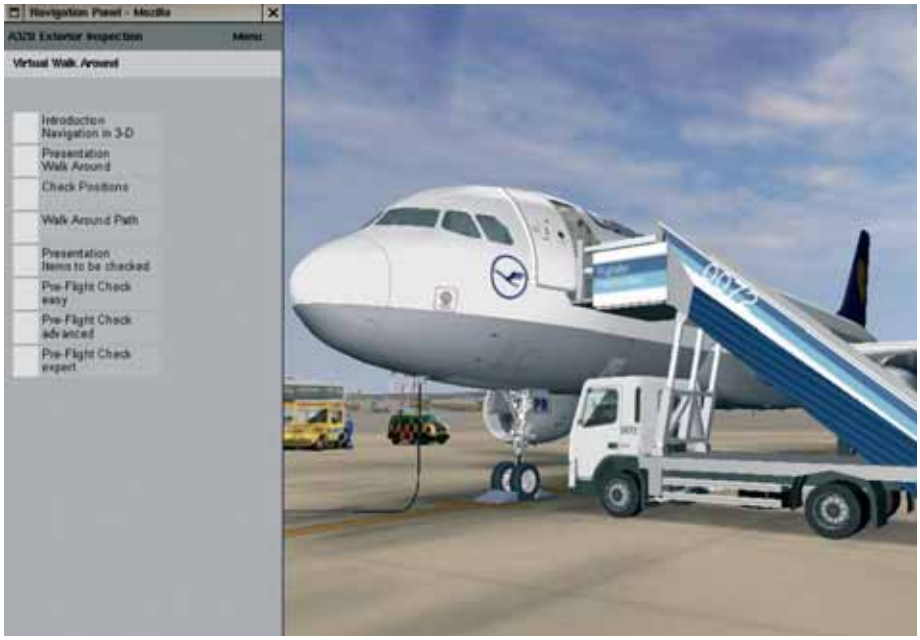

Figure 6: The start page of the educational module with the 2-D navigation bar on the left and the interactive 3-D window on the right.

To evaluate the virtual walkaround module, Lufthansa Flight Training supplied a PC on which pilots have been able to test the prototype in Lufthansa's briefing department since June 2005. The results of first evaluations revealed that acceptance is generally high and the quality of the representation is impressive. However, the ergonomics of the 3-D interaction make greater demands on users than was previously assumed. Handling was evidently easier for younger pilots. Pilots with extensive empirical knowledge and a critical eye, for whom handling was sometimes quite difficult, find it very valuable in training.

Outlook

Future work will deal with optimizing the existing prototype in terms of the requirements of use. Above all, this will mean designing usable educational and training modules and embedding them in the pilot qualification process to ensure information is processed effectively and knowledge is transferred purposefully.

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Collaboration
– Lufthansa Flight Training GmbH, Frankfurt a.M.

MOBIlearn: The Next Generation of Paradigms and Interfaces for Technology Aided Learning in Mobile Environments

Motivation

The project was commissioned by the European Union as a research and development project (RTD) in its 5th Framework Programme INFORMATION SOCIETY TECHNOLOGIES (IST). The project consortium consists of twenty-four partners from ten European countries, Israel, the USA and Australia.

The objective of the project is to research new ways of using the technologies of mobile devices and environments to optimally meet learners' needs. The knowledge and the learning contents are provided allowing for location, personal preferences and their form as a function of the device used. Priority is being given to designing contents suitable for learning and developing a technological reference architecture for mobile learnning. Another emphasis is developing a business model and the associated strategy for disseminating mobile learning throughout the EU.

Approach

Learning in mobile environments is an established subfield of e-learning already employed commercially. One challenge is providing learning contents on mobile terminals, i.e. specifically creating pedagogical principles for collaborative learning and generating and providing dynamic knowledge (developed in a group) in mobile environments.

Scenario analysis was used to define the requirements of mobile learning. Three scenarios from different areas of life were defined, which, in terms of their contents, make very different demands on the system being developed.

- The museum scenario (Arts, Figure 1) used a questionnaire to collect the requirements of potential visitors to a museum.
- Observation and interviews were applied to the MBA scenario (Education) to record the requirements of university students and teachers.
- The health scenario (Healthcare) employed several "Future Technology Workshops" to record the requirements of first responders.

While the technology was being developed, four prototypes that build upon one another were created. The technological basis is an "abstract framework", which enables interoperability.

In addition, the technological reference architecture supports:

- Adaptive user interfaces, which optimally adjust to changed conditions such as location, user preference (e.g. language) and the device used
- Context-sensitive tools
- Integrated multimedia contents and learning content management systems
- Collaborative learning in mobile environments

A market study formed the foundation for the development of the business model. Its most important criteria were research of existing business models and trends on the market for mobility and mobile learning.

Outside studies also entered into the development of strategies for disseminating mobile learning throughout the EU.

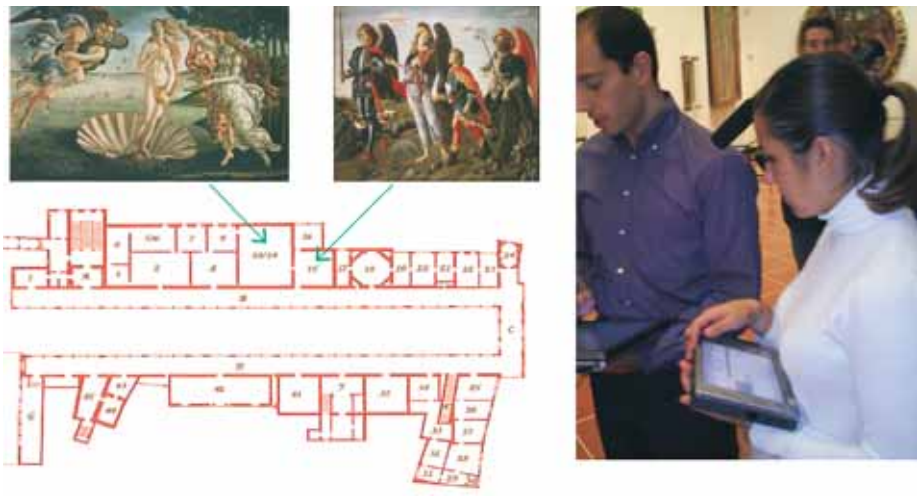

Figure 1: Museum scenario.

Results

The main results of the project are

- Guidelines and best practices for mobile learning and teaching
- The MOBIlearn system (Figure 2)
  - New generation of adaptable user interfaces
  - Context-sensitive tools
  - Tools for collaborative learning in mobile environments
  - Reusable learning objects generated and optimized for special thematic areas
- Roadmaps for further research activities in the field of education
- Business models for dissemination aimed at making the concepts developed socially and economically sustainable

Although the fields of application for the MOBIlearn system were selected very representatively (college courses, cultural and medical information), most of the project's technical and methodological results can be directly applied and transferred to other sectors of business and knowledge.

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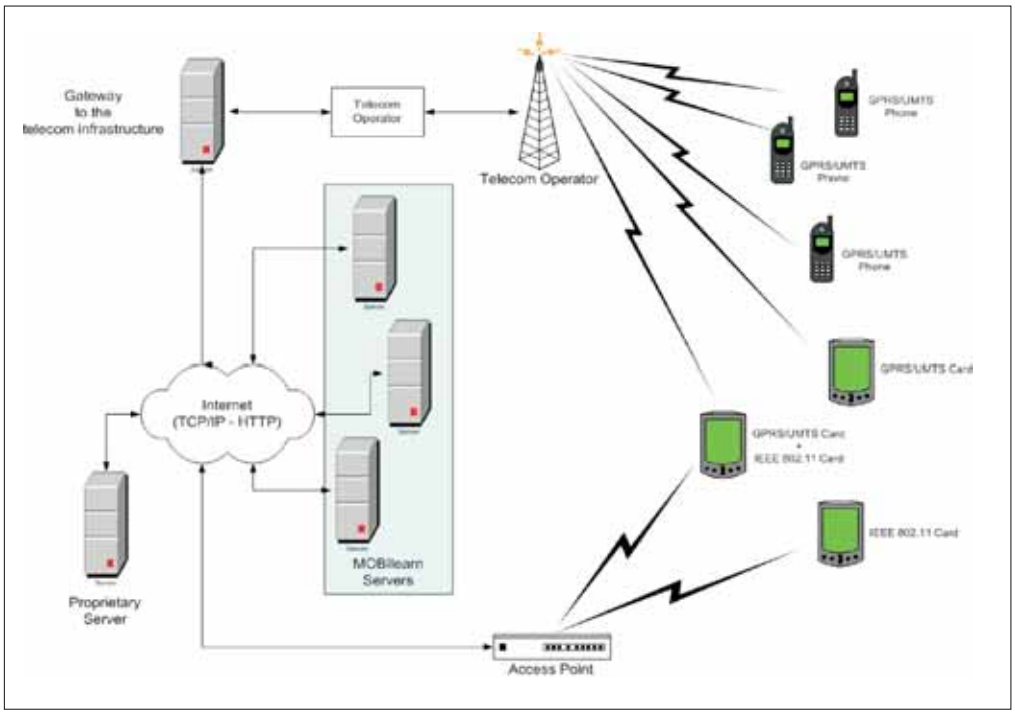

Figure 2: MOBIlearn system architecture.

MOBIlearn server

- Giunti Interactive Labs, Italy
- Fraunhofer IFF, Germany
- University of Birmingham, Great Britain
- Space Hellas, Greece
- Emblaze, Israel

Coupling Discrete System Simulation with Interactive VR Environments

Motivation

Small and medium-sized enterprises are increasingly confronting the challenge of having to react to customer demands at short notice and be able to rapidly assess the feasibility of potential orders. To do this, existing production capacities must be examined, potential new investments estimated and comprehensible quotation materials compiled. Up to now, the widest variety of simulation and visualization software systems have been used for these purposes. Their modeling requires special expert knowledge and consumes considerable time and effort.

Hence, building upon the Fraunhofer IFF virtual engineering toolbox for SME, a standardized platform based on VR technologies was supposed to be created to prepare further run-up projects in order to accelerate such planning processes and visualize their results realistically. To this end, established discrete simulation systems and interactive visualization had to be coupled to accomplish the following tasks.

- Easy creation of virtual models incorporating real model data
- Utilization of catalogs with prefabricated modules for fast, semi-automatic model generation
- Support of simulation model validation with the aid of the visualization model
- Execution of simulation runs based on the simulation model generated
- Provision of interactive visualization of the simulation runs or simulation results to generate knowledge

Based on these premises, a communication platform was created with which planning processes can be executed easily and efficiently and discussed with everyone involved.

Approach

The foundation for modeling and visualizing simulation results is the Interactive Visualization System for Virtual Development and Training (IVS_VDT) created at the Fraunhofer IFF. A module for communication with an external simulation system and integration of the simulation data was generated, which was implemented as an extension of the IVS_VDT platform. Elements of this extension are interfaces for the exchange of descriptive model data and simulation results for visualization and storage in the VR system. In addition, functions for providing and applying a predefined quantity of objects specific to a company were implemented as a module library. Methods for visualizing simulation results were developed, which can representatively visualize the widest variety of simulation processes yet nevertheless include sufficient latitude for users to individually design the animations.

Using commercial, discrete simulation systems to generate simulation results is envisioned. The simulator eM-Plant from Tecnomatix was selected to produce the prototype. This system was used to test functions and formats of data exchange with the VR system to semi-automatically generate models and execute simulation runs. The methods developed can be transferred in analog form to other simulation systems.

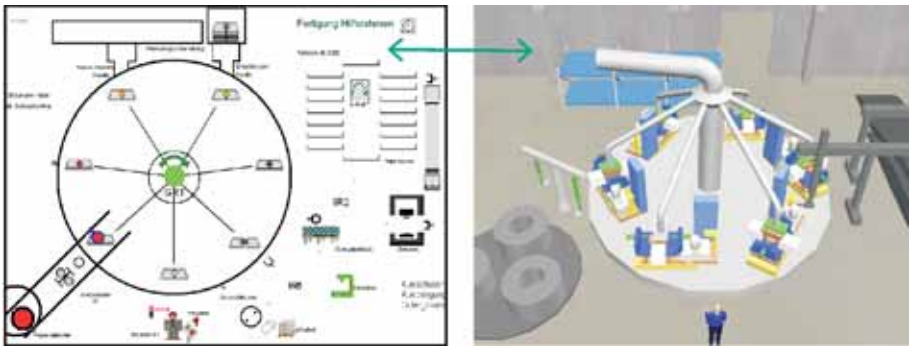

Figure 1: Simulation coupled with interactive visualization.

Figure 2: Modeling with the support of a library of predefined modules.

Figure 3: Application of the coupling piloted with Rautenbach-Guss Wernigerode GmbH.

Results

Coupling a simulator to the Fraunhofer IFF VDT platform created a tool for rapidly generating and animating realistic models. The tool was jointly introduced with Rautenbach-Guss Wernigerode GmbH as a prototype for an SME foundry. The VR system's simulation extension made it possible to both evaluate future manufacturing processes and generate interactive 3-D visualizations to present and demonstrate the processes planned.

By using a module library, users can quickly generate the model to be analyzed and and manipulate the parameters of the individual modules. Afterward, model information can be supplied to an external simulation system for semi-automatic model generation. The results of the subsequent simulation runs are transmitted to the VR system and represented with appropriate animations.

In this way, users can employ their virtual models to learn what effects their planning will have in the long term and which dynamic processes run when potentially produced.

This animated model serves as the basis for generating information about necessary investments and can also be used for customer presentations.

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The Virtual Machine Tool

Motivation

The MAGDEBURG Werkzeugmaschinen AG developed a technologically novel verticle lathe (MVT160) as part of a research project with partners from the PIZ IF ROTA consortium, funded by the State of Saxony-Anhalt. The Fraunhofer IFF took over the creation of a virtual functional model of the lathe including workpiece feeds and preliminary stages of machining (Figures 1 and 2).

Approach

On the basis of the 3-D design data from the CAD system used, not only the tool machine's geometric product features but also its technological and functional product features were reproduced in virtual reality. This was possible at a very early point in the product development process, i.e. even before the first prototype of the new machine had really been built.

Virtual models can already be used in this early stage to convey a comprehensive, three-dimensional impression of the product, which was and is being used both for design engineering as well as technological planning and for early marketing of the new machine concept.

Result

In the development phase of the MVT160, the virtual model supports, among other things, discussion among the design engineers and technologists involved by mapping the machine's functional features and its interplay with peripheral elements such as the feed of blanks, the machining of ends and the removal of the finished parts.

The system used makes it possible to store model-dependent features, which describe the system status of the machine mapped and consequently make functional tests with the virtual prototypes possible to already test diverse parameters in the design phase, to discuss stages of development with partners and thus to modify the design if necessary to eliminate potential sources of error before construction. Thus, a functional copy of a product still being engineered is produced in the virtual world.

Figure 1: Virtual model of the vertical lathe MVT160 including its peripheral equipment.

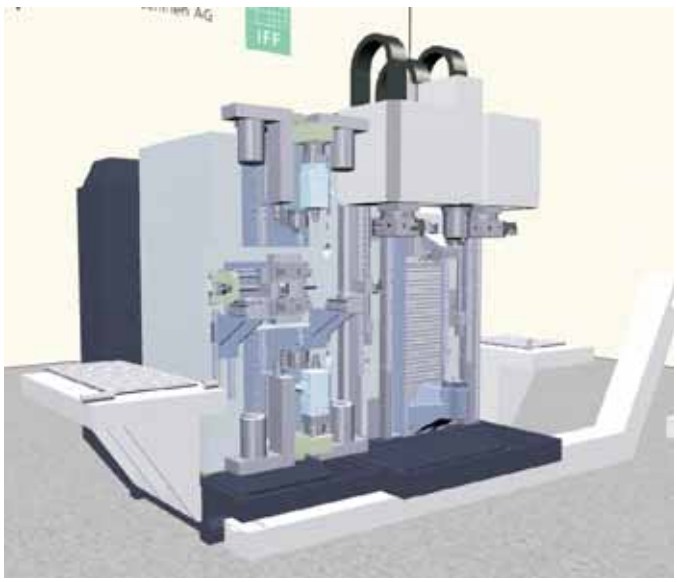

Figure 2: The tools of the vertical lathe MVT160 can be viewed by hiding the housing.

Consequently, a principle field of application for the virtual tool machine is the integrated planning, validation and control of product development processes.

The virtual MVT160 is also used alongside the real machine for customer presentations and at trade shows. The virtual model can be clearly and realistically upgraded to a modern, flexible marketing tool.

The functioning of the vertical lathe is quickly understandable and its interaction with other tool machines in a production line can be assessed. In initial tallks with customers, concrete proposals can already be put forward and solutions discussed, which are tailored to individual manufacturing conditions.

Users can acquire initial direct experience with the product and move freely in the virtual environment to explore the machine. Depending on the representation's level of detail, it is possible to view every assembly and every individual component of the machine. Techniques for making specific machine components transparent or for hiding them can also make internal and thus difficult to access elements visible (Figures 2 and 3).

The configuration module produced (Figure 4) opens the possibility for sales staff to put together customized configurations corresponding to an end customer's needs. In view of the diversity of potential combinations, which is often difficult to take in, and the time and expense needed to produce real prototypes, virtual functional models provide an effective support for presenting customized configurations.

The virtual model already proved to be extraordinarily practicable and successful in supporting sales at the METAV 2004 in Düsseldorf.

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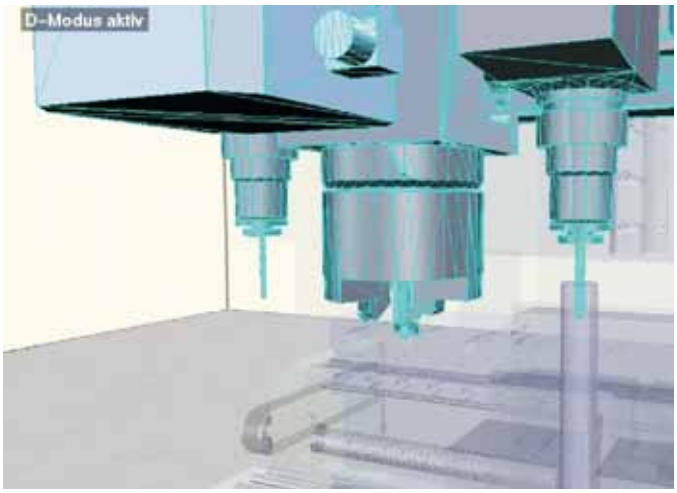

Figure 3: Tools for machining ends (boring, trimming, threading). The VR techniques make it possible to highlight important assemblies by using color contours and making obstructing elements transparent.

Figure 4: Configuration management makes it possible to represent the machine with various configurations, e.g. coupled with different storage solutions.

ViVERA: Virtual Network of Competence for Virtual and Augmented Reality

Motivation

Supported by the Federal Ministry of Education and Research, twelve universities and research institutes nationwide are bundling their research resources in the field of virtual and augmented reality in the ViVERA network of competence. ViVERA aims to network VR and AR developers' competencies, to identify need for developments, to bundle and transfer experiences to others areas of application and to develop prototype demonstrators to do this. The results of the network members and partners' research will be documented in a knowledge base and integrated in the international research scene. Thus, they can be made accessable to the widest community of users possible.

Approach

The Virtual Development and Training Centre VDTC of the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg has taken over the lead management of the transfer network. The VDTC acts as the contact for technology transfer and establishes contact with the cooperating research partners.

Together with universities and industry partners, the Fraunhofer Institutes organized in the ViVERA network of competence in existence since the Fall of 2004 are developing projects aimed at making technologies of virtual and augmented reality usable in nearly all areas of the product life cycle.

Research work in the network is concentrated on applications for automotive engineering, plant engineering, mechanical engineering, shipbuilding and medical technology.

Results

The Fraunhofer IFF brings its competencies in the field of basic technology and in the fields of application of mechanical and plant engineering into the network. In the basic technology "Generation of Virtual Models", a method for 3-D digitization is being developed that makes it possible to record the surface geometries of objects. What is new about the method is that, in addition to geometry data, the image data (color values) is also recorded with high precision. The basic technology "Interfaces to Systems for 3-D modeling" includes an analysis of potentials for exporting various CAD and 3-D modeling systems. The goal of the work is to simplify and standardize the processes for data migration into the VR system. This will make it possible to create VR models more cost effectively.

Figure 1: Connecting a CNC machine control with the virtual model of a heavy tool machine in an interactive 3-D environment.

In applications of VR technologies, work at the Fraunhofer IFF in the past year especially concentrated on connecting real machine controls to virtual models. To do this, VR models of three heavy machine tools manufactured in Saxony-Anhalt were created and connected with the components of the real CNC machine control. Previously, it was customary to subsequently program the machine's function in the VR system. Directly connecting the machine manufac-turer's CNC control eliminates this effort. What is more, this ensures that the virtual model behaves like the real machine. The connection/interface was initially developed with a focus on operator training. In the future, the behavior of the physical machine will be rendered in even more detail and thus enable testing the control on virtual models.

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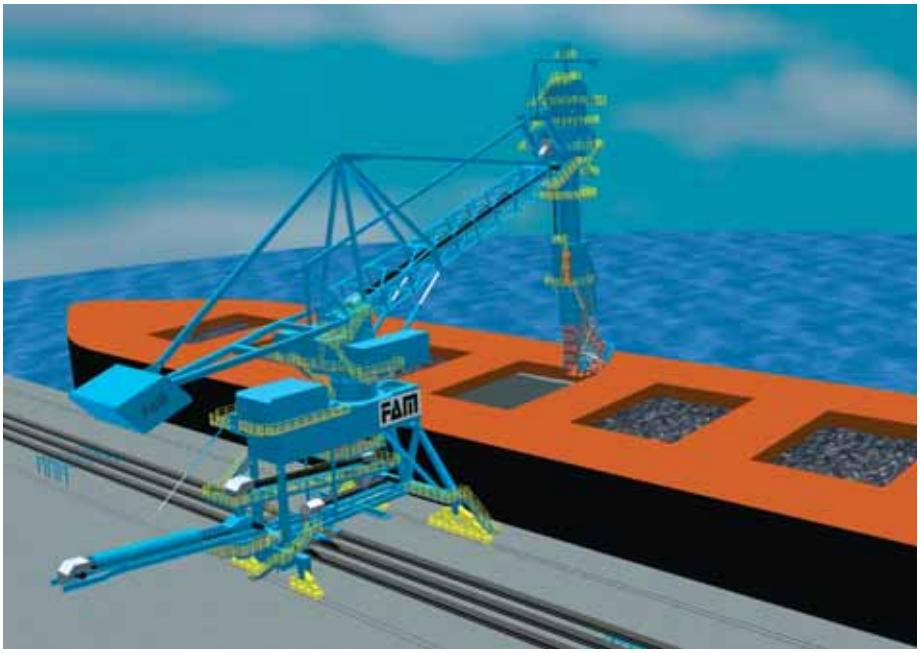

Figure 2: ViVERA concentrates on the sectors of automotive engineering, plant engineering, mechanical engineering, shipbuilding and medical technology. The picture shows the virtual model of a ship unloader

Using Optical Metrology to Generate Texturized 3-D Models

Motivation

Virtual three-dimensional models are needed throughout the various process stages of the product life cycle (e.g. digital product development, marketing and user training). In the ideal case, these 3-D models are available from the CAD process and can be converted accordingly and used as needed.

If this data is not on hand, it has to be modeled relatively elaborately, depending on its complexity. Reverse engineering processes can be used to convert physically existing prototypes (e.g. products, tools, mold patterns) into virtual models. However these only supply the geometric description of the surface of the 3-D models and require time-consuming, predominantly manual processing stages.

The objective of the project is to develop a method for rapidly and automatically generating virtual surface models, which, in addition to geometry, also captures color and the texture with great precision and automatically integrates this in the virtual model. This should result in the development of new areas of application for virtual models (e.g. monument preservation, medicine).

Metrological Capture

A light-sectioning sensor mounted on a measuring arm (Figure 1) is used to capture geometry without contact. The sensor developed by the Fraunhofer IFF consists of a camera and a line laser and operates according to the light-sectioning principle. Image processing based on integrated hardware can digitize up to 100 contour lines per second, each with approximately 1,000 3-D measuring points on the object of measurement. This generates a spatially dense, detailed map of the object surface in the form of a three-dimensional point cloud.

A major advantage of this system is that even larger complex free-form surfaces with a large, number of measuring points can be captured completely in one step. Compared with conventional methods, this eliminates complex reconstruction of the point cloud from several views. The accuracy of the 3-D measuring points is approximately +/- 0.1 mm.

In a second step, a high-resolution, calibrated color camera also mounted on the measuring arm records a set of images of the surface texture. Based on the parameters known from the calibration, the camera's spatial position and orientation are determined very precisely and errors in the image geometry caused by lens distortion are eliminated.

The number of scanned images required primarily depends on the geometry of the real object.

Figure 1: Manually guided measuring arm with light-sectioning sensor.

Fusion of Geometry and Image Data

First, the metrologically captured point cloud is used to create a geometric surface model in which triangles interconnect the individual 3-D measuring points. The pictures taken are used to assign color information to the 3-D points of the surface model. To do this, the points are projected on the color images arranged in the virtual 3-D environment (Figure 2) and the color values are interpolated.

Camera calibration provides the parameters for backprojection. If one point is on more than one color image, then they are weighted during fusion depending on their angles. A hit test is conducted to eliminate errors when assigning colors to surface areas that are occluded from the perspective of a camera image. Taking the camera as the starting point, the rays to the particular 3-D surface areas of the geometry model are tested for multiple overlaps. If the hit test detects an occluded area, then the corresponding color values are not used for texturizing.

Based on the application of the digitized models, three variants are differentiated as in Table 1 in terms of the required detailedness of the models.

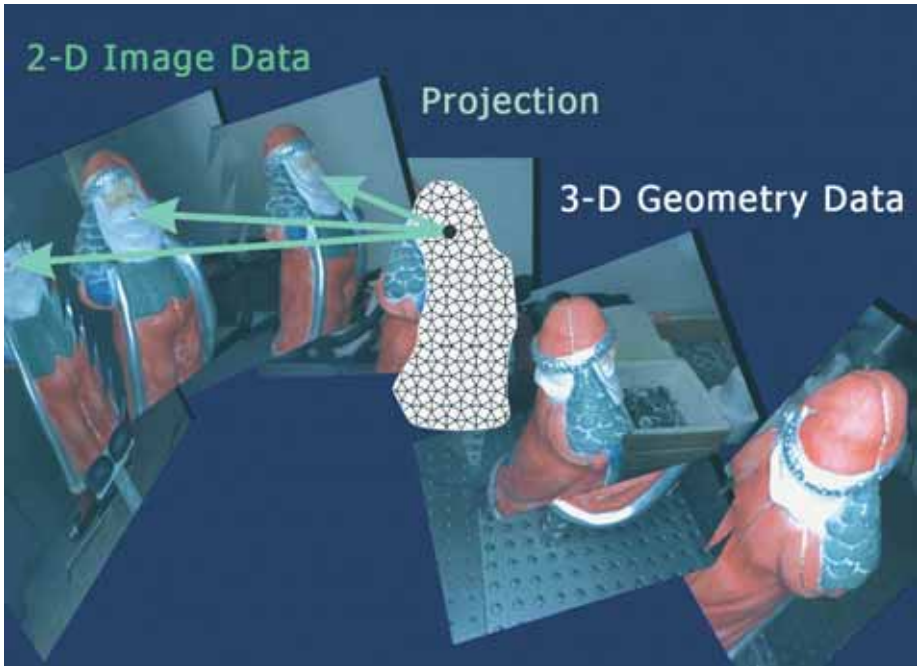

Figure 2: Texturizing by projecting the 3-D measuring points on matching color images.

	Variant A	Variant B	Variant C
Density of Geometry Data	high	medium	low
Color Allocation	for every measuring point	for every interpolated measuring point	for larger surface areas
Example Applications	Quality control, inventorying and monitoring in cultural heritage preservation	Medicine, medical technology	Internet product marketing

Table 1: Features and applications of different types of texturized 3-D models.

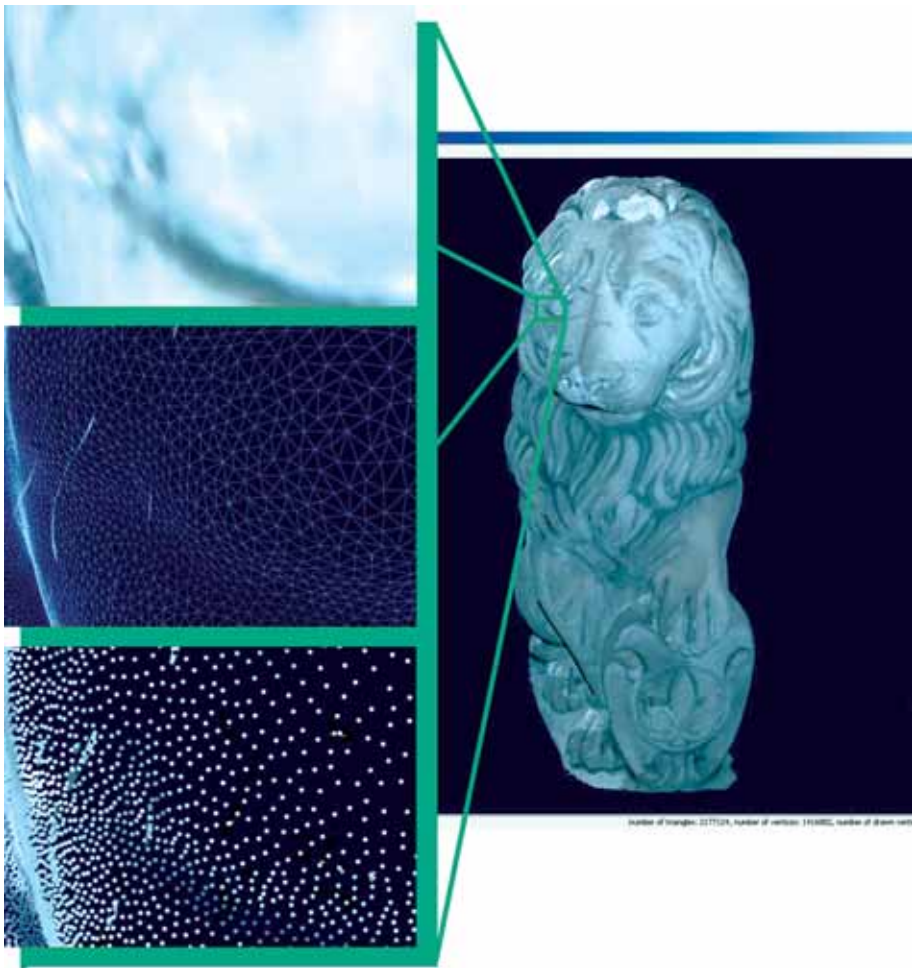

Figure 3: Texturized 3-D model of a sculpture (right) and model details in different variants of representation (left).

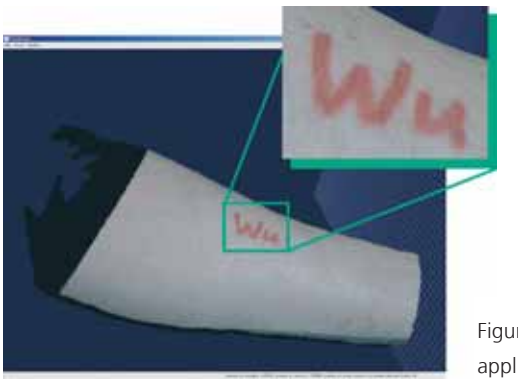

Figure 4: 3-D model of a human forearm with applied texture attribute.

Variant A assumes the 3-D model is scanned very densely, every measuring point being assigned a color value. It generates an extremely high resolution (average distance between measuring points: 0.5 mm) and dimensionally accurate virtual model (Figure 3).

Variant B includes a preprocessing step that generates additional scanning points if the geometry, e.g. from measurement, is available in a low resolution form (Figure 4).

This step is necessary in order to be able to visualize high quality models. The subdivision of the geometry can be both planar or a function of the surface topology. The latter subdivision is expedient primarily wherever a strong surface structure exists and planar subdivision would cause surface details to be lost.

Variant C involves another approach. It primarily generates virtual models for such applications (e.g. 3-D Web applications, virtual reality scenarios), which require a greatly reduced quantity of data (Figure 5). Color is assigned conventionally, i.e. a two-dimensional image is projected on larger surface areas of the model (texture mapping). The largely automatic procedure first reduces the model geometry until it adequately approximates the original 3-D model with the lowest quantity of data possible. Afterward, the surface textures from the camera images have to be generated so that the virtual model does not contain any perspectival distortions.

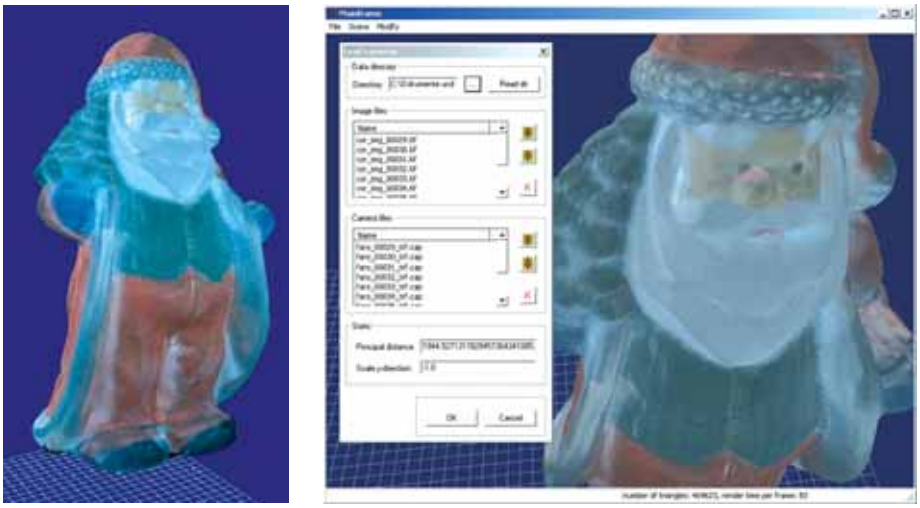

Figure 5: Virtual 3-D model of a toy for product marketing.

Results

The method presented here makes it possible to automatically generate virtual 3-D models of physically extant objects to a large extent. The methods developed for integrating surface geometry and texture can generate extremely realistic models. Thus a base technology is available, which has a relatively broad range of potential applications. Significant in this context is the virtual models' resolution that can be scaled as desired depending on the application.

At this time, prototypical use in various fields of application is being tested and developed further.

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Methods and Tools for Cooperative Bid Management in Plant Engineering

Motivation

Service and supplier companies in plant engineering are increasingly seeing themselves confronted by the customer demand to provide the widest possible range of services "from one source". In conjunction with this, small and medium-sized enterprises (SME) are having difficulties holding their own against large competitors, since they have often specialized their range of services. Large enterprises on the other hand usually have a broad range of services or can use acquisitions to expand more easily as required than SME, which additionally usually lack the requisite financial cushion.

For SME, initiating and running joint operations in general and temporary ad hoc joint operations in particular are connected with various problems. Joint operations in preliminary and early phases of projects are especially connected with the following challenges

- Short notice reaction to incoming inquiries and bids
- Media breaks at company boundaries because a large number of different calculation tools are used
- Effective handling of heterogeneous service directories
- Lack of know-how and tools for initiating joint operations quickly and flexibly
- Practicable review of potential project partners' capabilities to cooperate
- Lack of possibilities to evaluate the success of cooperation on the basis of different criteria

The objective of the joint project "FASA III – Tools for Cooperative Bid Management in Plant Engineering" was to support the bid preparation process with methods and software and to reduce process cycle times. The Fraunhofer IFF was the research service provider in the joint project.

Approach and Results

In order to be able to develop a bid management software for plant engineering, several analysis and coordination workshops with the project partners were necessary. First, internal directories of company services were analyzed for their elements and structure. The analysis of the inquiry/bid process was used to draft an individual database for every internal directory of company services. Individual company requirements were the basis for devising data and functional models as the basis for the bid management software. Once the the programming had been developed, the prototype "Bid Management Tool" that provides enterpises support to tackle the aforementioned challenges was presented to the enterprises at the end of the project.

Several theoretical and empirical tests of the methods and software developed to measure the success of joint operations in plant management were also conducted. As the basis for measuring success, the cooperation life cycle had to be analyzed specifically for conditions in plant engineering. To this end, the cooperation life cycles researched in the literature were analyzed for their adaptability forplant engineering. Combining this with the process steps in plant engineering made it possible to develop a cooperation life cycle model for plant engineering.

The model constitutes the foundation for identifying phase-based indicators for measuring the success of cooperation. By applying a utility analysis as a multi-dimensional goal assessment system in conjunction with an indicator catalog developed, a method has been developed for measuring the success of joint operations in plant engineering. It was used as the basis for developing a software tool to ensure the method would be applied in practice.

Several analyses of different aspects were necessary in the course of developing the methods for selecting partners for joint operations in plant engieering. Among others, this included developing a classification for projects in plant engineering. To this end, the joint project identified three fundamental dimensions of analysis, which form the space for a classification model. The project classes were reviewed for their relevance and specified in detail with the aid of properties. In a subsequent step, an analysis of potential success factors for joint operations in plant engineering were used to identify properties of cooperative behavior. Since it is crucial in the partner selection process to identify the attributes of the properties among potential project partners, the properties were broken down into in "hard facts" and "soft skills", which produced a two part analysis. "Hard facts" can be inquired about in a statistical survey. A scenario was developed to analyze "soft skills". It employs psychological tests to identify attributes. Statistical analyses can then be used to select partners.

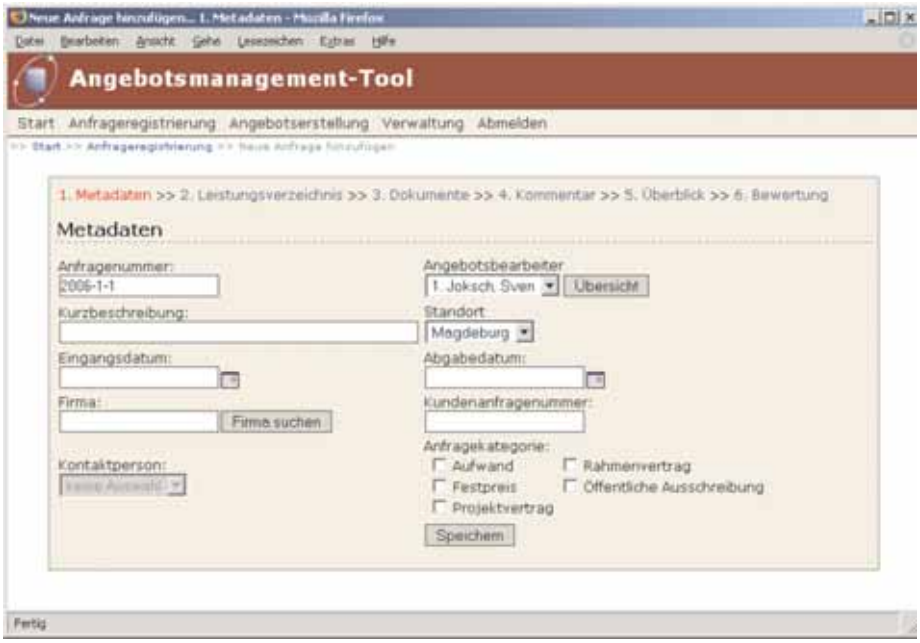

Figure: Bid management software screenshot.

Outlook

Using the methods and tools developed in the project to support the bid management process in plant engineering substantially improved aspects of quality, time and cost. Thus, the less time needed to prepare bids with the support of the intuitive bid management software cut costs in the bid phase among the joint partners by around 20 %. At the same time, bids that were now standardized and based on an internal directory of services enhanced quality.

The research work in this project was able to fill two fundametal gaps in the existing literature. On the one hand, a cooperation life cycle was developed for plant engineering and, on the other hand, a project classification was produced to map the complex diversity of projects in the plant engineering business.

Both models are fundamentally important for advanced research projects on management in plant engineering.

The methods developed for measuring success and selecting partners for cooperation in plant engineering are the first basic points of comprehensive controlling of joint operations for plant engineering. Continuing research and development are needed here to satisfy the need for practicable, simple, undemanding tools to control joint operations.

The joint project "FASA III – Tools for Cooperative Bid Management in Plant Engineering" created a basis for companies in general and SME in particular to significantly improve the bid management process and provide it software support.

Furthermore, fundamental skills were imparted to the companies to establish and control joint operations. Thus, the cornerstone was laid for further developing a holistic and practicable concept for controlling joint operations.

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Plan – Control – Optimize:
Logistics Solutions for the Networked World

Mr. Holger Seidel,
Head of Division LSN

Logistics Systems and Networks LSN

- Production Logistics and Factory Systems PFS
- Material Handling Engineering and Systems MFT
- Identification Systems and Logistics Networks ISL
- International Competence Center Logistics ICCL
- Information Logistics IFL

Project Reports

Motivation

Not just since their appearance in media reports have the issues of outsourcing and securing locations dominated German industry. In the early 1990s, outsourcing of processes, divisions and services was already recognized as an option to, among other things, reduce costs, internal complexity, capital expenditure and concentration on core business. In the meantime, outsourcing is viewed as a strategic management tool.

In the summer of 2004, the employee representation of an internationally operating German corporation contracted the Fraunhofer IFF to review corporate management's relocation concept within six weeks.

The concept provided for relocating two parts of the corporation to Eastern Europe and letting a majority of the employees go. The Fraunhofer IFF was supposed to use a sound analysis to scrutinize the concept for deficiencies, weak points and overlooked risks and potentials at the German site.

Approach

Organizationally, when such projects have been carried out, the communication between employer and employee representations in this tense corporate situation have proven to be problematic and present a particular challenge to managing the project and internally communicating project results in the company. Substantively, the heart of an outsourcing project is the selection and evaluation of those parts of a company to be potentially relocated.

At present, steadily increasing competitive pressure in the industry frequently leads to overhasty application of the outsourcing strategy. In part, inadequate and often only financial consideration is given to the risks and aspects of relocation decisions evaluated. The outsourcing strategy is reduced to a short-term reaction to a company's acute troubles and cannot be considered more than preliminary corporate strategic management.

Holistic evaluation of the units affected is crucially important for successfully completing an outsourcing project and maintaining the current corporate situation. Along with a business evaluation, this requires a multidimensional view of processes, organization, IT structures and interface management of the networks generated by a potential relocation. Consequently, the reason such projects fail can be found in the inadequate assessment of an outsourcing concept's risks regarding aspects such as quality, process reliability and flexibility.

Results

The project's holistic analysis of the corporate concept was able to identify these deficiencies and potentials. While the fundamental financial assessment of the corporate situation (business case) was absolutely correct, deficiencies were revealed in the selection of the corporate units and the concept underpinning the execution and safeguarding of the production supply. Since standardized approaches for practical application are lacking, a clear demand for concepts and methods for a holistic evaluation of relocation plans was consequently identified for further research.

In the future, the Fraunhofer IFF Departments of Production Logistics and Knowledge Management will more intensively develop this topic with research and underpin it with concepts.

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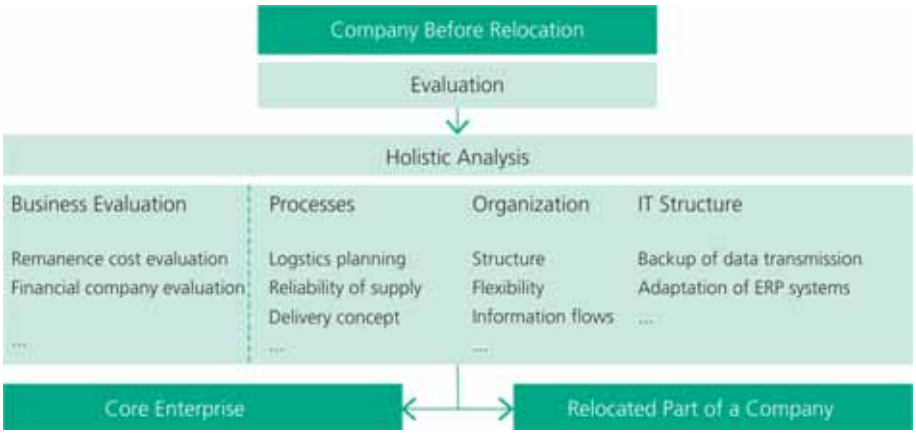

Figure 1: Schematic of the evaluation model.

DITO: Dynamic IT Infrastructures for Organizations Undergoing Changes

Motivation

Business processes and information technology (IT) cannot be dynamically adapted to the constantly changing demands from small and medium-sized enterprises (SME).

SME are currently confronting a multitude of changes. The increasing globalization of markets is also compelling German SME to orient themselves more strongly toward international competition. In order to remain competitive against far more cost effective international competitors, enterprises are being forced to concentrate on their core competencies and to outsource their secondary competencies. This concentration in combination with steadily growing customer demands for more complex and innovative products are the significant drivers behind the growing number of joint operations between different companies. Hence, flexible enterprise networks can be found especially in the sectors of mechanical engineering and automotive parts supply – pioneers in reduced manufacturing depth and global procurement.

Collaboration in networks demands increased flexibility from an SME, which makes it necessary to adapt business processes dynamically. Unfortunately, process orientation and the related customer orientation are currently often only catchwords, whenever companies have to be sustainably positioned profitably as competitive pressure grows. Now as before, process management is however not an end in itself but rather the rigorous implementation of a customer or service orientation to increase efficiency and cut costs.

The pressure on SME to flexibilize their business processes is also making new demands on companies' IT and, consequently, on IT service companies.
SME need both IT solutions that are flexible, adaptable to business processes and cost effective as well as methods and tools to adapt to the requirements of joint operations among companies.

Approach

The objective of the research project "Dynamic IT Infrastructures for Organizations Undergoing Changes (DITO)" was to develop a concept for the integrated management of SME business processes and IT solutions. This involves providing approaches to and methods for identifying core business processes, their interfaces to customers and suppliers and deriving the IT requirements. Since the operation of complex IT systems often demands too much of SME specifically and SME use external service providers, potential operator concepts were analyzed and their risks assessed.

Following the modularization strategies of products in the capital goods industry, an opportunity for flexibilization is seen in modularizing business processes and IT infrastructure. The figure below illustrates the approach.

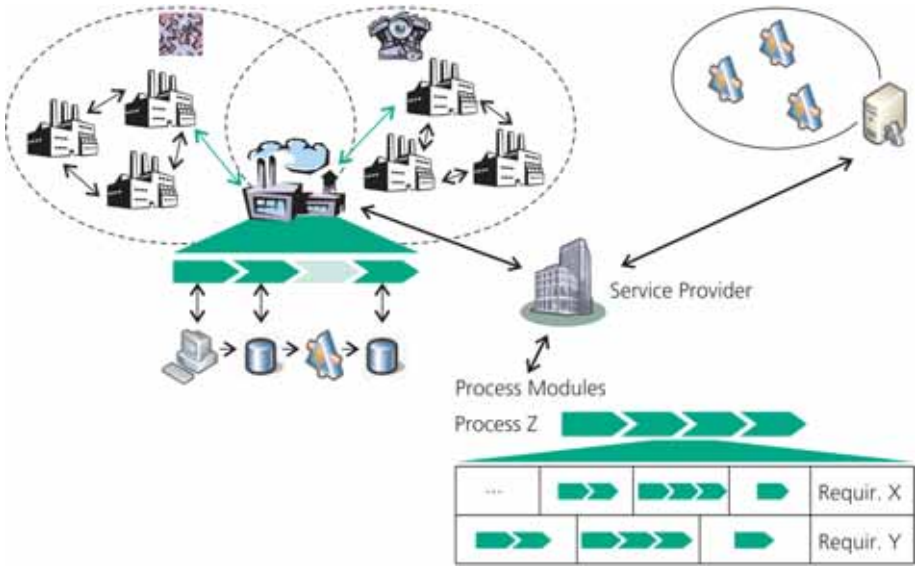

Figure 1: Flexibilization by modularizing of business processes and IT infrastructure.

An enterprise positioned in several company networks (in the graphic, mechanical engineering and the automotive industry) must adapt its processes to the respective business partners and basic conditions. To this end, the DITO project devised a methodology with which modular business processes can be developed (cf. process modules in the graphic). Thus, SME business processes can be assembled from predefined process modules (templates) from the modules and refined and adapted for a particular company context.

The IT infrastructure supporting the business processes must be able to keep pace with the flexibilization of processes. Web service technologies can do this. Web services enable dynamically integrating encapsulated functions in the existing IT infrastructure. Web services are based on the XML standard (eXtensible Markup Language) and can be obtained over the Internet and integrated in the IT infrastructure.

As represented in the graphic below, the approach of service-oriented architecture (SOA) can link business processes and web services. In an SOA, the widest variety of previously unconnected IT applications provide their functions as (web) services. Business processes no longer revert directly to individual IT applications, but rather merely their functionalities provided by the services.

Should the process change, the services must simply be reassembled and integrated in the process. So far, such concepts have only been implemented in large companies. For SME, this approach seems overwhelming since it presupposes a large number of extensive and correspondingly expensive IT systems. By contrast, inter-company cooperation platforms that integrate different companies' IT applications and provide additional functions, constitute an interesting field for SOA use. In this way, SME can be involved in supply chain control or joint product development without having to install the functions provided on the platform themselves. Requirements from SME for such cooperation platforms were investigated.

In addition, the research project supported by the state of Saxony-Anhalt investigated the potential benefits of Web service technology for SME, reviewed the theoretical foundations and raised questions for future research. The approaches presented in the project are initial steps toward fulfilling the vision of the ""Adaptability of IT Applications to a Business Process at the Push of a Button".

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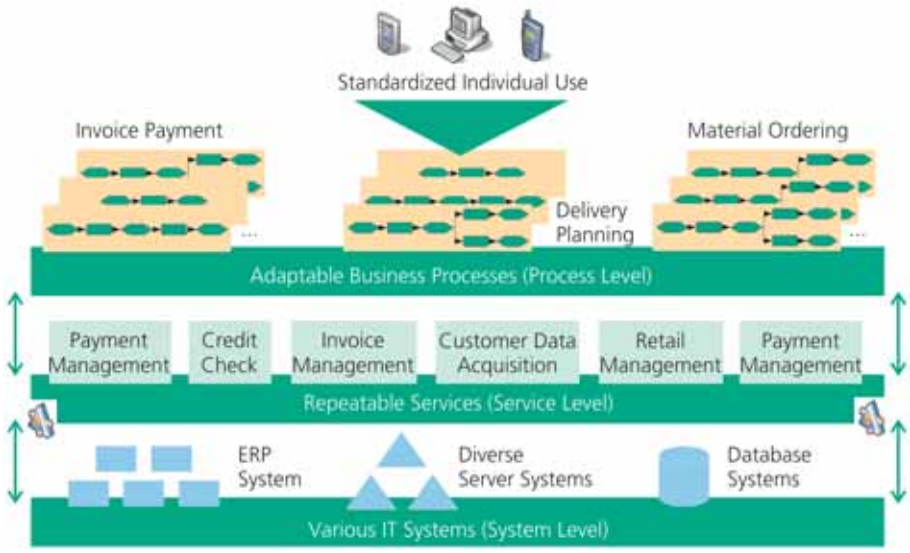

Figure 2: Service-oriented architecture (SOA) integrates processes and IT through a service level.

Modeling and Simulation of Logistics Networks: Qualifying Units of the Digital Factory

Motivation

Internationally, the automotive industry has set itself the goal of achieving complete digital backup of production synchronous with digital backup of the vehicle. Meeting the specified cost, quality and schedule objectives, the digital vehicle must pass through the digital logistics system before the real factory and process flows are approved. As the digital factory is increasingly implemented, the integration of external planning partners, systems and parts suppliers parallel to the integration of internal company data is growing in importance. While process life cycle management (PLM) analyzes logistics processes directly coupled with production extremely intensively, supplier processes in the digital factory have received only slight attention so far. Integrated process mapping and logistics network planning absolutely require integrating supply chain management (SCM) technologies in the digital factory's functionality.

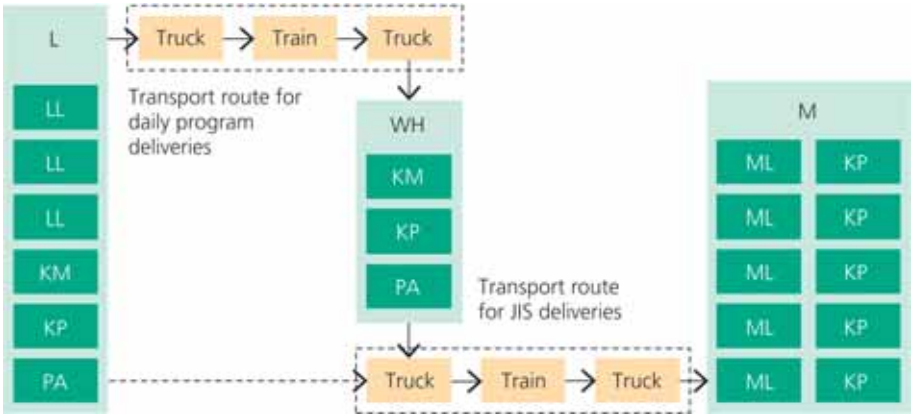

Figure 1: Modeled logistics network.

Approach

Taking the digital factory's available sources of information as the basic starting point, the objective of the research project was to derive potential strategies as well as modules and methods for managing supply chains and networks. The chief task was to utilize tools of the digital factory to describe and analyze the elements of a procurement system and process to obtain a formal and implementable model of logistics networks. Attention was focused on tools for process modeling (e.g. Tecnomatix eM-Planner) and for process simulation (e.g. Tecnomatix eM-Plant). The first crucial step to producing the intended automatic modeling and simulation of corresponding logistics networks was to create a model library containing the highly parameterized modules for every type of network node (resources).

SCM planning tasks are broken down into three levels

Structure Configuration Level (Supply Chain Configuration)

- Modeling supply chains in relation to manufacturing and storage locations, capacities and cost data
- Comparison of potential logistical alternatives in relation to target factors such as cost, customer service, etc.

Planning Level (Supply Chain Planning)

- Forecasting (requirements planning) on the final product level
- Production planning and inventory planning for the links in the supply chain
- Distribution and transport planning

Execution and Monitoring Level (Supply Chain Execution)

- Production order execution
- Transport order execution
- Production monitoring and information distribution to external partners

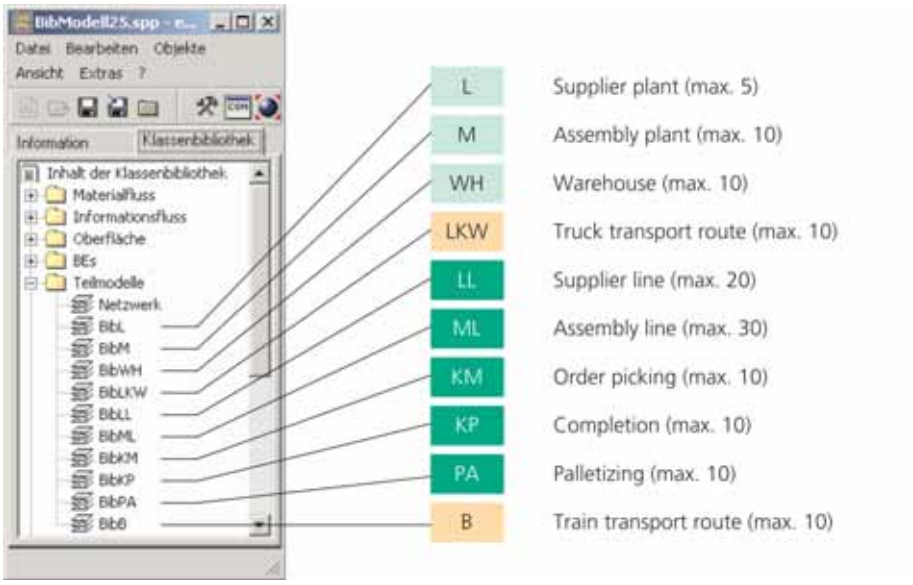

Figure 2: Structural components in the model library.

The research project is primarily concentrating on analyzing problems of planning and structural configuration.

The SC model created in conjunction with this project provides excellent opportunities for preplanning, operatively planning and monitoring supply chains and networks. So-called structure-forming modules were developed to create models for supplier networks. Figure 1 shows a maximum transport route assembled from these modules. Beginning at the supplier (L), which can operate several supplier lines (LL), the conceptual model contains specifications for order picking (KM), completion (KP) and palletizing (PA). The transport from supplier to assembly plant (M) can be optionally modeled over a warehouse (WH) as intermediate station. A transport chain can consist of a truck route or the sequence of truck – train – truck. Moreover, transport in the assembly plant is modeled from the input buffer to assembly lines. Among others, the assembly plant includes modules for asssembly lines (ML) and for completion . For a concrete simulation run, the executable simulation model is generated as part of the data-based modeling. The dynamic model configuration allows sizeable room to maneuver in the simulation experiments. Diverse parameters such as buffer area dimensions, drive times or setup times expand this room to maneuver even more. The model can even allow for shift schedules and holidays.

Results

The simulator eM-Plant was used to program the modules of the conceptual model as a library (Figure 2). Users without special simulation experience can themselves define and analyze structure and strategy variants for supplier networks. The library developed serves as the basis for automatic data-based modeling so that the model coding stage is unnecessary when new models are being created and simulation experiments are beeing conducted.

The project identified the prerequisites and procedures needed to represent virtual logistics as an integrative element of the digital factory for an integrated virtual company model incorporating supply chains. The Fraunhofer IFF has successfully implemented this solution in industry projects for clients from the automotive sector and is continuing to develop it further.

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Collaboration
– Partner Companies from the Automotive Industry

OPTIAS: Evaluating Commercial Parks

Motivation

Despite the difficult economic situation, in Germany and its new states in particular, new commercial properties are continuing to be listed in newly established commercial estates or parks. The intention is to tie companies looking to expand to the location and convince new companies to locate there in order to thus strengthen the economic power of the respective cities and communities. As a rule, these commercial estates are located in the outskirts of urban developments where they form a separate area only minimally connected to the development itself. It is especially important to conceive and develop these commercial properties in such a way that they become sustainably successful economic factors in the region and simultaneously make allowances for ecological and socio-political issues.

Given this challenge, the Fraunhofer IFF together with its partners developed the "Management Concept for OPTImizing the Location Strategy in Urban and Suburban Comercial Properties" in the OPTIAS project supported by the European Union.

Approach

The principal idea of the project was to conceive optimal structures for commercial parks, which are oriented toward the specific basic conditions and commercial park's surroundings. Starting with the consideration that an optimal commercial park does not exist, but rather every commercial park must respond to the surrounding situation and specific locational conditions, the following questions were focused on:

- What locational factors are required for siting a commercial park?
- Are there locational factors, which must exist for every commercial park as a matter of principle?
- What factors significantly influence the success or failure of a commercial park?

Particularly in the analyses, the final question proved to be the key for the overall project. Everyone involved in a commercial park defines its success differently. Consequently, the factors significant for a commercial park's success also differ or, at the least, are weighted differently in the performance assessment. Thus, the optimal commercial park structure (target state) varies.

A list of relevant locational factor was compiled based on criteria decisive for companies' site selection and sufficiently treated in the literature. This compilation constitutes the base material for identifying relevant commercial park success factors. The success factors identified were verified in case studies in existing commercial parks. To this end, eleven commercial parks selected in the project partners' various countries were intensively surveyed and analyzed. The objective was to determine the specific relevant success factors and to analyze the interaction of these factors. The comparative study not only ascertained some all embracing factors but also various features distinctive to specific countries.

The basis of the park analyses was a performance indicator system specially designed by the project consortium, which in principle makes a comprehensive, comparative study of commercial parks possible in the first place.
This performance indicator system is argely oriented toward the interest groups involved in a commercial park and their target objectives. Coresponding to their contents, the objectives can basically be broken down into economic, ecological and social objectives. Each area can be allocated its own success factor. This was used to develop a performance indicator system, which uses indicators to represent a commercial park's success in these three subareas.

Figure 1: Commerical parks analyzed.

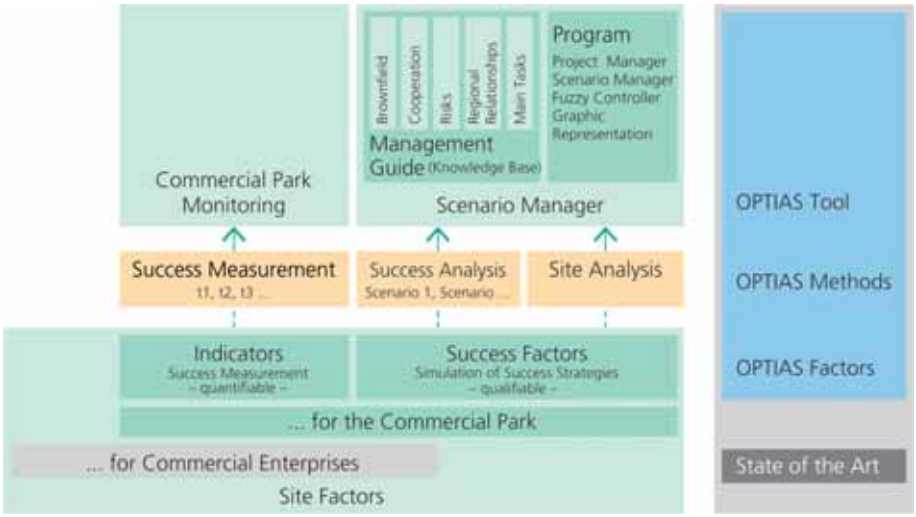

Figure 2: OPTIAS structure and results.

Based on the findings of the commercial park analysis, a tool for optimizing commercial parks was subsequently conceived. This tool employs scenario analyses to identify a commercial park's potential for development and, beyond that, provides support for actions to optimize and realize these potentials. While the indicator system records a commercial park's current situation and compares it either with the objectives defined by the commercial park itself or with other analyzed parks, the scenario tool supports the identification of potentials for improvement. The tool is based on a system of relationships between defined success factors and, along with determining the actual and target states, contains various scenarios with which the impacts of changes to individual parameters can be analyzed. This system based on success factors focuses on mapping a commercial park's active interrelationships. The tool's capability to map and evaluate these active interrelationships is its distinctive feature.

Results

The tool developed in the project supports a systematic, effective method for establishing and developing commercial parks. A site's strengths and weaknesses are represented and actual and target variances are identified. The planning process is made more reliable and misinvestments can be prevented. An analysis for optimizing synergy effects additionally reveals located companies' potentials for efficiency and increases the commercial park's ecological and economic sustainability.

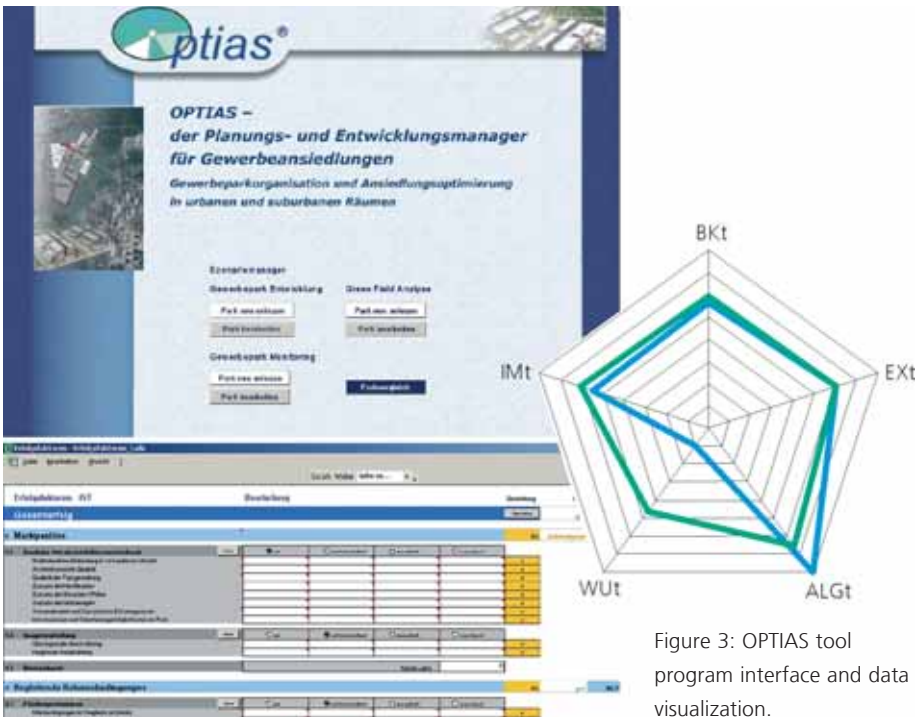

Figure 3: OPTIAS tool program interface and data visualization.

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- EKSPRO ´87 Sp.Z.O.O., Poland
- INTECO, Hungary
- IGZ Innovations- und Gründerzentrum Magdeburg GmbH, Barleben

Using Locating Systems for Airport Luggage Cart Management

Motivation

Luggage cart management is an essential part of airport terminal operation and must therefore be analyzed and represented holistically, i.e. company-wide.

The goal of the process of providing luggage carts is to ensure their quantitative availability for arriving transferring/departing passengers as luggage cart users, allowing for the current as well as future volume of traffic/persons and possible disturbances (buffer). To this end, the requisite number of luggage carts must be made available to users at the right time at the right place (Figure 1).

The safety of the luggage carts in and of themselves has to be guaranteed and comprehensive process engineering/control has to ensure the organizational, structural and technical availability of the luggage carts – with greatest possible safety for users.[1]

The operative process flow of luggage cart handling breaks down into four subprocesses, which correspond to a cyle. Apart from these four "cyclical processes", two more support processes performed by operative employees exist, i.e. quantitative recording of the luggage carts and assurance of luggage cart functionality/safety.

Localizing the Luggage Carts

Luggage carts, which are in disarray outside the predefined staging area, must be located to be collected or returned. Until now they have been localized by on site operative employee checks or by third party notification (internal/external). The immediate vicinity of the airport (e.g. highway access roads, etc.) is searched for luggage carts two times a week.

Collecting the Luggage Carts

After the luggage carts to be returned have been localized, they are collected. During their collection, the luggage carts are gathered, arranged, brought together and made available for return in rows of a maximum of 18 luggage carts.
The frequency of collection in terminal facilities depends on employees' empirical values, prioritization by the control station and the actual volume of users or the luggage cart situation. They can be collected mechanically by means of push feeders or manually. Luggage carts outside the terminal facilities are collected manually.

Returning the Luggage Carts

After the luggage carts have been collected, the luggage carts arranged in rows are returned to the staging area. Carts are returned depending on the staging point and the volume of persons. The technical terminal infrastructure (escelators, elevators, paternosters) between all levels is frequently used to do this, immediately or time delayed (e.g. in the night shift).

Supplying Luggage Carts

Luggage carts are supplied in areas that are adapted to the pedestrian flow as well as predefined and labeled or zoned (by rails) as staging areas. The number of luggage carts supplied at the staging area is adjusted to the volume of persons and is redefined in regular intervals based on demand.

Quantitatively Recording Luggage Carts

The night shift brings together and counts all the luggage carts in cyclical intervals (usually biannually).

Inspecting and Ensuring Luggage Cart Functionality/Safety

In order to satisfy users and lawmakers's demands for safe and available luggage carts, operative employees are responsible for inspecting the functionality/safety of the luggage carts as part of their work. Luggage carts with defects or dangerous flaws have to be taken out of circulation immediately.

Luggage carts undergo a thorough inspection in yearly intervals. Inspected luggage carts are labeled to indicate and monitor the inspection performed.

[1] This is done by providing directions for proper luggage cart use at the luggage cart stands, information columns and escalators as well as by the operative service personnel. In addition, quality is constantly monitored for weak points and accidents, which generates measures for optimization, e.g. replacing accident-causing escalators that end abruptly with escalators that end more gradually.

Figure 1: Staging zone for luggage carts.

The "Operative Early Warning System" Project

The Operative Early Warning System (OFS) project to develop an operative planning and control tool for terminal operation has been underway in the Fraport AG since May 2001.

With the development of the Operative Early Warning System for terminal operation, the Fraport AG is pursuing various objectives:

- Early warning of anticipated malfunctions/influencing variables
- Optimized resource use by reconciling projected capazity utilization and available resources (e.g. personnel, luggage carts, etc.)
- Creation of a base of data for continuous evaluation/analysis and reality-based projections
- Linking of static (flight/train schedules, indicators) and dynamic (video sensors, counting systems, etc.) information
- Proactive process control
- Automation of routine operations and standard processes (workflows)

All these objectives primarily support the optimization of terminal operation processes but can be equally applied to all individuals Fraport areas, airlines and authorities involved in passenger processes.

This planning/control tool will be used as an operative tool to proactively control terminal operation processes, as a reality-based planning tool for long-term process optimization and as an automated reporting tool for real-time visualization/monitoring of operations.

Various innovative technologies are employed such as active RFID[2], WLAN and diverse sensors. Their localization and identification readings can be intelligently linked with external information media (e.g. flight/train schedules, trade fair, vacation and event dates) and displayed on a layout-based user interface.

Handhelds eliminate the use of paper, lists and pencils. Leaner processes make duplicated work superfluous. Annoying routine operations can run (semi-) automatically. Extensive information options and optimized channels of communication provide every individual a comprehensive overview of the current situation and help optimize the interaction of all the forces involved.

[2] Active RFID (Radio Frequency Identification Technology): Transponder technology for localization in the microwave range.

The data forms the foundation for a multitude of potential services, beginning with online inventory or systematic culling of luggage carts ("TÜV" inspection date).

Along with the optimized work equipment and work environment, the increased process transparency and capacities will enhance the quality of service for customers.

The prototype phase in 2003, executed together with the Fraunhofer IFF, has been successfully brought to a close.

Approach

A fundamental focus in engineering the OFS is supporting system-related processes for operative luggage cart management:

- Equipping the luggage carts with active RF transponders to not only identify but also localize them
- Equipping the operative workforce with BDE devices
- Defining minimum/maximum luggage cart values in defined areas of terminal operation
- Defining dynamic target values based on anticipated demand (coordination with flight plans and pedestrian flows)
- Dynamically reconciling defined values with actual values
- Initiating workflows, from detecting a deviation up through assigning the next free worker
- Documenting the luggage cart situation
- Devising an optimal arrangement of luggage carts by making simulation-aided forecasts, based on evaluation of past data and incorporating anticipated variables.

When designing and selecting a system for luggage cart identification and localization, appropriate importance must be attached to luggage cart localization covering all areas in the particular terminal area as well as the number of luggage carts in the individual staging areas being precisely monitored.

The overlap of terminal areas and staging areas is particularly relevant. Nevertheless, it must be possible to view both areas individually. In order to be able to assign the data collected in the central database to the appropriate luggage cart, it has to be given a unique identification number, which can then be used to retrieve any data on a specific luggage cart.

An active RF based transponder system was selected, which employs a runtime measuring system to determine a transponder's position and consequently a luggage cart's status. In designated areas, special localization technologies based on magnetic fields determin a luggage cart's position.

For the prototype, 430 luggage carts at gate A of Frankfurt Airport and only used in this area, were equipped with RFID tags made by Wherenet. Along with installing antennas for luggage cart localization, selected staging areas were furnished with so-called Whereports, which enable exact localization in these areas.

By introducing a standardized database with the OFS, detailed events could be immediately referred to for evaluations (online statistics, trend analyses) and automatically visualized (Figure 2).

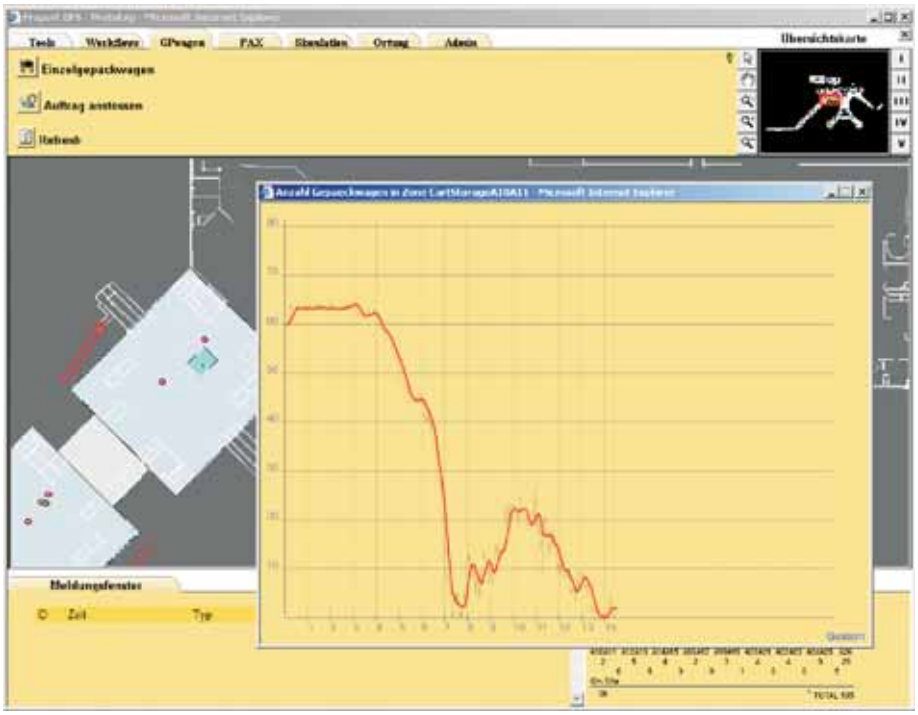

Figure 2: Staging area statistics.

Results

The luggage cart localization system based on RFID technology and other counting data on current pedestrian flows in upstream and downstream areas increases the reliability of data for projections. However, the amount of data from the accumulated readings and the variety of indicators necessitate computerized methods to derive firm indicators and measures.

The simulation-aided projection of pedestrian and luggage cart flows is an important instrument for estimating potential developments in the next hour or in the next days on the basis of scenarios.

To do this, a flexible, parameter-controlled simulator was developed, which starts with current information on gate occupancies and train schedules and combines this with sensor data from terminal areas and history data – always allowing for the airport's infrastructure and basic conditions.

The simulator can be used to better plan and control resources and capacities for daily use. In addition, the simulator can also be used as a tool for the planning and control of seasonal changes (e.g. during local remodeling at the airport, when flight schedules change, etc.).

On the one hand, more precise cost and resource control and need-based logistics will benefit the airport. On the other hand, fast check-in and short waiting times at passport control and baggage claim will increase the pleasure of flying for travellers.

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Analysis and Engineering of Internet-based Services to Support Shutdown Processes (Shutdown Services)

Motivation

The complexity of large-scale shutdowns of technical assets in different industries necessitates comprehensive planning and control competence and backup. While the components installed in plants are no longer as maintenance intensive as earlier, they incur higher costs, e.g. due to legal and insurance requirements, when activities are prepared, executed and documented. Moreover, modifications in plants to increase productivity or to adapt to changed market conditions are playing a greater role in the planning of shutdown processes than in the past. In a shutdown, operators try to bundle a number of activities from maintenance, inspection, repair, overhaul, documentation, legaly required reporting, conversion of production or expansion of the plant. General contractors and service providers execute the majority of activities.

Today, shutdowns are projects that in part need several years of preparation and are executed in extremely short times. In a shutdown project, human and material resources from service providers and plant engineers must be organized and controlled simultaneously and in parallel. In practice, completely and exactly determining the work to be executed is a major deficit during shutdown planning.

The following shutdown model is replete with substantial financial and schedule risks for operators as well as service providers since a temporary service network must largely completely dismantle, refurbish, reassemble and start up the plant exactly on the day scheduled and with the requisite quality and quantity. Supporting systems that map control, monitoring and analysis functions for specific roles do not exist at all.

Innovative methods and showcases for medium-sized industry were developed for the problem areas of shutdown planning and control as part of this research project (Nov. 2003 - Nov. 2005) supported by the Saxony-Anhalt Ministry of Economics and Labor.

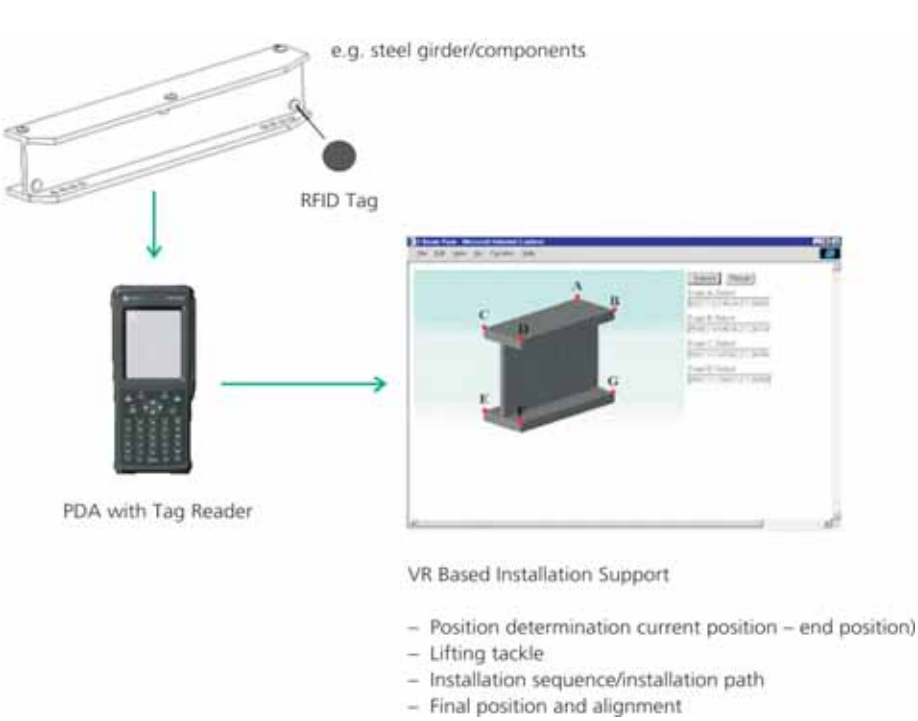

Figure 1: Example application scenario of adaptive visualization with RFID and VR.

Approach

To engineer web-based services for shutdown planning and to coordinate these services during a shutdown, interviews were used to analyze the different partners' activities during a shutdown, compile process specifications and identify deficits (informational, organizational, internal and external). The processes and deficits identified were the basis for organizing reference processes and structuring their information. Regional companies, which assessed the practicability and feasibility of the reference processes, were worked with here too. In the end, concepts were developed for implementing selected reference processes and creating showcases.

Results

To improve the transparency and the quality of planning of shutdown actions, the Fraunhofer IFF developed a model that determines rates of wear for the purpose of condition-based maintenance and tested it on selected partial plants. The methods were based on information from company information systems and experiences from use and maintenance.

Concepts for the creation of Location Based Services (LBS) were developed to support the execution of planned shutdown actions. Two technologies in particular were analyzed more closely: radio frequency identification (RFID) and virtual reality (VR). RFID technology supports the identification and localization of assets and materials during a shutdown. Adapted to the different needs for information of those performing the work, virtual reality uses adaptive representations combined with additional information to reduce the complexity of the activities to be executed.

Together with medium-sized enterprises from the region, which can play different roles in a shutdown (operator, service provider, equipment supplier, etc.), these two technologies were tested for their potentials for improving processes and increasing productivity (demand analysis). Based on selected application scenarios (RFID secure transfer of goods and storage, VR based purchasing support, order progress monitoring, etc.), data models were designed and technical systems were analyzed and selected (engineering). Existing equipment technology from the Fraunhofer IFF LogMotion Lab was reverted to. Functionalities currently lacking were visionarily designed and represent future directions of research and development for which the first showcases have been technically implemented.

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Collaboration
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Figure 2: Material storage during a shutdown.

Figure 3: Mobile job management with RFID.

Integrated Logistics Chains for the Forestry and Wood Processing Industries

Motivation

The German forestry and wood processing industries are subject to enormous economic pressure. High labor costs and intense competition ensuing from foreign wood deliveries are significantly affecting the wood market in Germany.

Timber production and processing are complex processes with many different parties involved and widely varying tasks. New technologies and organizational forms are needed to improve the information flow and the collaboration among all the parties involved and to make Germany internationally competitive in the forestry and wood processing industries.

In a run-up project, the state of Saxony-Anhalt studied the basic organizational and technical conditions in the regional forestry and wood processing industries. The study clearly revealed that, for the forestry and wood processing industries in Saxony-Anhalt, demand exists for the development of a pilot system.

The use of new technologies is intended to optimize the logistics chain from the forest to the factory for all actors. Apart from the wood processing industry's demand for cost effectiveness and optimization special significance is also attached to environmental protection to ensure management protecting resources on a long-term basis.

Objectives

The "Wood Logistics Demonstrator" is aimed at developing and producing a technical pilot solution for Saxony-Anhalt's regional forestry and wood processing industries. The demonstrator includes an Internet platform for the planning, control, monitoring and controlling of wood logistics chains. Access to a shared database allows better controlling the processes among those involved in the logistics chain "from the forest to the factory". Further, new technical possibilities of on site data acquisition and processing are being tested.

The development of the demonstrator requires the incorporation of many factors: Technological, economic and ecological interrelations have to be balanced with the basic regional conditions of forestry operations and service and wood processing companies. The participating companies' size, structure, personnel and equipment have to be alowed for as much as the topography of forest lands including protected areas and conditions of forest ownership.

Functions

Increasing cost effectiveness and efficiency and ensuring environmental protection and nature conservation were uppermost during the development of the "Wood Logistics Demonstrator".

On the one hand, the demonstrator provides a technical platform. On the other hand, it also provides advanced equipment such as mobile terminals for testing. Forest owners, forest management and processing service providers, carrier companies and the wood processing industry have the following functions at their disposal:

- Planning, monitoring and control of logging and of transport contracts
- Road condition and weather information for active and environmentally compatible navigation of humans and machines
- Localization and event-based navigation of mobile assets in the forest
- Fast, integrated (paperless) and correct data transmission

Figure1: Saxony-Anhalt Wood Logistics Demonstrator homepage.

– Coordination and status-based control and monitoring of wood flows
– Reduction of forest pollution by providing environmentally relevant information

The demonstrators's various components make these functions available in the Internet or on mobile terminals and can be supplemented by basic functions such as user rights and master data management. Consequently, every party involved is given the capability to select individually required functions and to customize the demonstrator's range of functions for individual users.

The demonstrator's core and basis is a data model, which interconnects the individual components and their data. Setting up a communications platform based on of the demonstrator is planned for the future. The regional actors' existing enterprise resource planning systems and data sets will be connected to the platform.

The Wood Logistics Demonstrator not only demonstrates technological solutions for support but also organzational requirements for improving information flows. The desired success from cutting the costs of the wood logistics chain and optimizing it crucially depends on the willingness of all the parties involved to provide information on the one hand and to incorporate the provided information in their own planning on the other hand.

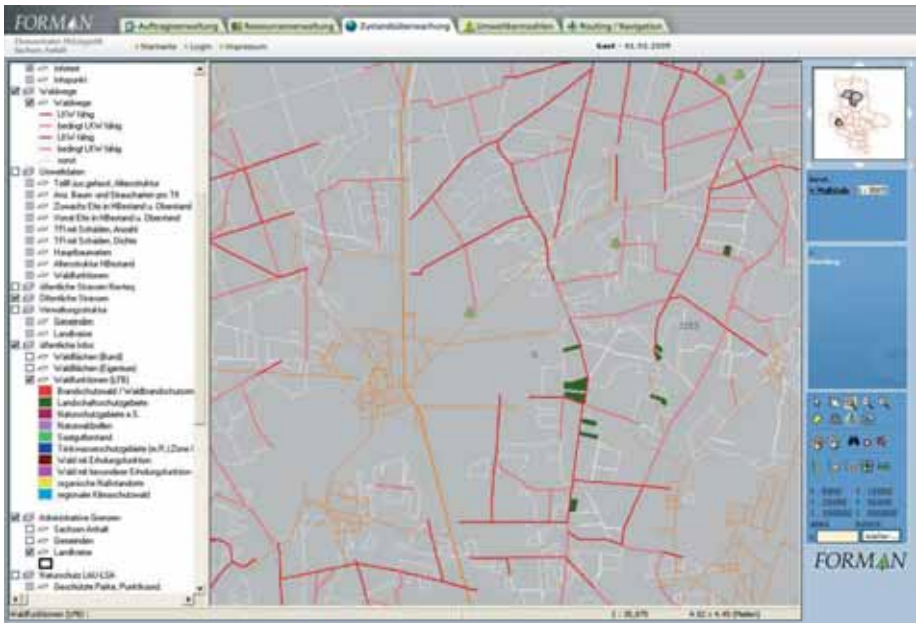

Figure 2: Map of forest and public roads with current data.

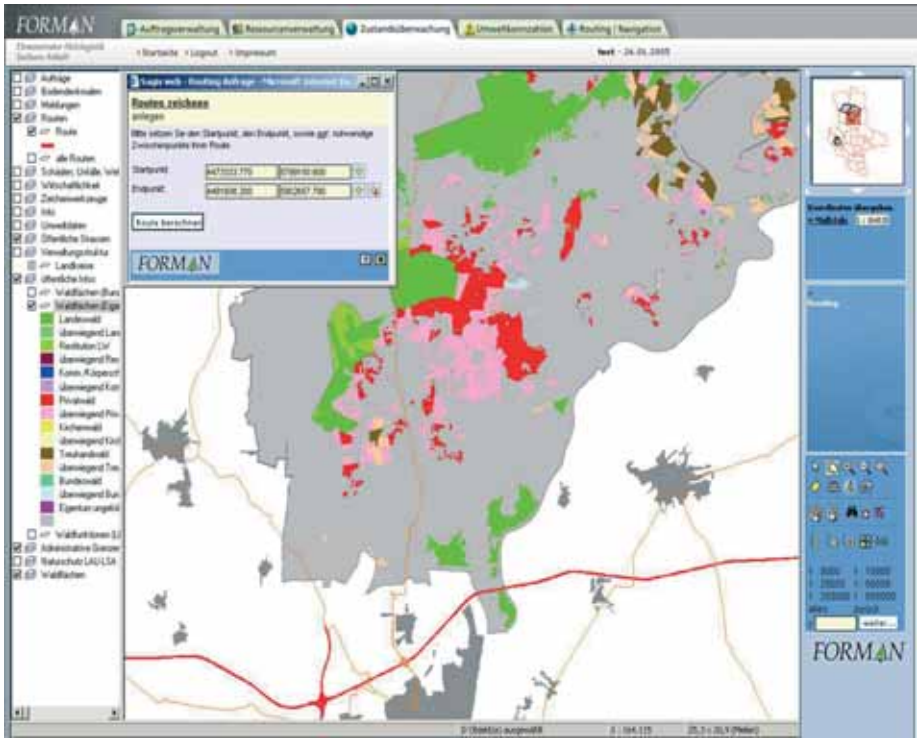

Figure 3: Route planning in the forest with current data on the condition of forest roads.

Outlook

In the run up to the demonstrator's piloting phase, various parties in Saxony-Anhalt had already been recruited by April 2005 to test the application and suitability of the various technologies in on site use in two selected test regions.

The test phase will result in more extensive coordination of the regional actors of the forestry and wood processing industries. Sustainably organized workflows including collectively accepted user and rights concepts are being initiated. Components and services to be shared as well as coordinated cost and operator models are being prioritized for an integrative complete system and the aforementioned services, technologies and functions.

The Fraunhofer IFF has already has begun initiating this discussion process and will be doing more than just acting as a moderator overseeing the interface to the "Wood Logistics Demonstrator".

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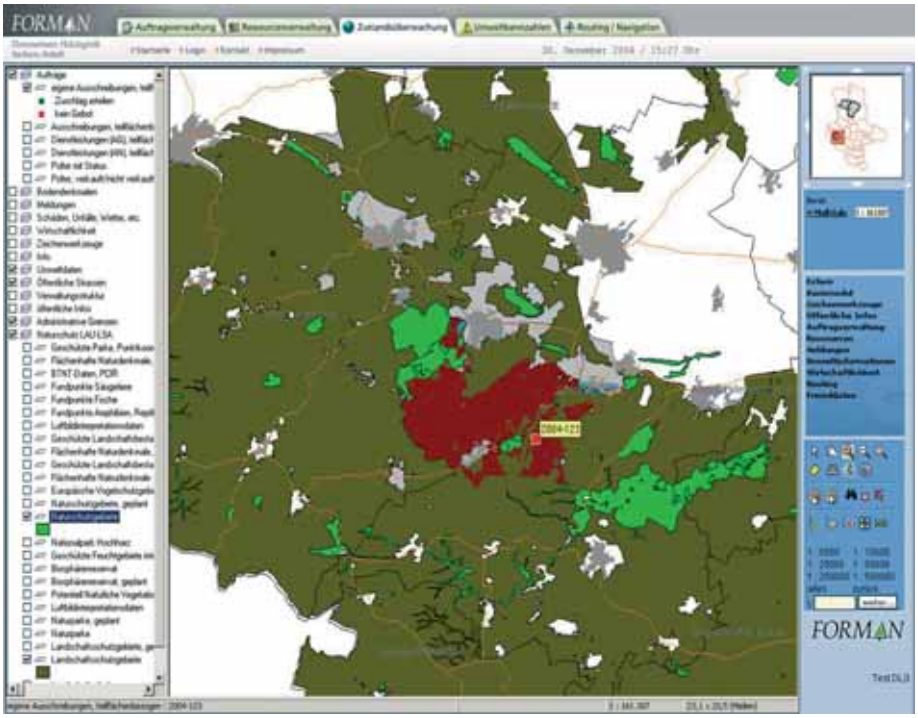

Figure 4: Forest condition map with current data on order status.

Figure 5: Mobile terminals are used to determine position in the forest.

Virtual Reality (VR) Based Modular System for Plant Layout

Motivation

Even in early design phases, the planning of complex sorting, processing and residual waste treatment plants demands great imagination, experience and technical background from sales and layout engineers. The novel virtual reality-based development tool "AMB-VRBuilder" makes it easier for planners to design their plant system.

The sales unit of AMB Anlagen Maschinen Bau GmbH in Oschersleben involves clients in laying out a plant to take advantage of their wealth of knowledge and know-how to identify special requirements and specify individual basic conditions. The result is often restrictions on the design of plants, which are generated by structural conditions or arise from the process to be implemented itself. The restrictions must be collectively identified and incorporated. Vivid virtual reality (VR) based plant models suggest themselves as a reference point for the communication necessary between sales and the client. The tool AMB-VRBuilder is used to generate such models.

Approach and Results

Using the AMB-VRBuilder in sales facilitates interactive sales talks in the course of which a client intuitively comprehends the VR plant model. The design can be exported as a 3-D model in the various formats of the CAD system used for engineering and is available there to elaborate the details of the design.
A function for automatically compiling standard texts increases the efficiency of project documentation. Using the widespread and standardized 3-D data format VRML enables clients to use standard hardware and software to view design alternatives. Mutual understanding of client requirements and possibilities for the provider grow. Acceptance of the resulting design rises. Prospects for a successful sale increase.

The prototype library developed and VR-Builder's efficient spatial interconnection techniques are the foundation for generating plant designs in 3-D space. The prototype library contains specific AMB components of equipment for comminution, separation, mixing and materials handling and reproduces the modules of AMB products. The library is augmented by easily, flexibly applicable models of piping, structural elements and steel structures. The components are configured by an individually defined set of parameters. The configuration options corresponding to reality make it possible to assemble complete plant designs flexibly andoriented toward the process.The junction points defined in the individual prototypes are used to automate the configuration of the components in the virtual environment during interactive plant layout. The junction points are contextually selected by interconnection techniques that are geared toward the material flow, activated and joined together.

This kind of automation of component configuration supports speedy, intuitive work on a design. Typical configurations of subsystems can be stored in structured form and reused.

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"Life Cycle Oriented Plant Management LCPM" – E-Learning for Training Maintenance Technicians

Motivation

As part of the project "Life Cycle Oriented Plant Management LCPM" Asian partner institutions were empowered in continuous education to use the offering of new forms of Internet learning to strengthen industy executives' problem solving skills in the field of life cycle-oriented industrial plant management.

The Internet is the technical platform for this e-learning offering. Hence, modern, IT supported methods and tools are available, which facilitate efficient knowledge transfer. The InWEnt gGmbH offers the training through its e-learning community Global Campus 21 (www.gc21.de).

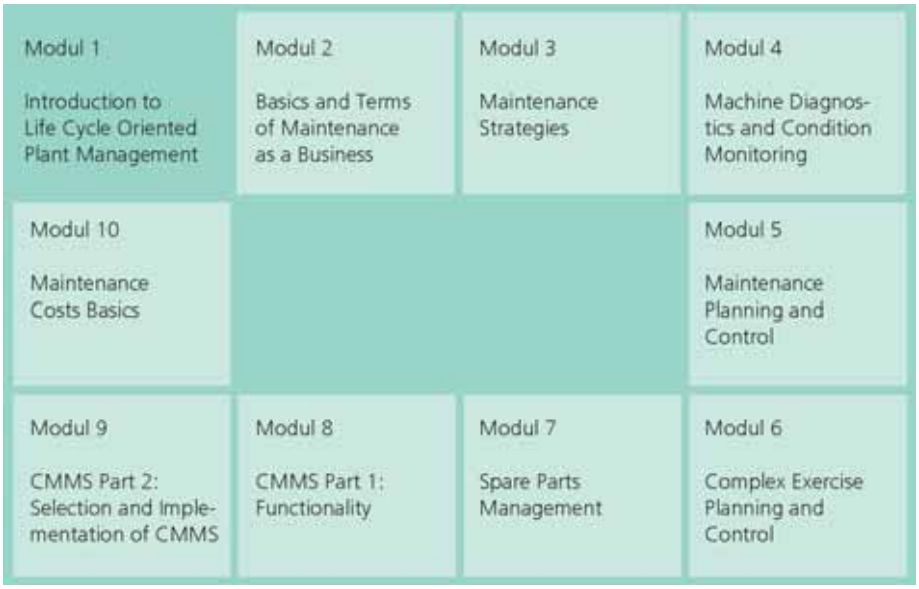

Figure 1: Overview of the online modules.

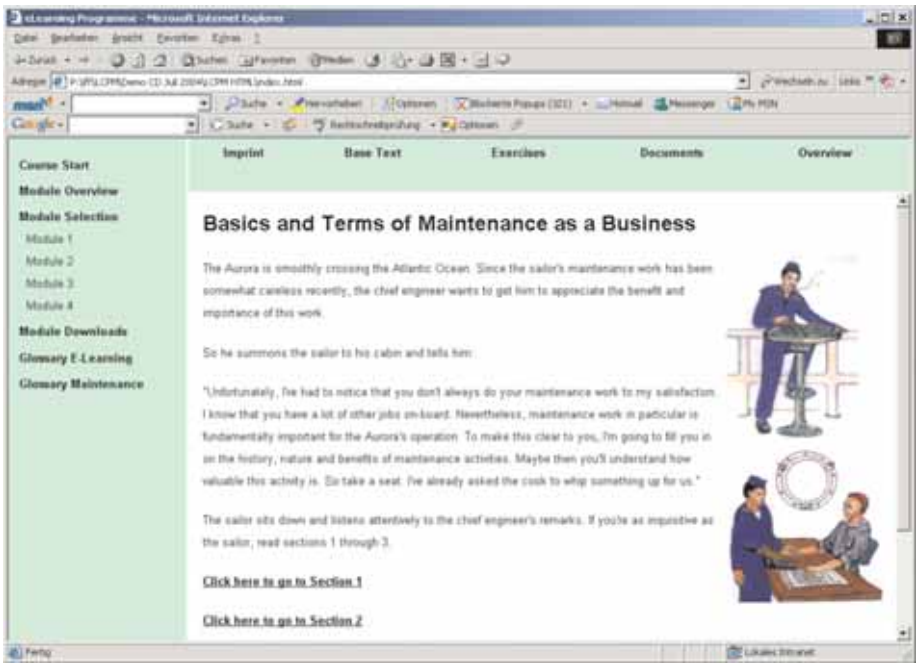

Figure 2: Online didactic scenario mask.

Results

LCPM is currently divided into 10 online learning modules, which teach relevant contents of professional knowledge of maintenance management. The course contents were developed in cooperation with German industrial enterprises and foreign training institutions in the ASEAN region. Training institutions took over conducting the LCPM course in the respective regions and national languages.

The content of the training is not geared toward any particular branch of industry. Practices, methods and holistic concepts are presented in such a way that they can be applied to a multitude of industrial enterprises. Hence, the educational contents (basic texts, examples, videos, animations and work materials in MS Office®) are attractive to a broad target group. The future goal is to further integrate industry-related examples, indicators and case studies to provide courses customized for the specifics of individual industries.

Apart from actual learning by means of texts and exercises, another server provides 2-D plant layouts, a 3-D virtual reality community and diverse web services. These support learners when they apply what they have learned in the field to examples of virtual plants and processes and when they are solving more complex problems.

Selected chapters contain exercises, which must be completed by ascertaining the necessary information from the virtual model. In addition, real software systems (e.g. the Fraunhofer maintenance planning and control system idasys) and web services are partially integrated for practically oriented learning on a high level. Users are connected by Plug Ins and ActiveX elements.

Easy manageability of the web technologies used is a priority. As a result, learners with little or varying computer knowledge can also work with the system whatever their skills.

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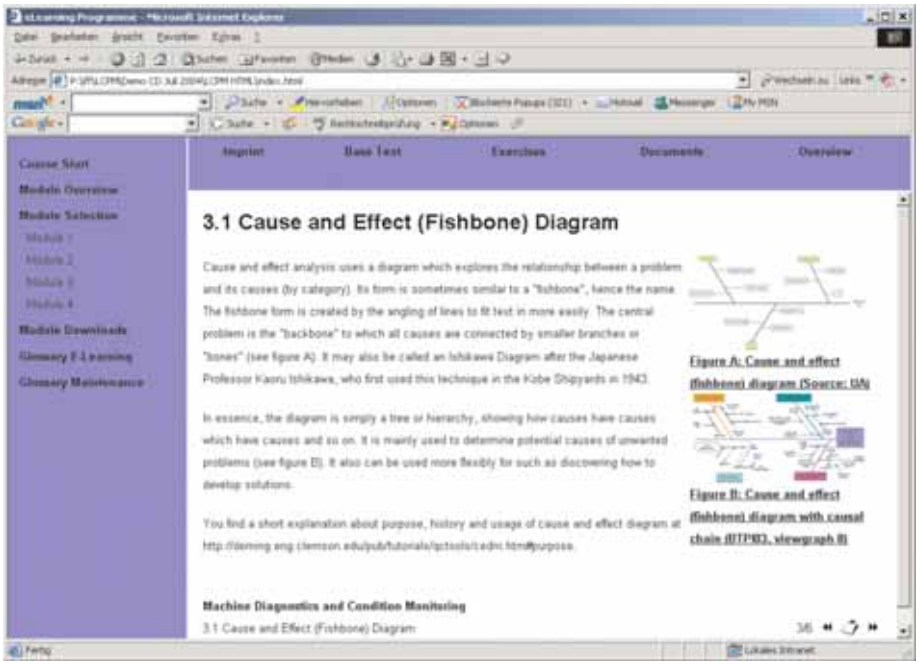

Figure 3: Online mask with animated graphics.

Corporate Sustainability Management: International Transfer Projects in the ASEAN Region

Motivation

Strong growth characterizes the industrial sector in the territorial states in Association of South East Asian Nations or ASEAN. For example, economic growth in Thailand has averaged 6 % since 2002.

Increasing competitive and cost pressure (e.g. distinctly lower manufacturing costs in China compared to ASEAN), the incorporation of international standards (e.g. implementation of ISO 14000 as a prerequisite for integration in the supply chain – the textile industry such as Adidas, Nike, Otto is a leader here) and a diminished quality of life due to pollution concentrated in and around industrial parks (e.g. Haiphong in Vietnam, Lum Phun and Rayong in Thailand) are inducing companies to take action.

Against this background, sustainable corporate management is becoming increasingly important and a long-term prerequisite for successful action on the market. Sustainability management means incorporating ecological, economic and social aspects when business processes are being oriented and optimized. However, the prerequisite for this is the transparency of corporate processes and allowance for their interlinking and interrelations. This leads to increased requirements on the quality of companies' data and information. Suitable methods and tools are therefore needed to meet these requirements.

However, an intersectoral actual state analysis of the use of corporate controlling and resource management systems, taking Thai industry (see EuropeAid "Asia IT&C FORCE", www.asia-itc-force.de) as an example, revealed that small and medium-sized enterprises in particular have a tremendous need to catch up.

Approach

As part of the international transfer project "Environmental Performance Assessment for Industries" (2001-2005), completed in cooperation with the InWEnt gGmbH in the ASEAN countries of Indonesia, Philippines, Thailand and Vietnam, the Faunhofer IFF developed a methodology for corporate sustainability management based on environmental performance indicators. Along with providing qualification (training of around 600 participants from industry, consulting, government and research) and ensuring sustainable dissemination (trainer seminars), implementation projects were carried out in selected companies. The software solution for corporate sustainability management "Enterprise Performance Indicator System (EPI)" developed by the Fraunhofer was used. EPI software support enables companies to systematically identify weak points along the process chains, to analyze their causes and to continuously develop the potentials for their optimization. The EPI system was conceived and implemented as an integrated management system.

Depending on corporate features and objectives, various aspects can be incorporated in the system, e.g. productivity/ resource management, environmental protection, quality, maintenance or occupational safety.

Figure 1: Fraunhofer IFF EPI project team at the Oil & Gas Training Centre Pusdiklat MIgas, Cebu, Indonesia.

Results

The pilot companies were already able to develop substantial potentials for savings in the first year after implementing the EPI system. Thus, for example, the pilot company in the Philippines (a medium-sized enterprise in the food processing industry) saved a total of US$ 118,000 and the pilot company in Indonesia (a training center for the oil and and gas industry) saved a total of US$ 98,000. This corresponds to an amortization period of less than four months.

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- General Starch Limited, Nakornratchasima, Thailand
- Xuan Hoa Company, Vinh Phuc, Vietnam
- Thanglong Joint-Stock Company, Hanoi, Vietnam

Automated Solutions
from the Idea through Practical Application

Dr. Ulrich Schmucker
Division Director AUT

Automation AUT

Intelligent Sensor Systems ISS

Robotic Systems RS

Project Reports

Sensor Systems for Medical Technology: Inertial Sensor Gait Analysis for Neurological Rehabilitation

Motivation

As a result of strokes, accidents and brain tumors, a multitude of functional failures can be observed in the human body, including motor dysfunctions of the lower extremities, which can result in gait disturbances or complete loss of mobility. While the actual motor elements (muscles) and the nerve conductors between brain and muscle needed for control continue to function, random movement is no longer possible or is limited because brain functions are partially dysfunctional.

One approach to treating such dysfunctions is based on the human brain's capability to "learn to think differently". Systematic, intensive movement training can get other parts of the brain to completely or partially take over the functions of dysfunctioning parts. Until now, the outcome of such treatment was usually evaluated by a physician or physical therapist. Thus, the evaluation of the progress of therapy is subjectively influenced to a great extent. Other systems for gait analysis, e.g. video or strength sensor systems, are often extremely complex and consequently cannot be used profitably for smaller rehabilitation and physical therapy institutions.

This provided the motivation for developing a simple system for gait analysis with the goal of objectively evaluating progress in the treatment of gait dysfunctions.

System Specifications

The system to be developed had to first metrologically capture the motions of the human gait. In a second step, the motion information recorded by sensors is used to derive an objectified gait.

To record the motions in the gait, an inertial sensor module is affixed to the test person's shoe, which is able to metrologically capture the movements of the foot (Figure 1).

This inertial sensor module consists of a Cartesian triaxial configuration (XYZ) of longitudinal acceleration and sensors measuring torsional rate (accelerometer and gyroscope). A sensor pair consisting of accelerometer and gyroscope is placed on each of the three axes that are perpendicular to each other.

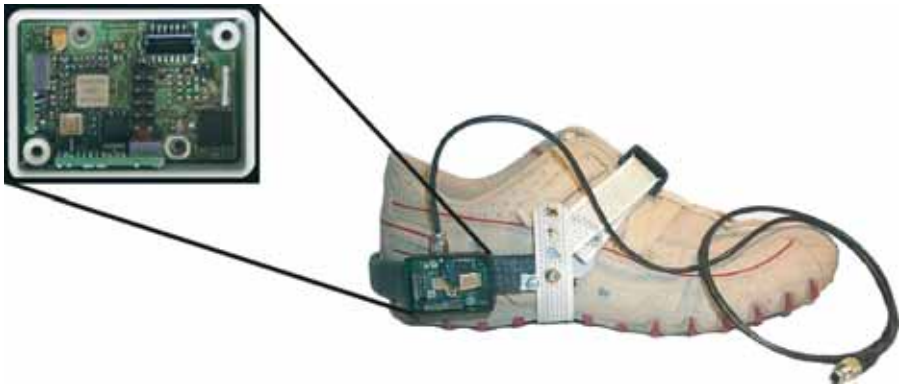

Figure 1: Inertial sensor on a foot .

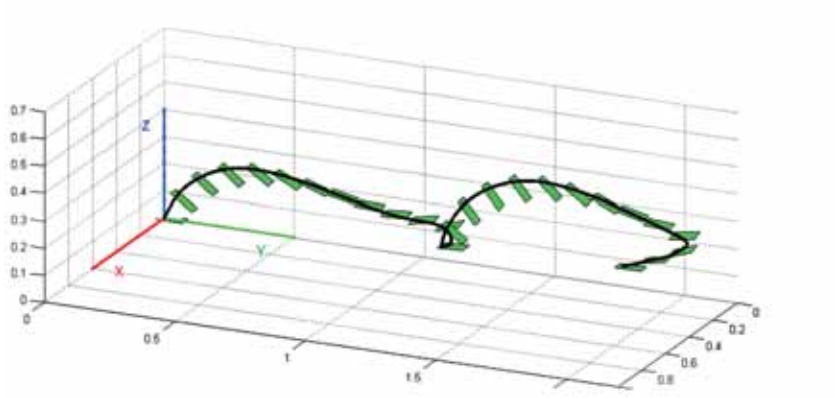

Figure 2: 3-D path of foot movement (position and orientation).

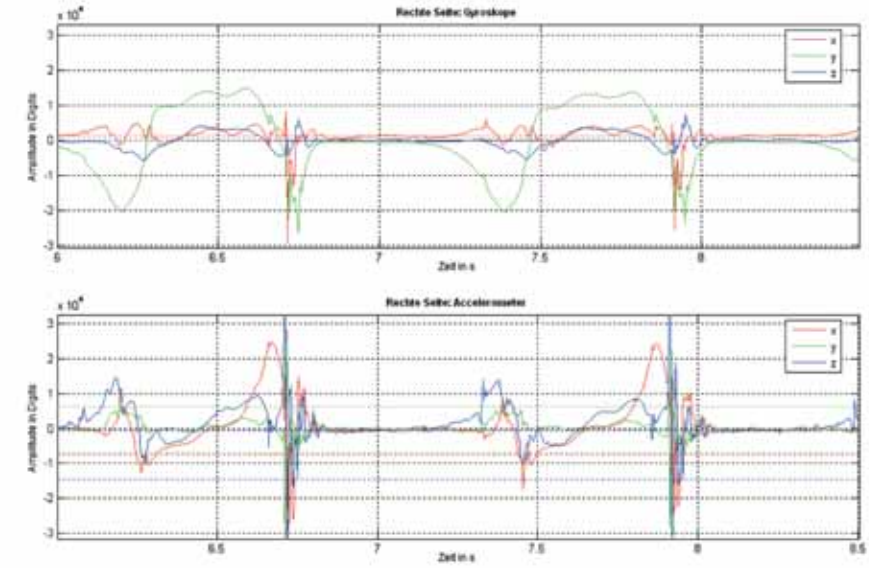

Figure 3: Torsional rates and acceleration values during a double step.

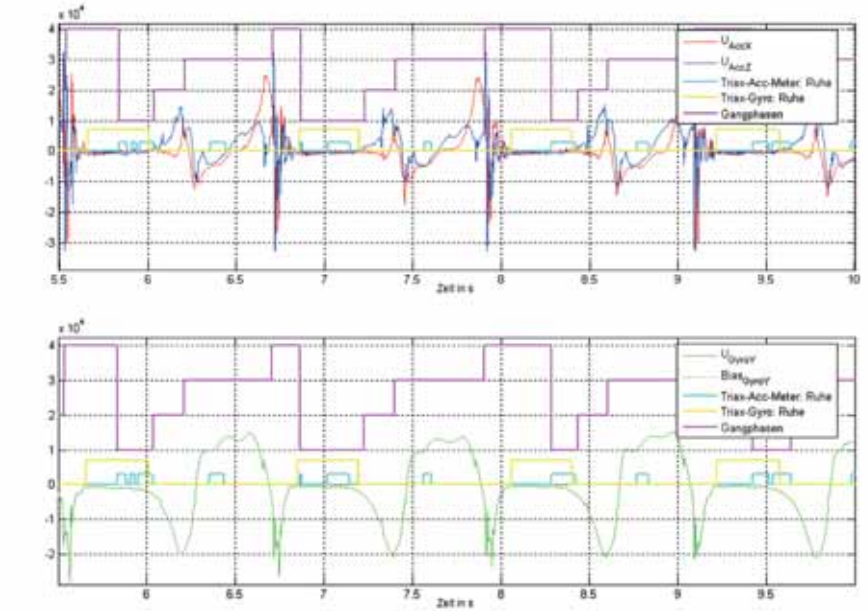

Figure 4: Determination of gate phases from the sensor signals.

A microcontroller controls the continuous recording and digitization of the sensor signals, stores them or transmits them to an evaluation computer (PC or laptop).

The sensor signals are analyzed and evaluated in two ways. On the one hand, parameters describing acceleration are determined directly from the sensor signals or from a mathematical breakdown of the individual sensor signals (e.g. determination of the angle of foot lift from the rotation angle on one of the horizontal axes by simply integrating the torsional rate over time). On the other hand, the six sensor signals can be used to calculate a complete reconstruction of the foot's path of movement. In the process, the norm of the motion vector is determined from the three components of translatory motion (double integration of acceleration to determine the path) at the discrete times of digitization as well as the direction of the motion vector from the three gyroscopes. The thusly determined 3-D motion trajectory of the foot can then be used to ascertain parameters describing gait, e.g. stride length, stride height, gait tempo and track width (Figure 2).

The gait is further characterized by determining the phases during a gait cycle (initial contact, loading response, mid-stance, terminal stance, pre-swing, swing). To this end, mathematical methods are used to evaluate the sensor signals. In turn, parameters describing gait, e.g. percentage time distribution of the individual phases of a foot or the symmetry of the phase times of right and left foot, can be determined from the gait phases.

The multitude of parameters determined can be used to assign the gait to different clinical pictures and levels of damage. At the same time, the development of the parameters over time can be used to evaluate the outcome of treatment.

Results

The system developed represents an efficient solution for gait analysis. For the field of neurological gait rehabilitation, this development provides a system of equipment to objectively record and evaluate the progression of treatment. This is equally important for physicians and therapists as well as the cost units of such treatments.

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In Situ Bending Angle Measuring System for CNC Controlled Bending Machines

Motivation

In industrial mass production, quality assurance in manufacturing is taking on great significance since it provides information about whether a production lot satisfies the specified requirements. If this is not the case, reworking or even new production of the entire production lot incurs additional costs. The earlier quality assurance can be integrated in the running production process, the sooner defects can be reacted to, e.g. when manufacturing tolerances are not kept.

A multitude of various industrial sectors use CNC controlled pipe bending machines to bend pipes and profiles. Today, fully automatically controlled pipe bending machines are able to run positioning values preselected by an operator for feed, rotation and bending angle with repeat accuracy. Yet, it has been extremely difficult to measure or even control the actual angle of bend, which results when elastic recovery on the pipe bend is allowed for. The value of elastic recovery depends on a number of material, machine and process parameters, e.g. variations in the composition of material and in the geometry of the pipes, quality and quantity of lubricant used or the state of wear of the bending tools.

The system for bending angle measurement jointly developed at the Fraunhofer IFF with the bending machine manufacturer Tracto-Technik GmbH enables already measuring the exact angle of bend in the bending machine directly following the bending process. This makes immediate quality control of the result of bending and feedback to the bending process possible.

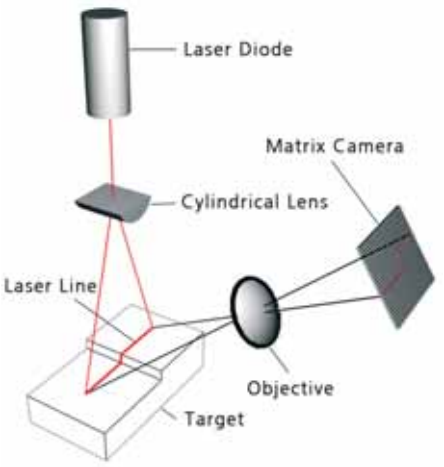

Figure 1: Light-sectioning principle.

Method and Measuring Principle

The optical non-contact measuring system for determining bending angles employs the light-sectioning method based on the principle of triangulation (Figure 1). A fanned laser beam (line projector) is projected on the device under test, as a result of which a fine light-dark line is generated on the object surface, the shape of which is in turn recorded by a camera and automatically analyzed with special algorithms. In this specific case of application, two lines are projected on the cylindrical area of the pipe behind a bend. The thusly acquired three-dimensional points of the pipe surface arrayed in two crescent shapes (Figure 2) can be used to determine the pipe's orientation in space. To this end, an algorithm is applied, which mathematically approximates a cylinder in the surface points (Figure 3). The cylinder calculated forms the first leg of the pipe bend. The second leg is produced from the cylindrical pipe area before the bend, which is found in a fixed reference orientation in every measurement.

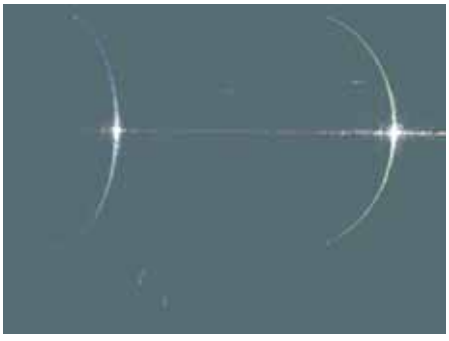

Figure 2: Camera image: Extracted laser lines (blue and green) and disturbance (red).

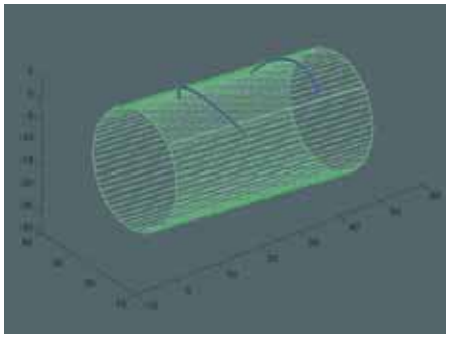

Figure 3: Cylinder approximation.

The two orientations of the legs of the pipe bend can then be used to calculate the absolute angle of bend in two planes with great precision (measurement uncertainty ± 0.05 °).

The measuring system's automatic adjustment to the device under test (color, brightness, roughness) enables measuring the widest variety of pipe material. Intelligent evaluation algorithms tolerate disturbances on the pipe surface such as reflections, scratches, writing and the like as well as changing ambient conditions such as ambient light.

With the aid of a simple gauging block, the measuring system can be automatically calibrated in the machine and its correct functioning can be checked at any time.

The measuring system's compact design and the time requirement of a few fractions of a second for the actual process of measurement and evaluation satisfies two important practical requirements. The pipe bending machine's bending clearance is retained as far as possible and any increase of cycle time is limited to a minimum. What is more, the system is virtually maintenance free.

Results

The bending angle measuring system integrated in the machine provides users the option of in-process measurement and logging of angles of bend as well as the option of direct feedback of bending results to the bending process. This integrated in-situ quality assurance reduces manufacturing costs and simultaneously achieves high manufacturing quality.

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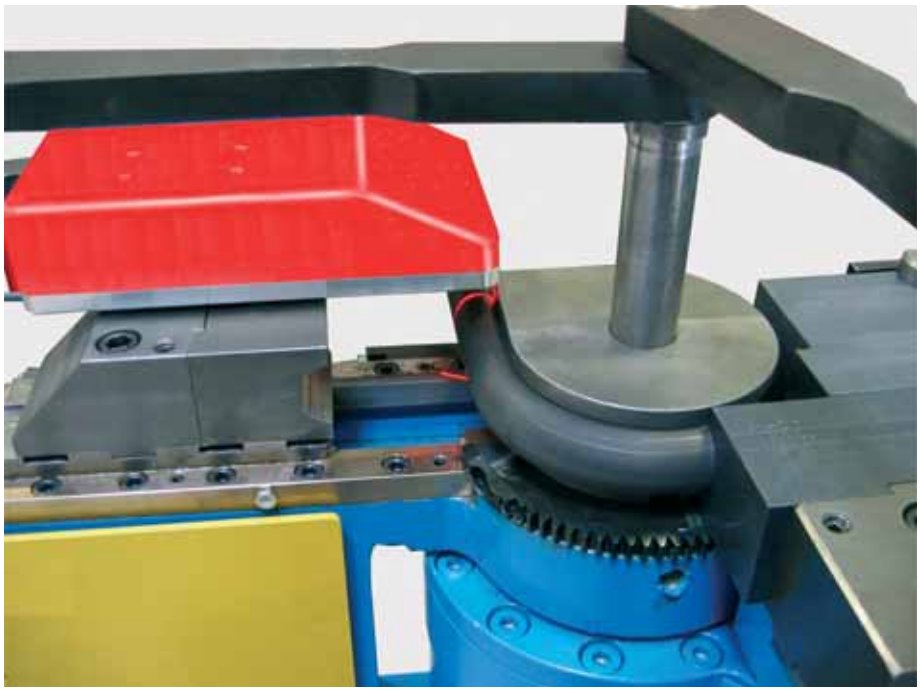

Figure 4: Bending angle measuring system in the machine.

Figure 5: Bending machine.

NOMAD: Autonomous, Flexible Robot for Welding Large Steel Components

Motivation

The overall objective of the NOMAD project was to develop an autonomous, flexible robotic welding system for large steel components. The range of components such a system can produce includes volumes of up to several cubic meters, weights of up to approximately 5 tons and material thicknesses of 3 to 50 millimeters. At present, such steel structures are either welded manually or produced in special purpose robotic welding systems.

Manual welding has the advantage of being extremely flexible as regards the size and shape of the structures produced. However, the disadvantages of manual welding are its high costs, low output rate and varying quality. What is more, the number of qualified welders in Europa is dropping steadily and this trend is expected to continue.

Special purpose robotic welding systems can achieve high and consistent product quality and high output rates. However these systems are expensive and inflexible since they can only be used for specific types of products.

Approach

The work of the Fraunhofer IFF focused on the following details:

- Integration of the autonomous robotic system
- Software design for an autonomous robotic system
- Automatic route planning
- Simulation and visualization of navigation
- Development of sensor-guided high-level navigation
- Development of an image processing system to automatically detect the position and orientation of the workpiece
- Development of an image processing system to automatically detect the position and orientation of the autonomous robot

Results

The main component of the autonomous, flexible robotic welding system is a 6-axisrobot arm to weld large steel constructions manufactured in small quantities or with extreme variances.

The welding arm is located on a mobile, autonomous robot transport vehicle (RTV). Thus, the welding robot can be positioned on any workpiece. Expensive and elaborate constructions for workpiece positioning are eliminated. The RTV can move around the workpiece in such a way that the robot arm is able to reach every weld.

An optical sensor system mounted over the work cell detects the workpiece's position and orientation. In the same way, this sensor system detects the position of the RTV and this information is combined with the navigation data of the RTV control.

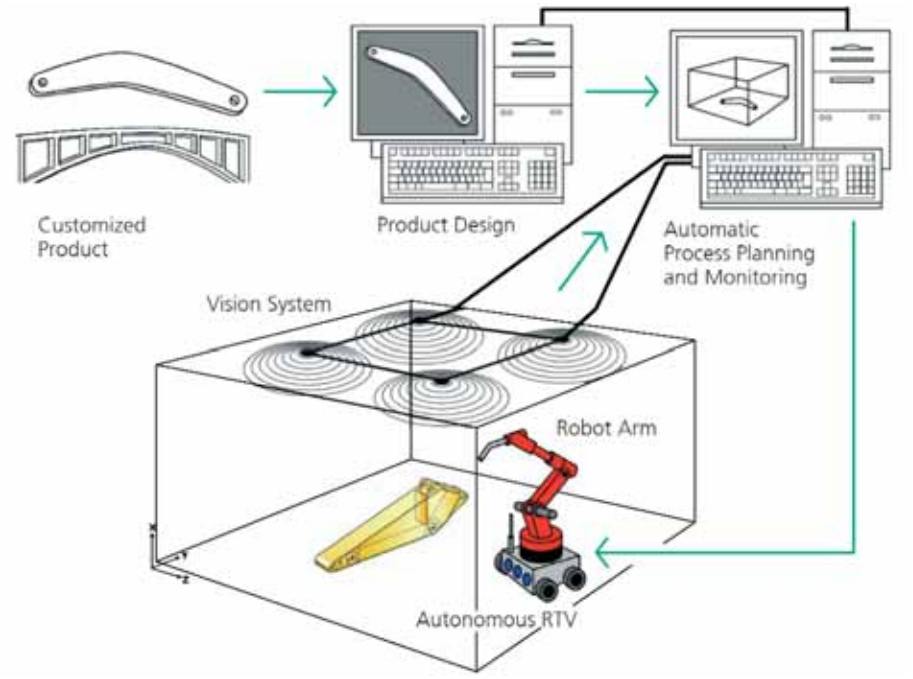

Figure 1: Diagram of the functions of the welding robot NOMAD.

The program for the robot arm (welding) and RTV (navigation) is generated automatically in combination with the workpiece's original CAD data, the real data measured by the camera system and a simulation tool.

The autonomous, flexible robotic welding system provides the following innovative aspects:

- Simulation of production for automatic process planning and system monitoring in real-time
- Navigation system for an autonomous robot transport vehicle (RTV) to enable positioning a robot arm with greater precision
- Design and construction of a robust industrial RTV with the precision and stability needed for welding jobs
- Specially developed welding equipment, welding procedures and sensor systems, which enable welding in all positions with a degree of control and precision unattainable with present systems

Figure 2: Full view of the autonomous, flexible robot for welding large steel structures.

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Identifying and Handling Biotechnology Materials

Motivation

The use of biotechnology, one of the key technologies of the 21st century, necessitates completely automating all operations in research and manufacturing.

A market analysis of the availability of handling technology for biotechnological research and manufacturing revealed that the handling of liquid media is largely automated and a sizeable market for components and instruments exists. However, practically no components are commercially available for handling solids with the specific features of biological objects. Here, handling is defined by manual labor and, in part, self-developed individual solutions.

Taking this as the point of departure, the goal is to design and develop techniques and components for handling solid phase biological materials and to test them as prototypes in a complex biotechnological system. Corresponding to the project partners' field of business, the prototype should be usable in routine analysis of active ingredients.

Approach

Solving this problem requires extremely interdisciplinary work from engineering and life science researchers with diverse specializations. Thus, two biotechnology SME are specifying the tasks. Researchers and engineering SME are developing and implementing the component and prototype system in joint work, coordinated with and monitored by the biotechnicians. Individual and complete tests are being performed collectively by all project partners.

Results

The results of the project are selected sensored components for handling cells, cell colonies, tissue sections, etc., which, to the greatest extent possible, have standardized interfaces and demonstrated their performance in the prototype system.

Its use is accordingly aimed in several directions:

For the biotech SME, use of the prototype boosts its performance and thus competitiveness in the longer term.

The engineering SMEs are developers and manufacturers of the components. They thus gain entry in a sustainable component market, both for the systems developed in the project and for customized new and subsequent developments.

For the research organizations, the project supported by the BMBF means being able to further enhance their core competencies in a new field of application. The results, especially the newly acquired know-how, will enter into other similarly oriented research and development projects. The academic partners will also use the findings for teaching purposes.

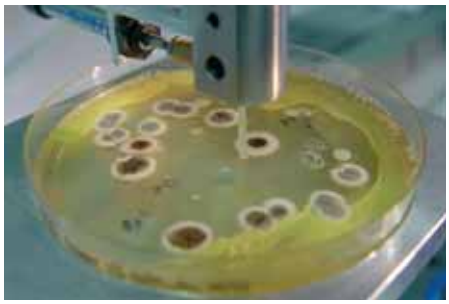

Figure 1: Automatic, sterile sampling from a fungus culture bred on culture agar as the growth medium in a Petri dish.

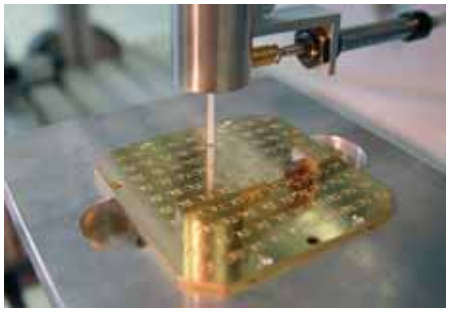

Figure 2: Depositing the sample on a highly polished special target for subsequent analysis in a mass spectrometer (MALDI-TOF).

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Bionics: Tactile Sensing Systems for Robots Modeled on Insects

Motivation

Why tactile sensing? Modern camera technology, laser, ultrasound and inductive sensors make tactile sensing appear almost archaic. Lasers form walls and paths, ultrasound measures ocean depths and detects schools of fish, infrared detectors detect heat sources, induction sensors identify metals and cameras deliver extremely sharp pictures. Robots thus appear to have their environment under control. Or do they? This is where nature strikes back. Whenever the sun is low, an infraredcontrolled robot becomes a sun worshipper. Unknown spaces and damping materials can confound an ultrasound echo just as much as an idyllic morning dew or a lovely autumn fog can blind a laser and camera.

Thus, tactile sensing has intrinsic advantages because it

- Is independent of light conditions
- Functions even in dusty environments
- Is based on an obstacle's real existence, not on secondary effects such as an ultrasound echo
- Only delivers significant data

The biological model of an insect is able to overcome extremely high obstacles, and wide cavities. At close range, antennae are used, which support active tactile exploration, localization and object recognition. Crustaceans use this principle under water. Tactile sensing appears promising in this environment too.

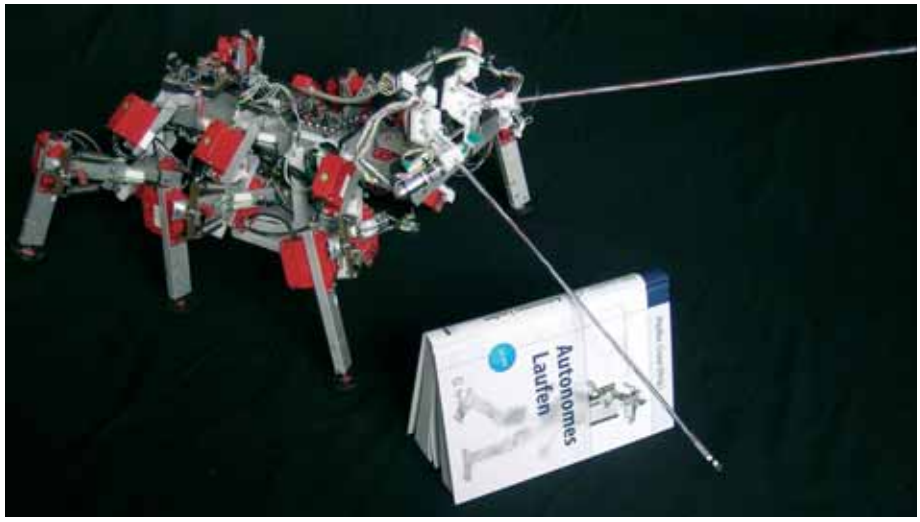

Figure 1: Tactile feelers on the research robot of the biological project partner, the University of Bielefeld.

Approach

Following nature, a new method of measurement based on sensor technology was developed.

Two motors prompt a rod to make oval rotary motions. A single acceleration sensor on the tip of the freely oscillating feeler detects the contact point with an object: When the feeler collides with an object, the tip of the rod vibrates. Depending on the point at which a feeler touches an object – approximately in its center or in its front third – the sensor measures at the tip a different oscillation frequency. Frequency and the motors' control signals, i.e. the angle of the rod at the time of contact, supply the position of the obstacle in space.

If contact has occurred, the tactile sensing system can adjust and more closely investigate the immediate environment of the point of collision. The Fraunhofer IFF has patented this method.

Potential Applications

The tactile sensing system is suited for mobile robots, which, for instance, are inteded for work in dusty or dirty environments. Disaster areas, difficult to access rescue sites and caves as well as control sensor technology for assembly robots in dusty manufacturing environments are conceivable areas of application for sensor robots.

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Analysis of the Use of a Facade Cleaning Robot on the Burj Al Arab Hotel Building

Motivation

Jumeirah International based in Dubai is one of the world's leading hotel companies with numerous luxury and business hotels. The highlight is the Burj Al Arab, the world's only seven star hotel. The climatic conditions in Dubai (sandstorms, high humidity, extreme temperature fluctuations) necessitate regularly cleaning the hotel's exterior facade in order to ensure the building makes a good visual impression all the time. Until now, cleaning has been done in two-week cycles in time consuming manual labor with the widest variety of work platforms and roof gantries. Reaching all the areas of the facade and ensuring the safety of the cleaning personnel have especially proven to be problematic.

At the request of Jumeirah International, the Fraunhofer IFF analyzed the feasibility of automatic cleaning for the Burj Al Arab building.

Figure 1: Burj Al Arab, Dubai.

Approach

After numerous preliminary discussions with the building's operators and detailed studies of the facade structure based on CAD drawings, it was possible to define initial boundary conditions for the use of robotic systems. All facts about the building such as facade structure and the design of the existing gantries were analyzed during the subsequent on-site meeting in Dubai. The individual areas of the facade were evaluated in terms of the following criteria:

- Complexity of the robot kinematics for movement along the facade
- Evaluation of the surfaces of the facade for the use of suitable cleaning methods
- Accessibility of all areas of the facade by using the existing gantries
- Estimation of the effort required to supply the system's energy and media over sizeable distances
- Selection of the level of automation

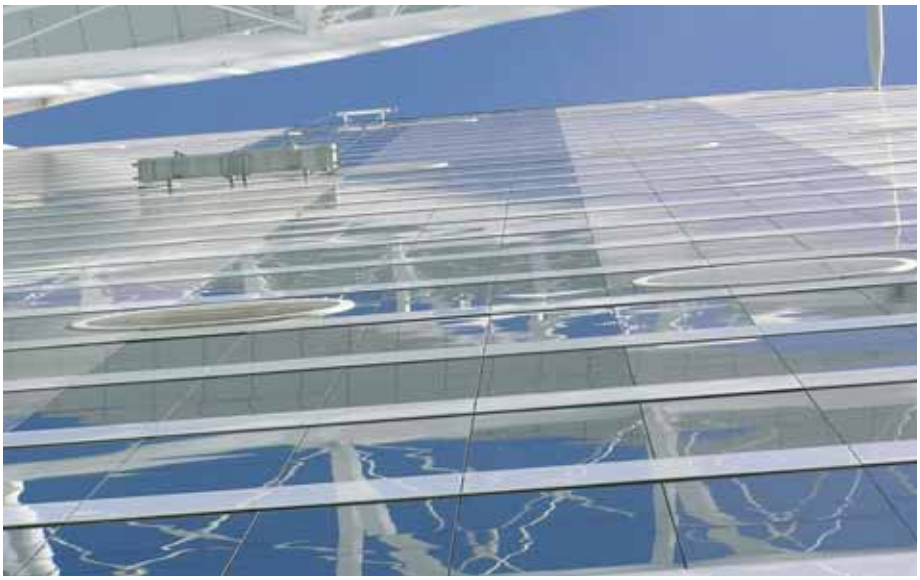

Figure 2: Using work platforms to clean the glass facade.

Figure 3: On-site meeting at an elevation of 200 meters.

Results

The analysis of the Burj Al Arab by the Fraunhofer IFF demonstrated that the use of automatic facade cleaning systems is generally feasible for most of the areas of the facade. The existing potentials for cutting costs, minimizing risks and increasing the quality and flexibility of cleaning are arguments in favor of employing automatic systems.

The completed analysis is the first important step toward automatic cleaning of the building. In other steps, concepts of solutions for the various areas of the facade will have to be developed and preliminary tests of specific subfunctions will have to be conducted. Progressively developing such innovative robot systems that are transferable to other systems has proven to be extremely expedient in the past.

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- Product and Process Management PPM

Project Reports

Development of a Plant Recovering Energy from High Calorific Fractions from Sorted Waste

Motivation

High calorific residues accumulate during the mechanical treatment of light packaging, household and bulk waste and mixed construction and commercial wastes. They generally consist of a light fraction (foil and paper scrap), an oversize heavy fraction and diverse impurities. Therefore they exhibit an inhomogenous range of composition and lumpiness and cannot be returned to the recoverable material cycle at all or only with disproportionately great effort. These residues have a calorific value though, which is between the calorific values of crude brown coal and hard coal and even surpass the latter when the plastic fraction is large.

These residues may no longer be landfilled, since the Technical Directive on Residential Waste (TASi) went into effect in mid 2005. For that reason and by virtue of their calorific value, energy recovery represents the prefered path. However, precisely because of their high calorific value, the danger of combustion chamber overheating exists in conventional waste incineration plants, which necessitates mixing with a low calorific fraction, or is reflected in excessive acceptance fees.

An alternative would seem to be to recover energy from high calorific residues in decentralized plants specially matched to their properties to produce power and heat directly at the locations of the processing plants. The R&D network with AMB Anlagen Maschinen Bau GmbH in Oschersleben has developed a suitable plant solution. It can be operated preferably in combination with mechanical waste sorting plants delivered by the firm or also employed separately as final stage thermal treatment for medium-sized quantities of waste.

	Average	Fluctuation
Inert Content	23 %$_{wb}$	3 – 46 %$_{wb}$
Water Content	16 %$_{wb}$	4 – 28 %$_{wb}$
Combustible Substance Content	61 %$_{wb}$	39 – 90 %$_{wb}$
Calorific Value	16.7 MJ/kg$_{wb}$	7.5 – 36.1 MJ/kg$_{wb}$

Figure 1: Fuel characteristics of highly calorific sorted fractions.

Approach and Results

Technological Concept

The concept is geared toward processing plants with annual throughput rates of up to 100,000 tons. The annual volume of high calorific materials is estimated to make up five to ten percent of a processing plant's throughput rate. This quantity of residual material can be used to operate decentralized conversion plants to produce power and heat with a thermal firing capacity of 3,000 to 6,000 kW.

The core component is a fluidized bed furnace, in which highly calorific residual materials are combusted in a fluidized bed at 850 °C. The heat of the flue gas produced by fluidized bed firing is transferred in an unpressurized boiler to a thermooil, which serves as the heat transfer medium for the Organic Rankine Cycle (ORC) module. The ORC process is a steam power process run with an organic working medium instead of water. Not only is electrical power generated in the ORC module but useful heat is also extracted.

The technological configuration consists of the following main components (Figure 2):

- Fuel and additive storage including charging unit
- Fluidized bed furnace module
- Thermooil boiler module
- ORC module
- Flue gas scrubbing module (dry sorption with fabric filter)

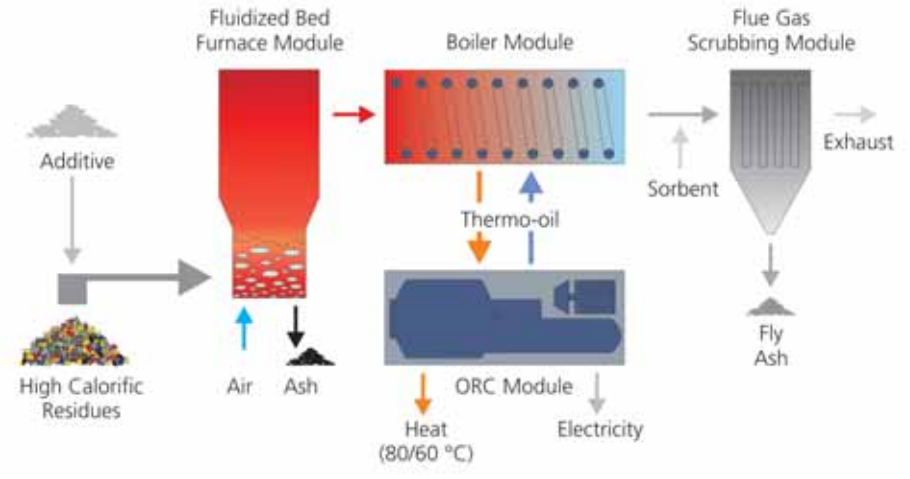

Figure 2: Technological layout: ORC process with fluidized bed firing.

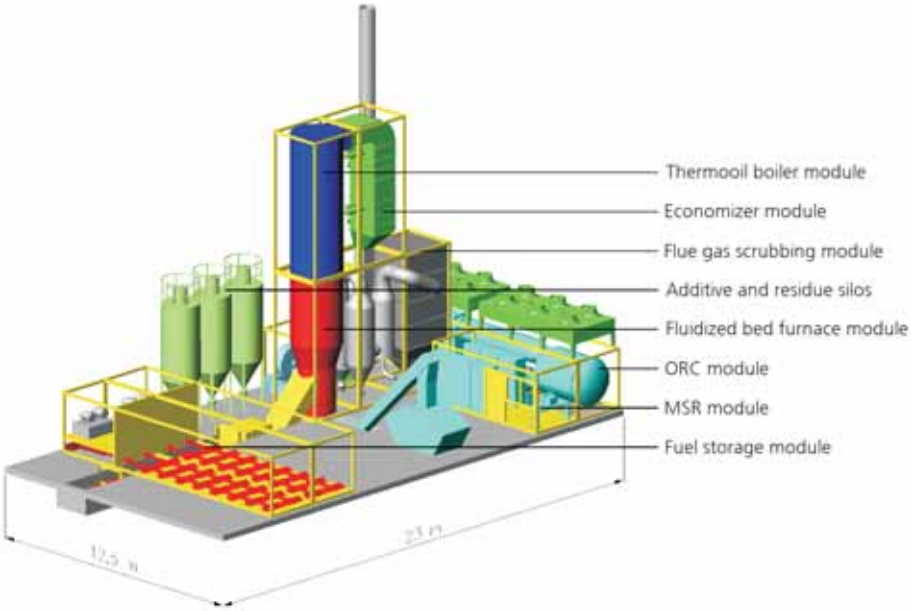

Figure 3: Plant configuration with equipment components.

Plant Design

The combination of grate firing with a steam power process and complex, downstream flue gas scrubbing is state of the art for cogeneration from residual materials. Along with investments in a high pressure steam boiler and water treatment and turbine plants, operation and monitoring also entail correspondingly high costs, which are not justifiable in this power range.

Advantages of innovative fluidized bed firing with the ORC process in small, decentralized plants are:

- On site utilization of high calorific residues
- Reduction of transport costs
- Low-emission combustion of fluidized bed firing (integration of sulfur dioxide by adding additives, minimization of nitrogen oxide and carbon monoxide emissions by controlling temperature and grading air)
- Cost effective quasi dry flue gas scrubbing to separate other pollutants (hydrogen chloride, hydrogen flouride, heavy metals)
- Unpressurized thermooil boiler, making monitoring in accordance with the Technial Regulations for Steam Boilers (TRD) unnecessary and allowing plant operation without special monitoring
- Energy conversion in a compact ORC module
- High fuel efficiency
- Modular design and thus minimization of transport and assembly costs
- Low space requirements (approx. 23 x 12.5 m)

Performance Parameters

The plant is designed for a throughput of 860 kg/h (at 16 ma.-% water content) and has the following performance parameters:

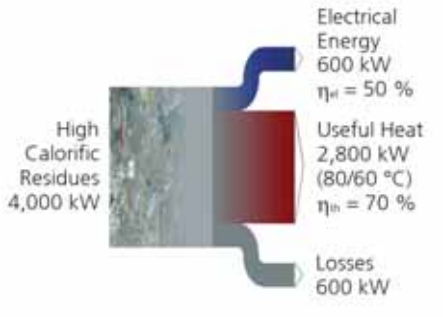

Figure 4: Energy flow of a 4 MW (FWL) plant.

6,000 hours of full load operation per year result in a plant throughput of 5,170 tons (at 16 ma.-% water content), annual power production of 3,600 MWh and annual heat production of 16,800 MWh.

Operating Conditions

The plant jointly developed with AMB GmbH and sold by the same under the name "FB-PowerCon" (Fluidized Bed Power Conversion) is based on a modular stacking concept and is delivered in container construction as a functional turnkey unit. In the current state of development, further activities are concentrated on long-term field testing as a pilot plant.

By virtue of its modular design – all the main components are integrated in the container framework – the concept provides a maximum of flexibility with respect to its site of operation and changing basic economic or political conditions and requires only a minimum of space.

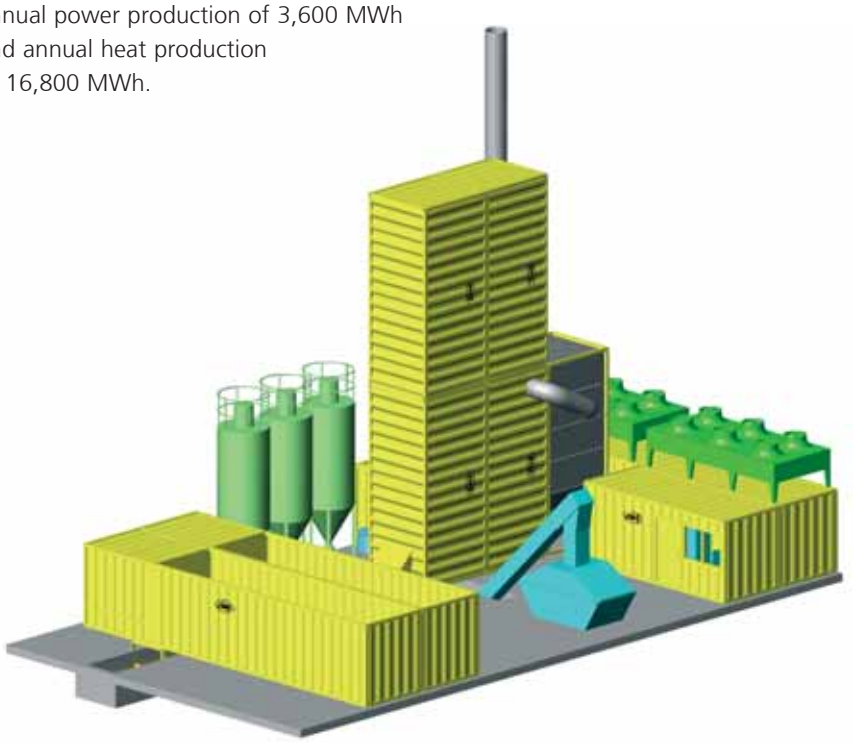

Figure 5: View of the FB-PowerCon plant.

The FB-PowerCon concept makes it possible to produce useful energy from sorted high calorific residual materials directly wherever processing plants are located. This eliminates high transportation costs and acceptance fees for outside utilization/disposal.

The electrical energy produced can replace expensive external power purchased to operate sorting and processing plants. The heat energy can be used to dry residual material fractions or cover private heat requirements (e.g. hall heating, social areas) and to supply external heat customers (e.g. supply into the local heating network).

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Collaboration

– AMB Anlagen Maschinen Bau GmbH, Oschersleben

The Fraunhofer IFF Test Lab: Fluidized Bed Firing as the Basis for R&D and Technical Services

Motivation

Current research and development work at the Fraunhofer IFF in the field of power and environmental engineering is geared toward energy recovery from biomasses and wastes in decentralized cogeneration plants.

Core competencies in the main field of process and plant engineering are concentrated on the development of complete plant solutions with solid bed and fluidized bed firing. Building upon this, technology is being developed for the subsequent process stages of gas purification and electrical energy conversion in the direction of complete, small to medium power CHP.

The potentials for using decentralized generation of heat and electrical energy or substituting fossil fuels span an extremely broad range of fuels with widely differing properties, which determine the feasibility of firing. The spectrum ranges from untreated forest and industrial scrap wood or old growth timber in the widest variety of conditioning up through high calorific sorted waste residues, substitute fuels or even waste fractions from specific industries, e.g. from the paper industry.

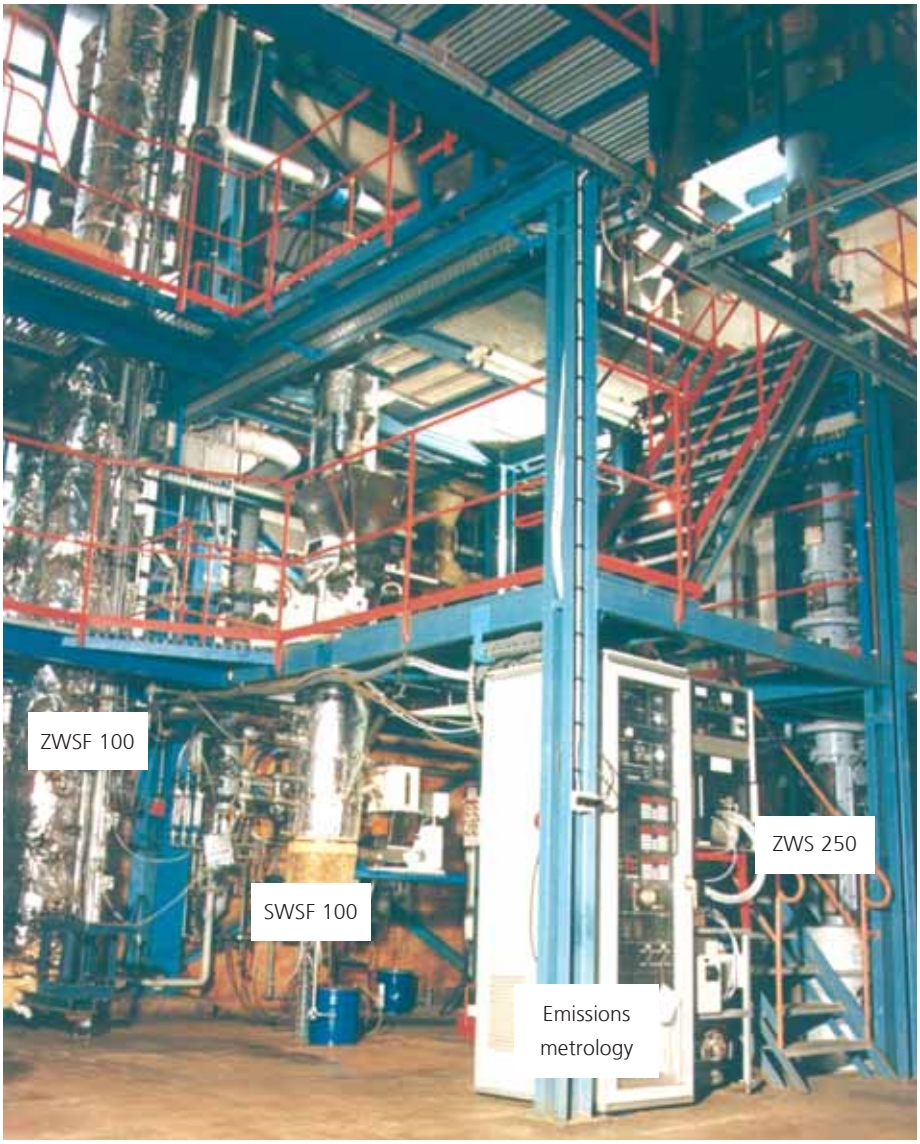

Figure 1: Experimental fluidized bed plants ZWSF 100, SWSF 100, ZWS 250 with gas emission metrology.

A site-based design variant with its particular specific requirements of use is crucial for efficiency. An appropriately backed-up database of basic conditions, which above all also incorporates fuel specifics in conjunction with appropriate process control, is already required in advance for investment decisions connected with the placement of a new plant or a plant upgrade or modernization. The Fraunhofer IFF fluidized bed testing facility performs such technology-based suitability and optimization tests. Here, process parameters can be determined on a semi-industrial scale closely approximating practice, which is in turn the foundation for engineering the process and scaling-up the original plant. As the starting point for all other planning and engineering activities, the technical process reliability achievable provides a cost effective opportunity to select alternative variants as well as to test the effectiveness and technical expediency of individual equipment components.

Experimental Plants

Plant development at the Fraunhofer IFF focuses on:

- Fluidized bed combustion with flue gas scrubbing/emissions reduction technology and electrical energy conversion with an ORC process module or Stirling motor
- Fluidized bed gasification with catalytic and/or absorptive fuel gas purification/treatment and electrical energy conversion with a gas engine or micro-gas turbine

The fluidized bed testing facility houses the following experimental plants:

SWSF 100
Stationary fluidized bed furnace
Height: 4.2 m
Diameter: 100/160 mm
Thermal power: 15 kW
- Burnoff tests
- Emissions tests
- Ash tests

ZWSF 100
Circulating fluidized bed furnace
Height: 6.9 m
Diameter: 100 mm
Thermal power: 60 kW
- Emissions tests
- Ash tests

ZWS 250
Circulating fluidized bed
Height: 8.0 m
Diameter: 250 mm
- Fluid mechancs tests

WSV 400
Circulating fluidized bed gasifier
Height: 3.0 m
Diameter: 400/600 mm
Thermal power: 100 kW
- Gasification tests
- Flue gas scrubbing tests

The modular design of the semi-industrial plants, which are engineered for different power ranges and firing variants, allows performing cost effective suitability tests as well as transferring dimensions to real cases of practical application. The fluidized bed testing facility is outfitted with state of the art instrumentation and control, which not only produces the thermodynamic state variables for plant operation but especially also measures combustion and gas emissions with the following systems:

- Flue gas analysis system
  System for automatic online sampling, sample processing and measurement of O_2, CO_2, CO, C_2H_2, H_nO_m, SO_2, NO, NO_2, N_2O and HCl and flue gases from combustion plants
- Fuel gas analysis system
  System automatic online sampling, sample processing and measurement of O_2, CO_2, CO, CH_4 and H_2 in fuel gases
- Tar metrology
  Wet-chemical method for detecting all condensable higher hydrocarbons from fuel gases
  Ratfisch TAR 120-3 (quasi-continuous tar measurement system)
- Dust measurement system for measurement of dust concentration and detection of filterable heavy metals from flue gases
- Oxygen-solid electrolyte sensors for measuring oxygen directly in combustion chambers, low response time (< 0,01 s), suitable for burnoff tests

The test lab is run in cooperation with the Institute for Process Equipment and Environmental Technology at Otto von Guericke University Magdeburg. Thus, secondary tasks of chemical analysis can be carried out in the fuel and firing lab. Mobile emissions metrology makes it possible to expand tests and consulting services for thermal plants already in operation directly on site or provide ongoing technical support for innovative plant solutions in use.

Services

The process and plant engineering researchers operate the plants, including the capture and analysis of metrological data. Services include relevant fuel tests on a technological scale as well as process engineering and deliver secure technical parameters on feasibility and energetic effectiveness, which in turn are the foundation for any economic analysis in the course of preparing for investments.

Sound process and plant layout is also advanced preparation for subsequent steps of concrete plant approval and engineering, including the requisite control components in interaction with the individual components, i.e. a solution "from one source".

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Collaboration
- Otto von Guericke University Magdeburg, Department of Process Engineering

Using Gaspotentiometric Oxygen-Solid Electrolyte Probes (OSEP) to Monitor and Control Thermal Conversion Processes

Motivation

The thermal utilization of solid fuels as well as the recently increasing use of biogenic fuels too is extremely important technically for the generation of synthesis gas as well as power and heat. This is the motivation behind the wide-ranging research on the complex sequences of chemical reactions that occur in combustion and gasification. In particular, experiments are being conducted on thermodynamic and kinetic aspects of redox processes as well as the characterization of fuels used.

In conjunction with this, OSEP were successfully used in recent years for detailed studies of combustion processes of gaseous, liquid and solid fuels. In addition, continuing experiments have demonstrated that this advantageous in-situ metrology can also be applied to coal conversion under conditions of gasification. This is possible because the signal generated by the OSEP immediately expresses the prevalent gas composition in the reaction zone. Specially derived functions enable specifying the quantitative correlation between cell stress and the corresponding concentrations of the reaction gases H_2, CH_4, CO, CO_2, H_2O and O_2.

Approach

These findings are an important foundation for developing monitoring and control systems based on OSEP. Against this background and in view of its general orientation toward utilizing regenerative energy sources in distributed plants with small to medium capacity, one objective the Fraunhofer IFF is pursuing is expanding the use of OSEP to the thermochemical gasification of biomass.

A significant distinctive feature of biomass gasification is its formation of hydrocarbons (tars). Using modified OSEP designs and corresponding modeling for signal analysis, it is essential to determine the concentration of tars in the fuel gas together with the water components (Figures 1 and 2). The Fraunhofer IFF is working on this focus of research as a sub-project in the initiative "Networks for Renewable Energy Research – ReGasNet" (Figure 2).

Continuing research activities will include monitoring the composition of fuel gas throughout the conversion and treatment line of equipment as well as process control. OSEP supported process control for an SOFC system run with biogas is being developed and produced as part of the two-year WISA project "High Temperature Fuels Cells for CHP".

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Figure 1: Standard OSEP.

Figure 2: 3-electrode OSEP.

Figure 3: Lab fluidized bed reactor for testing OSEP measuring behavior.

Functionally Optimized Prototypes for Rapid Product Development Using Integrated Multifunctional Materials

Motivation

More and more, future markets are demanding efficient prototypes in the early phases of product development, which have intelligence and multifunctionality to allow optimally engineering the features properties of assemblies throughout the entire value added chain. However, classical structural engineering is increasingly reaching its technological and economic limits here.

Approach

The main focus of this research project was the development of intelligent prototype components and tools, which can recognize and adapt to the parameters of their environment. The starting point for integrating adaptronic components was provided by generatively manufactured basic bodies that can be produced by state of the art rapid prototyping methods (LOM, vacuum casting). These incorporate the sensors for detecting physical parameters, register deviations from specified limit values and intervene in the control system or initiate an adjustment in the component or tool if these values are exceeded. This generates considerable advantages for users. On the one hand, product development times are shortened considerably, thus reducing costs. On the other hand structurally dynamic features of entire assemblies can be engineered to function optimally.

Especially in the early phases of product development, high development risk frequently makes it impossible or extremely difficult to calculate costs. In order to minimize such risks, a novel concept that uses generative (laminate) rapid prototyping processes to integrate sensor components was developed for the applications described. Most notably, the beneficial features of layer-laminate processes (LLM, LOM) promise fast and dimensionally accurate manufacturing of intelligent tools. A tool with a shell design was developed from a composite of various types of foil materials (metal, piezoceramic, paper). Extreme stiffness and stable in-process measuring data acquisition are its distinctive features.

Results

Knowing the pressure distribution in a polishing surface is extremely important for achieving maximum geometric accuracy. This novel approach is based on in-process measurement of the compressive forces while the workpiece (lens) and tool (polishing dish) are in direct contact. Generative rapid prototyping technologies (LOM in this case) use a composite of various types of foil materials (metal, piezoceramic, paper) to produce tools with distinctive features of extreme stiffness and stable in-process measuring data acquisition (Figure).

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Collaboration
- IGAM Ingenieurgesellschaft für angewandte Mechanik mbH, Barleben
- Friedrich Schiller University Jena, Institute of Materials Science and Technology

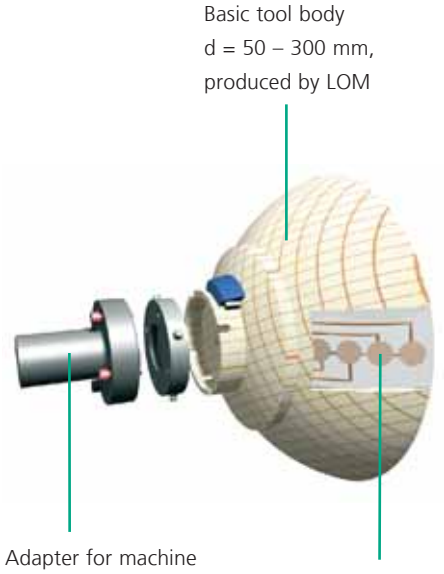


Figure: Polishing tool for ultraprecision machining of optical lenses.

Highlights, Events and Trade Fair Presentations 2004 (Selection)

January 19-22, 2004, Magdeburg
German-Russian Dialog on Forms and Structures of Research for Business

Direction:
Prof. Michael Schenk

L. to. r.: Dr. Ernst-Jörg von Studnitz, Prof. Michael Schenk and Dr. Horst Rehberger spoke about the experiences of the Fraunhofer IFF in Saxony-Anhalt.

L. to r.: Richard Smyth, Airbus Deutschland GmbH; Vladimir G. Peshekhonov, General Director of the state reasearch center ZNII "Electropribor"; Nikolai A. Anfimov, General Director of the State Research Center ZNIIMASCH; Dr. Hilmar Kath, Federation of German Industries; Konstantin V. Frolov, Director of the Institute for Mechanical Engineering "Blagonravov" (6th from l.); Dr. Horst Rehberger, Saxony-Anhalt Minister of the Economy and Labor (9th from l.), Martin Hoffmann, Chairman of the German-Russian Forum; Prof. Dr. Dennis Tsichritzis, Senior Vice President of the Fraunhofer-Gesellschaft, Yevgenii A. Fedosov, General Director of the State Research Institute of Aviation Systems "GosNIIAS" (13th from l.); Dr. Ernst-Jörg von Studnitz, President of the German-Russian Forum (15th from l.); Prof. Michael Schenk, Director of the Fraunhofer IFF (17th from l.).

January 28, 2004, Magdeburg
Chancellor Gerhard Schröder visited the Fraunhofer IFF where the four divisions of Logistics Systems and Networks, Virtual Development and Training, Automation, and Production and Plant Management gave presentations. Special emphases were:

- The logistics transfer center for the eastward expansion of the EU, an initiative of the Federal Ministry of Transport, the State of Saxony-Anhalt, the European Union and the Fraunhofer-Gesellschaft
- Virtual technologies as innovation drivers: the Virtual Development and Training Centre, initiative for SME
- The cleaning robot $Sirius_{ZV}$
- Rapid prototyping

Federal Chancellor Gerhard Schröder was impressed by the Fraunhofer researchers' work. He assured his support for future IFF work.

February 10-13, 2004, Karlsruhe
LEARNTEC 2004: 12th Conference and Specialist Trade Fair for Educational and Information Technology
Exhibits:
– Virtual Interactive Training
– Virtual Manuals
– AITRAM – Advanced Integrated Training in Aeronautics Maintenance
Technical collaboration:
Mr. Waleed Salem
Ms. Michaela Bochmann
Ms. Heike Kissner
Mr. Torsten Schulz

February 11-12, 2004, Bangkok (Thailand)
National Symposium on "Information Technology and Communication in the Field of Sustainable Environmental Protection for Resource Intensive Enterprises"
Hosted with: Asian Society for Environmental Protection (ASEP), Thailand; EU EuropeAid Programme Office Bangkok, Thailand
Technical direction:
Mr. Ralf Opierzynski
Mr. Frank Müller

February 24-26, 2004, Hanoi (Vietnam)
Workshop on "Environmental Performance Assessment for Industries I"
Hosted with: Asian Society for Environmental Protection (ASEP), Thailand; Vietnam Productivity Center (VPC) Vietnam
Technical direction:
Mr. Ralf Opierzynski
Mr. Frank Müller

February 29 - March 2, 2004, Madeira (Portugal)
ICSC Symposium on Engineering in Intelligent Systems (EIS 2004), International symposium
Technical direction:
Mr. Ralph Seelmann-Eggebert

March 2, 2004, Lübeck
Inno-how Results Workshop at the Project Partner Dräger Medical AG & Co. KGaA
Technical direction:
Mr. Hans-Georg Schnauffer
Mr. Mark Staiger
Mr. Stefan Voigt
Mr. Kai Reinhardt

March 3, 2004, Magdeburg
6th HLA Forum 2004
Hosted with: Otto von Guericke University Magdeburg
Technical collaboration:
Mr. Marco Schumann
Dr. Steffen Strassburger
Dr. Ulrich Raape

March 4-5, 2004, Magdeburg
Simulation und Visualization Symposium 2004
Hosted with: Otto von Guericke University Magdeburg, Arbeitsgemeinschaft Simulation (ASIM), Society for Computer Simulation (SCS) Europe, Gesellschaft für Informatik
Technical collaboration:
Dr. Eberhard Blümel
Mr. Marco Schumann
Dr. Steffen Strassburger

March 4-5, 2004, Magdeburg
Conference "Plant Engineering of the Future"

Presentation of the European Center of Competence for Innovative IT Services to Enhance Business Processes in SME and Management at the joint stand with T-Systems and Aston Business Solutions

Technical direction:
Prof. Michael Schenk

At the stand for trendsetting RFID technologies: VEM motors GmbH Wernigerode presented a global innovation, the Memory Motor, developed in cooperation with the Fraunhofer IFF. RFID technology from the Fraunhofer IFF was used to turn a common electromotor into a motor with all the data of its entire life cycle at its disposal.

March 10, 2004, Brussels (Belgium)
AMI Workshop
Technical collaboration:
Dr. Eberhard Blümel

March 10-11, 2004, Constance
MainDays 2004: Annual Conference for Maintenance and Technical Service
Technical collaboration:
Mr. Stefan Stüring

March 10-12, 2004, Bangkok (Thailand)
Workshop on "Environmental Performance Assessment for Industries II"
Hosted with: Asian Society for Environmental Protection (ASEP), Thailand
Technical direction:
Mr. Ralf Opierzynski
Mr. Frank Müller

March 23-29, 2004, New Delhi (India)
EuroIndia Conference 2004
Cooperation Forum on Information Society Technologies
Technical collaboration:
Dr. Eberhard Blümel

March 30, 2004, Magdeburg
Visit of the Thai Vice Minister of Industry Dr. Phanechet and other ministry representatives to the Fraunhofer IFF
Technical direction:
Dr. Gerhard Müller

March 31 - April 1, 2004, Stuttgart
5th German Factory Planning Symposium
Technical collaboration:
Mr. Steffen Gröpke

April 19-24, 2004, Hannover
Hannover Messe
Joint stand with VEM motors GmbH
Exhibit:
– Asset Concomitant Knowledge with RFID
Technical collaboration:
Mr. Steffen Fröhlich

April 13, 20, 27,
May 4, 11 and 18, 2004, Magdeburg
7th Logistics Guest Lecture Series 2004 "Logistic as a Field of Work of the Future: Potentials, Implementation Strategies and Visions"

In summer semester 2004, the Logistics Guest Lecture Series was successfully held again at the Fraunhofer IFF for the seventh time. The lecture series was under the patronage of Dr. Karl-Heinz Daehre, Saxony-Anhalt Minister of Housing and Transportation.

The lectures were regularly attended by around 100 interested students, Fraunhofer IFF and university staff and representatives from regional companies.

The Guest Lecture Series focused on the state of the Germans' favorite child: the automobile. Altogether four lectures dealt with logistics in the automotive industry. The speakers presented logistics strategies and concepts capable of mastering the challenges of the future. These challenges are primarily characterized by constantly increasing customer orientation, growing product complexity and ever shortening start up times for mass production.

A highlight was the lecture given by Dr. Ekkehard Gericke, Member of the Board of Festo AG, on "Best in the Class in Supplying the Pneumatics Market". Festo AG was awarded the 2003 German Logistics Prize for its holistic logistics concept that enabled shortening delivery time and reducing inventories while simultaneously cutting costs.

Technical direction:
Prof. Michael Schenk, Director Fraunhofer IFF and Chairholder for Logistic Systems at the Institute for Materials Handling and Construction Machinery, Steelwork a Logistics (IFSL), Otto von Guericke University Magdeburg
Prof. Dietrich Ziems, IFSL
Prof. Karl Business Administration Chair for Production and Logistics, Otto von Guericke University Magdeburg

April 20-22, 2004, London (Great Britain)
ITEC 2004: 15th European Conference and Exhibition for Defence Training, Education and Simulation
Exhibit:
– Virtual Interactive Training for Complex Machines and Equipment
Technical collaboration:
Mr. Stefan Stüring
Mr. Waleed Salem

April 20-22, 2004, Munich
SEMICON EUROPA 2004
Hosted with: IGAM - Ingenieurgesellschaft für angewandte Mechanik mbH
Exhibit:
– Shape Adaptive Tools for Precision Machining of Optical Surfaces
Technical collaboration:
Ms. Susan Gronwald
Dr. Uwe Klaeger

April 21 -22, 2004, Brussels (Belgium)

Plenary Session Committee of the Regions, Workshop "Innovative Actions in Europe's Regions and Cities" and Exhibition of the Nine Finalists' Projects in the "European Regional Innovation Awards"

European Regional Innovation Award to the Fraunhofer IFF for its project "ProDiMA" from the Division of VDT

L. to r.: Dr. Gerhard Müller, Deputy Director Fraunhofer IFF; Dr. Eberhard Blümel, Division Director, Virtual Development and Training; Antonio Guterres, Jury President and former Minister President of Portugal; State Secretary Rudolf Bohn and Heidrun Mushack, Chair of the State Parliament's Steeing Committee for EFRE Innovative Actions in the State of Saxony- Anhalt.

With a letter in July 2003 to the Minister President of the State of Saxony-Anhalt, the European Commission extended an invitation to a European competition. Eligible contestants had the best projects from the 126 European regions, which were part of European Regional Development Fund innovative actions. Each region was allowed one candidate. The VDTC was considered the most innovative project for Saxony-Anhalt and its model project ProDiMA (Development of Innovative Products and Services Utilizing VR Technologies for Machine and Plant Engineering SMEs) was entered in the competition.

Chaired by Antonio Guterres former Minister President of Portugal, the distinguished jury invited VDTC ProDiMA to Brussels to make a presentation. Thus the innovative joint project with the companies CIMBRIA SKET GmbH, Bio-Oelwerk Magdeburg GmbH, Schiess AG, SIGMA Maschinenbau GmbH, Anhaltische Elektromotorenwerke Dessau GmbH and the Fraunhofer IFF as research partner was one of the top three in the category "Regional Economies Based on Knowledge and Technological Innovation".
The winning Magdeburg team traveled to the awards ceremony in Brussels on April 22, 2004.

The Fraunhofer Institute for Factory Operation and Automation has been working intensively on the VDTC model project since June 2002. ProDiMA deals with demand-based developments of tools and technologies for small and medium-sized enterprises. Its goal is to provide new services for the digital factory, for the development and marketing of products as well as for advanced training based on state of the art modern virtual reality technologies.

Fraunhofer IFF researchers who attended the awards ceremony were:
Dr. Gerhard Müller
Dr. Eberhard Blümel
Dr. Martin Endig (Project Manager)

Virtual-interactive product documentation makes the functioning of complex equipment easier to understand. The example here is a flocking mill manufactured by CIMBRA SKET, and operated by the Bio-Ölwerk Magdeburg.

April 23, 2004, Heilbronn
MTM Conference on
"MTM for Product Design"
Host:
Deutsche MTM-Vereinigung e.V.
Technical collaboration:
Dr. Steffen Strassburger

April 30 - May 3, 2004, Cancun (Mexico)
2nd World Conference on POM:
15th Annual POMS Conference
Technical collaboration:
Mr. Ralph Seelmann-Eggebert

May 4-6, 2004, Phoenix (USA)
WATS 2004: World Airline Training Conference & Tradeshow
Exhibits:
– Training on Virtual Aircraft
Technical collaboration:
Mr. Stefan Stüring
Mr. Torsten Schulz

May 9-12, 2004, Parador Siguenza (Spain)
COMPIT '04: 3rd International EuroConference on Computer Applications and Information Technology in the Maritime Industries
Technical collaboration:
Dr. Eberhard Blümel

May 10-14, 2004, Sinsheim
Trade fair "Control"
Joint stand with ASCONA GmbH
Exhibit:
– Optical 2-D/3-D Combination Measurement
Technical collaboration:
Mr. Dirk Berndt

May 11-12, 2004, Lahnstein
25th VDI/VDEh Maintenance Forum
"Maintenance and Manufacturing Integrated in the Future"

The forum centered around discussion of the trend toward integrating maintenance jobs directly in the process line. This, way manufacturing and maintenance are equal partners and collectively bear responsibility for achieving corporate objectives. Hence, the forum presentations intensively reflected issues of organizational layout, information and knowledge management, new strategies and operator models.

Technical collaboration:
Dr. Gerhard Müller
Dr. Martin Endig

May 11-14, 2004, Hamburg
WindEnergy 2004 – International Trade Fair for the Wind Energy Industry
Hosted with WeserWind GmbH
Exhibits:
– Production Planning and Control for Tripod Manufacturing
– Wind Power Forecast for Offshore Windparks
– GIS Based Information System for Windparks
Technical collaboration:
Ms. Manuela Wahl
Mr. Frank Ryll
Mr. Frank Mewes
Mr. Mike Wäsche

May 15-21, 2004, Pamporovo (Bulgaria)
"International Workshop: Energy wood Production Chains in Europe"
Technical collaboration:
Mr. Helmar Tepper
Ms. Janet Schrader

May 17, 2004, Leipzig
Workshop on the VDTC Service Portfolio with SMEs from the Region of Saxony
Hosted with: German Confederation of Small and Medium-sized Enterprises, Leipzig
Technical direction:
Dr. Eberhard Blümel
Mr. Marco Schumann

May 24 - June 4, 2004, Bangkok (Thailand)
Train the Trainer Workshop on "Environmental Performance Assessment and Environmental Management Accounting for Industries"
Hosted with: Asian Society for Environmental Protection (ASEP), Thailand; University of Lüneburg, Germany
Technical direction:
Mr. Ralf Opierzynski
Mr. Frank Müller

May 31 - June 1, 2004, Erfurt
Rapid Tech 2004: Users Conference and Exhibition for Rapid Technology
Hosted with: Fraunhofer Network for Rapid Prototyping
Exhibits:
– Intelligent Prototype Tools for Precision Machining
– Recycling Thermoplastic Residual Materials from Recycling Processes into New, Standard Material Systems for Rapid Prototyping.
Technical collaboration:
Ms. Susan Gronwald

June 7, 2004, Brussels (Belgium)
"ECHAINE" Mid Term Meeting
Technical collaboration:
Ms. Janet Schrader

June 8-10, 2004, Batam (Indonesia)
Workshop on "Environmental Performance Assessment for Industries III"
Hosted with: Asian Society for Environmental Protection (ASEP), Thailand; Indonesian Society of Environmental Professionals (ISEP), Indonesia
Technical direction:
Mr. Frank Müller

June 11-12, 2004, Slany (Czech Republic)
International Conference INNOVATIONS 2004
Host: IPA Slovakia, Fa. LINET s.r.o
Technical collaboration:
Dr. Steffen Strassburger
Mr. Robert Sturek

June 13-16, 2004, Magdeburg
ESM 2004: 18th European Simulation Multiconference
Technical collaboration:
Dr. Eberhard Blümel

June 14-18, 2004, Berlin
PSAM 7: International Conference on Probabilistic Safety Assessment and Management
Technical collaboration:
Mr. Stefan Stüring
Mr. Waleed Salem

June 15-19, 2004, Düsseldorf
METAV 2004: International Trade Fair for Manufacturing Technology and Automation
Technical collaboration:
Mr. Stefan Stüring
Ms. Heike Kissner

June 23-25, 2004, Magdeburg
7th IFF Science Days
"Virtual Development and Training"

Technical direction:
Prof. Michael Schenk

Prof. Schenk at the opening of the 7th IFF Science Days

Numerous experts and executives from companies and research organizations attended the international conference focused on "Virtual Interactive Training", "Human-Machine Interface" and "Digital Logistics". Professional lectures and workshops informed them about current trends and research findings from the field of virtual technologies.

In its interplay of digital and real technology, the model scenario of a go-kart demonstrates only a small part of the capabilities of localization and communication technologies. Many of th lab's components are mobile and can be used by clients on site as required.

Over three days, the professional guests had the opportunity to gain insight into the field of work of virtual reality and other current research and project topics. The IFF Science Days additionally provided an excellent platform for personal conversations among experts from the research community and the field.
As part of the 7th IFF Science Days, the "LogMotionLab" was ceremoniously opened on June 23, 2004. Fraunhofer IFF researchers presented their logistics competence based on the widest variety of RFID technologies. The "LogMotionLab" provides extensive opportunities for testing and piloting. The lab provides an optimal test environment for industry and service providers, academia and research. The researchers analyze logistics processes at a client's facilities and reorganize these as required. With the aid of mobile test stations, they are able to check on site how the use of RFID makes logistics more transparent, flexible and efficient.

Along with the research highlights, the science days also presented an ideal setting for establishing and cultivating personal contacts. The first day of the Science Days closed in the historic and relaxed atmosphere of Fort Mark.

The historical ambience of Fort Mark presented an ideal stage for the festive evening event of the IFF Science Days.

7th IFF Science Days Program

June 23-24, 2004: Conference
- Sequence 1
  "Virtual Interactive Training"
  Moderation:
  Mr. Stefan Stüring
- Sequence 2
  "Human-Machine Interface"
  Moderation:
  Dr. Rüdiger Mecke
  Dr. Moh Sabeur
- Sequence 3
  "Digital Logistics"
  Moderation:
  Dr. Klaus Richter
  Mr. Steffen Fröhlich

June 23, 2004: Workshop
- "Emergency Management:
  New Challenges and Synergies"
  Moderation:
  Dr. Martin Endig
  Dr. Ulrich Raape

June 24, 2004: Workshop
- "BioHandling: Automation of
  Handling Jobs in the Laboratory"
  Moderation:
  Dr. Ulrich Schmucker

June 24, 2004: Industry Research Group
- "Cooperation in Plant Engineering"
  Moderation:
  Ms. Andrea Urbansky
  Ms. Mira Kleinbauer

June 25, 2004: Workshop
- "Innovative IT Services"
  Moderation:
  Mr. Holger Seidel
  Dr. Ina Ehrhardt

June 28-29, 2004, Copenhagen (Denmark)
International Conference on Economic, Technical and Organisational Aspects of Product Configuration Systems
Technical collaboration:
Mr. Ralph Seelmann-Eggebert

June 28 - July 1, 2004 Edinburgh (Great Britain)
European Simulation Interoperability Workshop 2004 (Euro SIW)
Technical collaboration:
Dr. Steffen Strassburger

June 29-30, 2004, Ludwigsburg
Fachkongress und Messe "Digitale Fabrik in der Automobilindustrie"
Exhibit:
- VR-Anwendungen in der Automobil-industrie

Technical collaboration:
Mr. Waleed Salem

July 1-2, 2004, Aachen
VDI Workshop "Optical 3-D Metrology"
Technical collaboration:
Mr. Ralf Warnemünde
Mr. Erik Trostmann

July 1-2, 2004, Münster
Münster GI Days
Technical collaboration:
Dr. Ulrich Raape

July 6-9, 2004, Manchester (Great Britain)
34th International MATADOR Conference
Technical collaboration:
Ms. Susan Gronwald

July 26-30, 2004, Chonburi (Thailand)
Workshop on "Life Cycle Plant Management/LCPM"
Hosted with: Thai-German Institute (TGI) Thailand
Technical direction:
Mr. Ralf Opierzynski
Mr. Peter Rauschenbach

July 28, 2004, Magdeburg
PIZ IF Rota Cornerstone Ceremony
Technical collaboration:
Dr. Gerhard Müller
Mr. Stefan Stüring
Ms. Heike Kissner

September 4, 2004, Schloss Birlinghoven
Symposium on "Competence Management"
Technical collaboration:
Mr. Mark Staiger

September 14-18, 2004, Stuttgart
AMB 2004: International Exhibition of Metalworking
Technical collaboration:
Ms. Heike Kissner
Mr. Stefan Stüring

September 16-17, 2004, Protoroz (Slovenia)
44th Foundry Conference
Technical collaboration:
Dr. Eberhard Blümel

September 16-18, 2004, Cologne
"Day of Space Travel"
Host: German Aerospace Center (DLR)
Technical collaboration:
Mr. Steffen Fröhlich
Mr. Friedrich Hülsenbeck

September 16-18, 2004, Rio de Janeiro (Brazil)
The International Workshop on Harbour, Maritime & Multimodal Logistics Modelling and Simulation
Technical collaboration:
Dr. Eberhard Blümel

September 21-22, 2004, Chemnitz
4th Chemnitz Colloquium on Production Technology (CPK 2004)
Hosted by: Fraunhofer IWU, Technical University of Chemnitz, Working Group for Machine Tools in Saxony/Thuringia
Technical collaboration:
Dr. Eberhard Blümel

September 21-23, 2004, Bangkok (Thailand)
Workshop on "Environmental Performance Assessment for Industries IV"
Hosted with Asian Society for Environmental Protection (ASEP), Thailand
Technical direction :
Mr. Ralf Opierzynski
Mr. Frank Müller

September 21-24, 2004, Berlin
"InnoTrans 2004"
Exhibit:
– Quality Inspection of Train Wheelsets
Technical collaboration:
Mr. Dirk Berndt

September 25, 2004, Stuttgart
Fantasy Machine Premieres at the Major Opening Event of Science in Dialog's Summer of Science (live SWR broadcast)

Learning science can be fun! That was the motto in the Year of Technology for the joint year-long action from Science in Dialog and the ARD Tigerentenclub. Five important research institutes including the Fraunhofer IFF with its Virtual Development and Training Centre VDTC took part in the collective nationwide action.

Children between eight and thirteen were invited to enter a creative competition. The hands on approach is intended to arouse enthusiasm for science and technology in order to foster interest in the natural sciences. The competition consisted of two phases of action:
A virtual inventor competition and real engineering workshops to actually construct "Fantasy Machines".
The young engineers worked feverishly toward the big public premiere.
The Fantasy Machine was unveiled for the first time in a major special Tigerentenclub broadcast opening Summer of Science from Stuttgart's Schlossplatz.

The Fraunhofer IFF would like to sincerely thank its sponsors. The project would not have been possible without the financial support from the Stadtsparkasse Magdeburg's Youth Foundation and SWM. Another big thank you goes to SCM, the Weidemann-Gruppe, Magdeburg-Marketing Kongress und Tourismus GmbH and Princess Interactive for their friendly support.

Technical direction:
Ms. Anna-Kristina Wassilew

In the first stage, the "virtual design workshop", young inventors were challenged to invent a virtual Fantasy Machine with the aid of special computer software. A jury selected the best designs and invited the winners to work at one of the workshop sites.

In the second stage, the Magdeburg module of the Fantasy Machine was built at the Fraunhofer IFF testing facility. Children and researchers work away on a complicated chain reaction made up of mouse traps, switches, twine, funnels and a model of the facade cleaning robot Sirius.

The third stage was held in Stuttgart. The first public presentation took place during the Summer of Science. The major event was carried live in a special Tigerentenclub broadcast.

September 27 - October 1, 2004, Bangkok (Thailand)
Workshop on Environmental Performance Assessment Bangkok
Technical direction:
Mr. Ralf Opierzynski

October 4-5, 2004, Berlin
11th ASIM: Conference on Simulation in Production and Logistics
Technical collaboration:
Dr. Steffen Strassburger
Mr. Marco Schumann

October 5-6, 2004, Glauchau
8th Saxon Automotive Supplier Conference
Hosted by: Southwest Saxony CCI Chemnitz-Plauen-Zwickau, Zwickau Regional Chamber
Exhibits:
– Optical 3-D Metrology
– VR Applications for Training and in Product and Process Development
Technical collaboration:
Mr. Dirk Berndt
Mr. Waleed Salem

October 7, 2004, Dresden
5th Symposium "B2B in Saxony: Companies Doing Business in the Web"
Hosted by: Saxony Economic Development Corporation
Technical collaboration:
Dr. Eberhard Blümel

October 11-12, 2004, Frankfurt a.M.
6th German Mass Customization Conference
Technical direction:
Mr. Ralph Seelmann-Eggebert

October 11-14, 2004, Stuttgart
CAT.PRO 2004: 20. International Trade Fair for Innovative Product Development, Data and Process Management
Joint Stand of the Virtual Reality Network Magdeburg with the Fraunhofer IFF, Tarakos, Princess Interactive and Livingsolids
Exhibits:
– Virtual-Interactive Training
– Interactive Assembly Instructions
– Virtual Product Development
Technical collaboration:
Mr. Stefan Stüring
Dr. Steffen Strassburger
Mr. Robert Sturek

October 12-13, 2004, Portugal
RPD-Agile Development for Productivity
Technical collaboration:
Dr. Uwe Klaeger

October 13-15, 2004, Stuttgart
Trade Fair "Intergeo 2004"
Exhibits:
– MEDSI
– Sagis-Log
Technical direction:
Mr. Frank Mewes
Mr. Mike Wäsche

October 13-17, 2004, Beja (Portugal)
Workshop: Energy Wood Production Chains in Europe
Technical collaboration:
Mr. Helmar Tepper

October 18-22, 2004, Chonburi (Thailand)
Final Workshop on "Life Cycle Plant Management/LCPM"
Hosted with: Thai-German Institute (TGI) Thailand
Technical direction:
Mr. Ralf Opierzynski
Mr. Friedrich Hülsenbeck

October 20, 2004, Ames, Iowa (USA)
John Deere Day/Virtual Reality Workshop
Technical collaboration:
Dr. Steffen Strassburger

October 20-23, 2004, Berlin
21st German Logistics Congress "Thinking Innovatively – Acting Rigorously"

Exhibits:
– Mass Customization
– LogMotionLab
Technical collaboration:
Mr. Ralph Seelmann-Eggebert
Mr. Steffen Fröhlich
Mr. Andre Hanisch
Ms. Manuela Wahl

November 4, 2004, Wernigerode
School Student Forum: Getting School Students Enthusiastic about Technology and Arousing Early Interest in Technical Professions and Studying Engineering
Technical collaboration:
Mr. Marco Schumann

November 9, 2004, Spergau
2nd Industry Research Group "Cooperation in Plant Engineering"
Technical direction:
Ms. Mira Kleinbauer

October 13, 20, 27, November 3, 10 and 17, 2004, Magdeburg

1st Guest Lecture Series
"Virtual Reality: Human and Machine in Interactive Dialog"

Under the patrongage of the Minister of Economics and Labor Horst Rehberger, a new Guest Lecture Series on virtual reality, a main field of IFF work, started up in 2004. Over 500 participants attended the six lectures.

Lectures delivered by well known figures from the business and research communities, vividly presented the forms in which and the extent to which methods of virtual reality have already entered industrial applications (e.g. in automotive and aircraft manufacturing) and how users and developers assess the technology trends in this field. More and more, computer-based technologies for modeling, simulation and visualization are supporting the development, testing and use of new products. Methods of virtual reality (VR) are increasingly supporting them.

Virtual reality provides diverse and novel opportunities for users to interact with objects in a computer generated 3-D world, which can be experienced with different senses. Resembling interaction in the real world on the one hand, they also enable new forms of experience on the other hand. Both the visualization algorithms and the interaction techniques are being researched by research organizations and increasingly being integrated in industrial applications.

Dr. Werner Schreiber from Volkswagen AG (right) explains to Minister of Economics and Labor Horst Rehberger (center) the potentials for using augmented reality to represent and optimize factory layouts.

Technical Direction:
Prof. Ulrich Gabbert, Head of the Department of Mechanics, Otto von Guericke University Magdeburg
Prof. Karl-Heinrich Grote, Chair for Engineering Design, Otto von Guericke University Magdeburg
Prof. Klaus Jenewein, Head of the Department of Vocational Education and Human Resources Development, Otto von Guericke University Magdeburg
Prof. Roland Kasper, Chair for Mechatronics, Otto von Guericke University Magdeburg
Prof. Bernhard Preim, Chair for Visualization, Otto von Guericke University Magdeburg
Prof. Michael Schenk, Director Fraunhofer IFF and Chair for Logistic Systems, Otto von Guericke University Magdeburg
Dr. Eberhard Blümel, Division Director VDT, Fraunhofer IFF

The general public responded to the first Guest Lecture Series on virtual reality with great interest. More than 500 participants attended the six lectures.

Organization:
Ms. Heike Kissner

November 15, 2004, Magdeburg
Groundbreaking Ceremony for the New Building of the Virtual Development and Training Centre VDTC

The groundbreaking ceremony to start construction of the VDTC took place on November 15, 2004. During the press conference, Director Michael Schenk remarked: "This groundbreaking is a significant moment in our institute's twelve year history. Out expansion is proof that Saxony-Anhalt has all sorts of opportunities for commercially successful work. The decision to build the VDTC in Magdeburg is a clear commitment to this center of research."

With the new VDTC building, the Fraunhofer-Gesellschaft has sent a signal in Saxony-Anhalt drawing international attention. The European Union, the Federal Government and the state of Saxony-Anhalt are supporting the project.

The press conference was attended by: Prof. Michael Schenk, Director Fraunhofer IFF (4th from l.); Deputy Director Dr. Gerhard Müller (2nd from l.); Dr. Horst Rehberger, Minister of Economics and Labor and Saxony-Anhalt State Commissioner for Innovation (5th from l.); Mayor Dr. Lutz Trümper (6th from l.); and Dr. Joachim Welz, Head of the Department of Science, Higher Education and Research in the Saxony-Anhalt Ministry of Education and Culture (3rd from l.).

November 15-17, 2004, The Hague (Netherlands)
IST 2004 Event: Participate in Your Future, Networking Session: N 62 Exploring and Integrating RFID Technologies Towards a Knowledge-based Society
Technical collaboration
Dr. Eberhard Blümel
Mr. Friedrich Hülsenbeck
Ms. Katrin Reschwamm

November 18-19, 2004, Magdeburg
10th Magdeburg Logistics Symposium "Logistics Quality"
Hosted by: Otto von Guericke University Madeburg
Technical direction:
Prof. Gerhard Wäscher, School of Management, Department of Management Science
Prof. Karl Inderfurth, School of Management, Department of Production and Logistics
Prof. Michael Schenk, Chair for Logistic Systems
Prof. Dietrich Ziems, Chair for Logistics

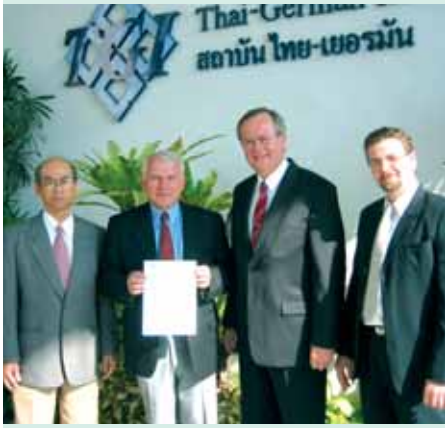
November 24-26, 2004, Nürnberg
SYMPRO: 9th Manufacturing Congress
Technical direction:
Prof. Michael Schenk

November 25-26, 2004, Jena
VDI Workshop on "Optical 3-D Metrology"
Technical collaboration:
Mr. Dirk Berndt
Mr. Ralf Warnemünde

November 28, 2004, Chonburi (Thailand)
Agreement on Research Cooperation with the Thai-German Institute, Chonburi, Thailand

The Thai-German Institute is the largest industrial training and vocational education center in Thailand. On the basis of already completed joint projects, technology and know-how transfer in the field of logistics will be intensified in the future.

Technical direction:
Dr. Gerhard Müller
Technical collaboration:
Mr. Ralf Opierzynski



Sealing future collaboration: The Thai-German Institute (TGI) in Chonburi, Thailand and the Fraunhofer IFF present the Memorandum of Understanding (MoU). L. to r.: Narong Varogkriengkai, Director TGI/Thai, Walter Kretschmar, Director TGI/German, Dr. Gerhard Müller, Deputy Director Fraunhofer IFF and Ralf Opierzynski, Fraunhofer IFF.

December 2, 2004, Hsinchu (Taiwan)
Signing of the Technical Cooperation Agreement between the Industrial Technology Research Institute (ITRI), Hsinchu, Taiwan and the Fraunhofer Institute for Factory Operation and Automation IFF Magdeburg

In the future, the Fraunhofer IFF will be collaborating even more closely with the ITRI. Interest is centered on energy recovery from renewable resources on the basis of fluidized bed gasification with subsequent scrubbing and conversion processes.

With more than 6,000 employees, ITRI is the largest research organization in Taiwan. It is a partner in the Asian network "Biomass Asia", in which other research organizations from China, Japan, Korea, Thailand, Vietnam and Singapore work together.

Technical direction:
Dr. Gerhard Müller

Dr. Hsin-Sen Chu, Executive Vice President ITRI (left) and Dr. Gerhard Müller, Deputy Director of the Fraunhofer IFF signing the Technical Cooperation Agreement.

December 1-3, 2004, Berlin
Online Educa Berlin 2004: 10th International Conference on Technology Supported Learning & Training
Technical collaboration:
Mr. Stefan Stüring
Ms. Heike Kissner
Mr. Waleed Salem
Mr. Torsten Schulz
Ms. Michaela Schumann

December 1-4, 2004, Frankfurt a.M.
EUROMOLD: Worldwide Leading Trade Fair for Moldmaking and Tooling, Design and Application Development
Technical collaboration:
Mr. Mario Tanke

December 5-8, 2004, Washington, D.C. (USA)
Winter Simulation Conference
Technical collaboration:
Dr. Steffen Strassburger

Highlights, Events and Trade Fair Presentations 2005 (Selection)

January 13, 2005, Peking (China)
Annual Conference of the Chinese Logistics Association (CLA)
Exhibit:
– Optimization of Passenger Flows in Airports
Technical collaboration:
Mr. Kay Matzner

February 15-18, 2005, Karlsruhe
LEARNTEC 2005: International Convention and Trade Fair for Educational and Information Technology
Exhibits:
– Virtual Interactive Training
– Virtual Manuals
Technical collaboration:
Ms. Heike Kissner
Mr. Waleed Salem
Ms. Michaela Schumann
Mr. Torsten Schulz

January 26-27, 2005, Magdeburg
Innovation Forum on the "Resource Wood"

As part of the BMBF project of the same name, a two day Innovation Forum on the "Resource Wood" was held at the Maritim Hotel in Magdeburg. More than 300 experts from politics, business, research and government met in Magdeburg to identify paths to a sustainable wood processing industry. The wood processing industry in Saxony-Anhalt has enormous potential and is confronting great challenges. In his closing remarks, Stefan Quitt, CEO of the Forstdienstleistungs- und Landschaftspflege GmbH in Thale, said that the creation of networks is the prerequisite for the success of the wood processing industry in Saxony-Anhalt. Forstdienstleistungs- und Landschaftspflege GmbH Sachsen-Anhalt was responsible for the project work. The Fraunhofer Institute for Factory Operation and Automation IFF Magdeburg was in charge of the technical direction of the event.

www.ressource-holz.de

Exhibits:
– Potentials for Energy Recovery from the Resource Wood
– Saxony-Anhalt Wood Demonstrator
– Virtual Development and Training Centre VDTC

L. to r.: Prof. Klaus Hoppe, Association of German Engineers VDI; Hans-Peter Hiepe, Head of Department of Regional Innovation Initiatives, New States in the BMBF; Stefan Quitt, CEO of Forstdienstleistungs- und Landschaftspflege GmbH Sachsen-Anhalt; Prof. Michael Schenk, Director of the Fraunhofer IFF; Dr. Horst Rehberger, Saxony-Anhalt Minister of Economics and Labor and Innovation Commissioner; Petra Wernicke, Saxony-Anhalt Minister of Agriculture and the Environment and Wolfram Ridder, CEO of Zellstoffwerk Arneburg-Stendal.

Technical collaboration:
Prof. Michael Schenk
Dr. Gerhard Müller
Dr. Ina Ehrhardt
Dr. Lutz Hoyer
Dr. Matthias Gohla
Mr. Steffen Fröhlich
Mr. Stefan Stüring
Ms. Andrea Urbansky

Accompanying exhibition in the foyer of the Maritim Hotel.

February 22, 2005, Magdeburg
"ViVERA Network of Competence"
Kick-off Meeting

The "Virtual Network of Competence for Virtual and Augmented Reality ViVERA" started its work with a kick-off event. The network pools the research resources of ten institutes and universities nationwide. The German Federal Ministry of Education and Research based the network's management in Magdeburg at the Fraunhofer IFF and Otto von Guericke University. In the presence of BMBF Parliamentary State Secretary Ulrich Kasparick and numerous other prominent guests from government and the research community, the members of the network presented themselves and their competencies at the Fraunhofer IFF in Magdeburg.

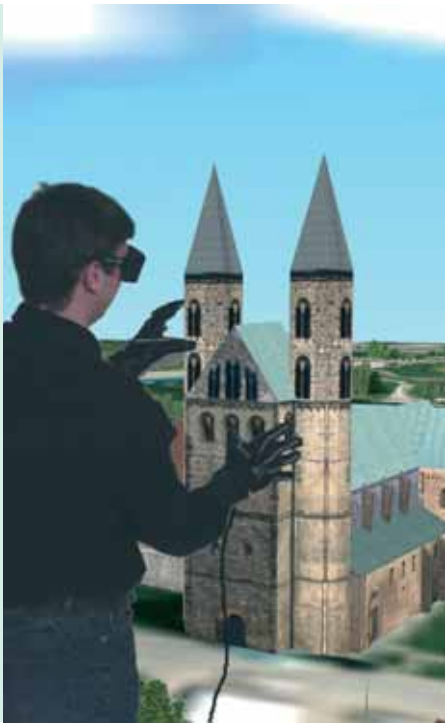
Technical direction:
Prof. Michael Schenk
Technical collaboration:
Mr. Marco Schumann

L. to r.: Dr. Joachim Welz, Head of the Department of Science, Higher Education and Research in the Saxony-Anhalt Ministry of Education and Culture; Dr. Bernd Reuse, Head of the Department of Software Systems at the BMBF; Ulrich Kasparick, Parliamentary State Secretary at the BMBF; Prof. José Luis Encarnação, Director of the Fraunhofer IGD; Prof. Michael Schenk, Director of the Fraunhofer IFF; Dr. Lutz Trümper, Mayor of the city of Magdeburg and Prof. Klaus Erich Pollmann, President of Otto von Guericke University Magdeburg at the ViVERA kick-off event.

February 23, 2005, Magdeburg
"Virtual Development, Testing and Training for the Technology of Tomorrow"

Twelve Lectures on Science and Research
Otto von Guericke University in Magdeburg organized a public lecture series as part of the city's 1,200th anniversary celebration. Twelve researchers from all Magdeburg research organizations dedicated twelve lectures on exciting topics from business and research to the city's anniversary. The Fraunhofer IFF hosted the lecture series on February 23, 2005. Director Michael Schenk took his enthusiastic audience on a trip through the virtual world. On one "Virtual Tour" the audience was given an interesting and exciting look into the ongoing work at the Fraunhofer IFF, new developments and current trends in the field of virtual reality.

Technical direction:
Prof. Michael Schenk
Technical collaboration:
Mr. Torsten Schulz



The virtual model of the Monastery of Our Lady can be placed anywhere in virtual space.

February 28 - March 1, 2005, Bangkok (Thailand)
Final Project Assessment Meeting
"EPA for Industries/GPP II"
Hosted with: Asian Society for Environmental Protection (ASEP), Thailand; InWEnt gGmbH, Cologne
Technical direction:
Mr. Ralf Opierzynski

March 3, 2005, Magdeburg
7th HLA Forum 2005
Hosted by: Otto von Guericke University Magdeburg
Technical collaboration:
Mr. Marco Schumann
Dr. Steffen Strassburger

March 3-4, 2005, Magdeburg
Simulation and Visualization 2005 (SimVis): 16th Conference
Hosted by: Otto von Guericke University Magdeburg
Program committee:
Dr. Eberhard Blümel
Technical collaboration:
Dr. Steffen Strassburger
Mr. Marco Schumann

March 7, 2005, Frankfurt a.M.
VDMA Exchange of Experiences with "Digital Plant Configuration"
Technical collaboration:
Dr. Steffen Strassburger

March 12-16, 2005, Bonn
IEEE VR 2005
Technical collaboration:
Mr. Marco Schumann
Dr. Steffen Strassburger
Dr. Rüdiger Mecke

March 17, 2005, Magdeburg
Workshop on "Innovative Plant Engineering"
Hosted by:
FASA Saxony and Saxony-Anhalt
Technical collaboration:
Dr. Lutz Hoyer
Dr. Matthias Gohla

March 17, 2005, Freising
Fraunhofer-Gesellschaft PR Prize Awarded

Anna-Kristina Wassilew was awarded the Fraunhofer-Gesellschaft's PR Prize for her action "The Fantasy Machine Competition". Prof. Hans-Jörg Bullinger presented the prize at the meeting of institute directors on March 17, 2005.

In the jury's opinion: "Even when the impetus for this project came from outside, the creative achievement was how the Fraunhofer IFF managed to use the idea and integrate it into its own conception to achieve goals such as fostering the next generation and enhancing the location. The result is exemplary collaboration with school students from the region, for whom technology and research was made accessable by addressing the target group appropriately. In addition, the Fraunhofer IFF managed to contribute tremendously to further regional development in the center of Magdeburg.

Fraunhofer-Gesellschaft President Hans-Jörg Bullinger awards Anna-Kristina Wassilew the PR Prize.

Thus the Fraunhofer IFF made an excellent name for itself regionally among important partners in politics and society."

March 17-18, 2005, Peking (China)
"EC-Bridge: China and EU Researching Together on Logistics Solution"

As part of the EU project EC-Bridge, a trend mapping study for China focusing on eLogistics was compiled under the lead management of the Fraunhofer IFF.

Technical collaboration:
Mr. Kai Matzner

Kay Matzner presented the results of the trend mapping study at the Chinese-European Networking Symposion in Peking on March 17 and 18, 2005.

April 7-8, 2005, Hamburg
IATA: Inflight Industry Forum
Hosted by: International Air Transport Association IATA
Exhibit:
– RFID: Technology Driver in Logistics
Technical collaboration:
Ms. Katrin Reschwamm

April 10-13, 2005, Kaiserslautern
WM 2005: 3rd Conference on Professional Knowledge Management: Experiences and Visions
Technical collaboration:
Mr. Mark Staiger

April 12, 19, 26, May 3, 10, 24, 31, June 7 and 14, 2005, Magdeburg
8th Logistics Guest Lecture Series 2005 "Logistics as a Field of Work of the Future: Potentials, Implementation Strategies and Visions"

In the Guest Lecture Series, industry pros presented intelligent logistics solutions at the Fraunhofer IFF. Outstanding speakers from the field highlighted how companies are using logistics to tackle current market challenges and exploit logistics as a competitive edge. Topics included shorter delivery times, growing product complexity and the increasing diversity of variants. A highlight of this year's lecture series was the presentation by Kay Middendorf, Managing Director of Tchibo Logistik GmbH, at the close of the series on June 14, 2005.
Mr. Middendorf spoke on "Success Factors of Consumer-oriented Logistics". Tchibo was awarded the 2004 German Logistics Prize for its concept "A new experience every week". Tchibo's concept is based on an unparalleled continuous linkage of retail, service and industry in the consumer goods sector.

The series' patron, Minister Dr. Karl-Heinz Daehre, delivered the opening remarks at the final guest lecture on June 14, 2005.

The Guest Lecture Series lectures aroused great interest and filled the conference rooms at the Fraunhofer IFF.

Prof. Schenk presented the Guest Lecture Series' patron Minister Dr. Karl-Heinz Daehre, a copy of the proceedings.

Patron:
Dr. Karl-Heinz Daehre, Saxony-Anhalt Minister of Housing and Transportation

Technical direction:
Prof. Michael Schenk, Director Fraunhofer IFF and Chair for Logistic Systems at Otto von Guericke University Magdeburg
Prof. Karl Inderfurth, School of Management, Department of Production and Logistics at Otto von Guericke University Magdeburg
Prof. Dietrich Ziems, Chair for Logistics at Otto von Guericke University Magdeburg

April 21, 2005, Magdeburg
EFRE Conference
Hosted with: brain-insi GmbH, Halle
Exhibit:
– Prototype Interface and Process Standards to Optimize Collaborative Purchasing and Sales Processes
Technical collaboration:
Dr. Ina Ehrhardt
Ms. Claudia Wilke
Mr. Holger Mattke

April 21, 2005, Oebisfelde
2nd Informational Event "Regional Energy Recovery from Biomass from Landscape Conservation in Drömling"
Hosted with: Zweckverband Naturschutzprojekt Drömling
Technical collaboration:
Mr. Frank Mewes

April 22, 2005, Magdeburg
How Robots Are Actually Built

The first youth academy led children on an exciting voyage of discovery in the world of robotics. Just as at a real university, the future engineers learned all about humans' intelligent helpers in lectures, seminars and project afternoons. The young engineers built their own first service robot together with Fraunhofer researchers, Otto von Guericke University and the "One Stone Network for Child and Youth Education". The Stadtsparkasse's foundation for youth work is supporting the project with 5,000 euros.

Technical collaboration:
Dr. Ulrich Schmucker

Dr. Ulrich Schmucker explained to the child-students how the walking robot Katharina functions.

April 26-28, 2005, Amsterdam (Netherlands)
ITEC 2005: Defense Training, Education and Simulation Conference
Exhibits:
– Virtual Interactive Taining
– Virtual Manuals
– AITRAM: Advanced Integrated Training in Aeronautics Maintenance
Technical collaboration:
Mr. Stefan Stüring
Mr. Torsten Schulz
Mr. Waleed Salem
Mr. Matthias Strauchmann

April 26-29, 2005, Sinsheim
Trade Fair "Control"
Exhibits:
– Riveted Joint Set Head Projection Measurement
– Flexible 3-D Digitization
Technical collaboration:
Mr. Dirk Berndt
Mr. Erik Trostmann

May 2, 2005, Brussels (Belgium)
"EIRAC" Kick-off Meeting
Technical collaboration:
Dr. Eberhard Blümel

May 2-3, 2005, Bonn
Expert Forum on "Solutions in Risk and Emergency Management"
Hosted by: Federal Agency for Civil Protection and Disaster Relief
Technical collaboration:
Dr. Martin Endig

May 2-6, 2005, Hannover
LIGNA 2005
Exhibit:
– Saxony-Anhalt Wood Demonstrator
Technical collaboration:
Dr. Ina Ehrhardt
Mr. Holger Seidel
Ms. Cathrin Plate
Ms. Karola Plack
Ms. Claudia Wilke
Mr. Mike Wäsche

May 7, 2005, Magdeburg
"12hundred: Magdeburg Celebrates Its Birthday"

1,200 years of Magdeburg is a good reason to celebrate! The Kaiser Otto Prize was awarded for the first time in the Magdeburg cathedral. The recipient was former President of the Federal Republic of Germany, Dr. Richard von Weizsäcker. Afterward, the prominent guests met at the official reception given by the mayor in the former national bank next to the cathedral: Among others, Richard von Weizsäcker, German Finance Minister Hans Eichel, Gesine Schwan and Dr. Peter Eigen, Minister President Wolfgang Böhmer and Nashville, Tennessee Mayor Bill Purcell.

Congratulators included the Fraunhofer IFF represented by Deputy Director Dr. Müller. The Fraunhofer IFF presented its visual-interactive model of Magdeburg and invited prominent figures on a virtual tour of the city.

Dr. Gerhard Müller, Fraunhofer IFF and the Minister of Finance Hans Eichel at the mayor's reception.

May 11, 2005, Hamburg
COMPIT 2005
Technical collaboration:
Dr. Eberhard Blümel
Mr. Marco Schumann

May 19-20, 2005, Magdeburg
Training Series on Power Quality, Module 1:
"Introduction to Power Quality"
Seminars in the EU Continuing Education Program LPQIves with International Certification
Technical direction:
Dr. Antje Orths
Technical collaboration:
Mr. Przemyslaw Komarnicki

May 23-24, 2005, Amman (Jordan)
EBEL 2005: International Conference on eLearning and eBusiness
Technical collaboration:
Prof. Michael Schenk
Dr. Gerhard Müller
Dr. Eberhard Blümel
Mr. Waleed Salem

May 24-27, 2005, Faroe (Islands
The International Emergency Management Society (TIEMS): 12th Annual International Conference 2005
Hosted by: TIEMS
Technical collaboration:
Dr. Martin Endig

May 30 - June 1, 2005, Milan (Italy)
"VIRTHUALIS" Kick-off Meeting
Technical collaboration:
Dr. Eberhard Blümel
Mr. Waleed Salem

May 31 - June 3, 2005, Munich
Trade Fair "Transport Logistics 2005"
Exhibits:
– IFF Smart Box
– Memory Motor
Technical collaboration:
Mr. Helmut Röben
Mr. Friedrich Hülsenbeck

May 31, 2005, Magdeburg
Vanderbilt University Visits the Fraunhofer IFF

Top management from Vanderbilt University visited the Fraunhofer IFF. In lively discussion and a tour of the testing facility, the academics and researchers discovered common research interests such as image processing or the development of intelligent systems.

Corinna Kunert explains the advantages of logistics supported by transponders to Gordon E. Gee, Chancellor of Vanderbilt University (right). Far left: German and Slavic Languages Dept. Chair Dieter Sevin.

June 1-4, 2005, Riga (Latvia)
ESM 2005 Conference
Technical collaboration:
Dr. Eberhard Blümel
Dr. Steffen Strassburger

June 14, 2005, Magdeburg
Young Entrepreneurs Working Group "Virtual Product Development for SME"
Hosted by: VDMA Landesverband Nordost
Technical collaboration:
Dr. Eberhard Blümel

June 14-15, 2005, Bonn
26th VDI/VDEh Maintenance Forum:
"Focus on Productivity Increase"

Dr. Gerhard Müller moderated the plenary event "Maintenance from One Source« and the workshop "Engineering and Organization" on June 14. Workshop participants intensively discussed technical developments and their influence on the operational organization of maintenance. The technical drivers of organizational changes were weighted differently depending on the industry. Dr. Martin Endig presented the Fraunhofer IFF in the plenum. The presentation of the VDTC especially aroused interest among the audience.

On June 15, Cathrin Plate moderated the sequence "Performance Indicators and Benchmarking". This sequence included a lecture on "Quantifying Rates of Wear in Technical Assets" in which Frank Ryll, Fraunhofer IFF, and Jens Götze, BMW Group Werk Leipzig, presented the results of a joint project.

Exhibits:
- Statelogger: Software for Quantifying Rates of Wear in Technical Assets
- Shutdown Management: Web-based Services to Support Shutdown Processes for Complex Systems
- Examples of Use of RFID Systems in Maintenance (Digital Nameplate, IFF Smart Box)
- 3-D Virtual Plant Documentation

Technical colaboration:
Dr. Gerhard Müller
Dr. Martin Endig
Ms. Cathrin Plate
Mr. Frank Ryll

Fraunhofer IFF stand at the maintenance forum's accompanying exhibition.

June 16, 2005, Magdeburg
Saxony-Anhalt Telematics Conference 2005
Exhibit:
– Saxony-Anhalt Wood Demonstrator
Technical collaboration:
Dr. Ina Ehrhardt
Ms. Cathrin Plate
Mr. Mike Wäsche

June 16-17, 2005, Magdeburg
3rd Joint Colloquium on Engineering Design 2005
Technical direction:
Prof. Karl-Heinrich Grote
Technical collaboration:
Mr. Juraj Sulc
Ms. Susan Gronwald

June 16-17, 2005, Veliky Novgorod (Russia)
Bioenergy 2005 Workshop:
"Sustainable Biomass Management Chains to Meet Kyoto Requirements"
Hosted by: Russian-Swedish Bio-Energy Information and Training Centre; Swedish University of Agricultural Sciences, Swedish Energy Agency, Energy Wood Production Chains in Europe
Technical collaboration:
Dr. Lutz Hoyer
Dr. Eyck Schotte

June 22-24, 2005, Magdeburg

8th IFF Science Days
"Virtual Reality and Augmented Reality for Planning, Testing and Operating Technical Systems"

Technical direction:
Prof. Michael Schenk
Patron:
Prof. Jan-Hendrik Olbertz, Saxony-Anhalt Minister of Education and Culture

Prof. Michael Schenk in discussion with Minister of Education and Culture Prof. Jan-Hendrik Olbertz.

The 8th IFF Science Days revolved around the international conference "Virtual Reality and Augmented Reality in Product Life Cycle Management and the Digital Factory". Experts from industry reported on the use of virtual reality and augmented reality (VR/AR) in the field. They presented these technologies' potentials and fields of application and explained the need for future research and development. Researchers from institutes and universities presented the current state of research as well as current trends and technology developments in the field of VR/AR.

The conference was a contribution to the ViVERA project (http://www.vivera.org/) supported by the BMBF, which is bringing together users and developers of virtual and augmented reality technologies. ViVERA pools the research resources of twelve institutes and universities nationwide and is aimed at integrating VR technologies in enterprises.

Along with the two-day conference, the Fraunhofer IFF presented research work and results from other fields of work at the institute. Thus, the Science Days provided an ideal platform for interdisciplinary discussions and to cultivate contacts and establish new ones.

View of the accompanying exhibition in the foyer of the Fraunhofer IFF.

Together with their wives, Director Michael Schenk and Saxony-Anhalt Minister of Finance Karl-Heinz Paqué drink to the successful first "Science Days". The backdrop for the evening event was the tent where the VDTC cornerstone laying ceremony was held the next day.

In the Port of Science, the guests resumed their discussions in a relaxed atmosphere on the first evening of the Science Days. The building site of the Virtual Development and Training Centre, the cornerstone of which was laid during the Science Days, was an ideal setting for the evening event.

8th IFF Science Days Program

June 22-23, 2005: Conference

- Opening
  Moderation:
  Prof. Michael Schenk
- Sequence 1
  "VR/AR in Product Development"
  Moderation:
  Dr. Rüdiger Mecke
  "VR/AR in Manufacturing and Production"
  Moderation:
  Dr. Steffen Strassburger
- Sequence 2
  "User Interaction in Virtual Worlds"
  Moderation:
  Mr. Marco Schumann
  "Training in Virtual Environments"
  Moderation:
  Ms. Heike Kissner

– Plenum
  "Trends and Future Scenarios in VR/AR"
  Moderation:
  Prof. Ulrich Gabbert, Otto von Guericke University Magdeburg

June 22, 2005: Workshop
– "Wood Logistics"
  Moderation:
  Mr. Bernhard Hauck, KWF Kuratorium für Waldarbeit und Forsttechnik e.V., Groß-Umstadt

June 23, 2005: Workshop
– "RFID and Telematics in Logistics"
  Moderation:
  Dr. Klaus Richter

June 24, 2005: Workshop
– "Information Documentation in Plant Engineering: New Methods and Challenges"
  Moderation:
  Dr. Martin Endig
  Dr. Matthias Gohla

June 22, 2005: Industry Research Group
– "Cooperation in Plant Engineering"
  Moderation:
  Ms. Andrea Urbansky
  Ms. Mira Kleinbauer

June 24, 2005: Industry Research Group
– "DITO"
  Moderation:
  Mr. Stefan Voigt

June 24, 2005: Industry Research Group
– "Shutdown Services"
  Moderation:
  Ms. Cathrin Plate

June 24, 2005: Industry Research Group
– "Pharamacies"
  Moderation:
  Ms. Claudia Wilke

June 23, 2005, Magdeburg
VDTC Cornerstone Laid

With its VDTC, the Fraunhofer IFF is expanding its competencies in the field of virtual technologies and their applications for virtual training and product and process development. With a total investment volume of around 15.5 million euros, the building will eventually dominate the Port of Science being redeveloped as a visible symbol of progress. Eighteen meters in diameter, the circular virtual reality testing facility housing a vaulted projection screen is already easy to make out. Approximately 170 new jobs will be created. The European Union, the Federal Government and the State of Saxony-Anhalt are supporting the project.

Wished good progress building the VDTC (l. to .r.): Bernhard Czogalla, 1st Deputy Mayor of Magdeburg; Dr. Horst Rehberger, Minister of Economics and Labor; Prof. Dennis Tsichritzis, Member of the Fraunhofer-Gesellschaft Board; Prof. Jan-Hendrik Olbertz, Saxony-Anhalt Minister of Education and Culture; Prof. Michael Schenk, Director of the Magdeburg Fraunhofer IFF and Prof. Klaus Erich Pollmann, President of Otto von Guericke University Magdeburg.

June 23, 2005, Brussels (Belgium)
Saxony-Anhalt Summer Party

1,500 guests – twice as many as expected – were thoroughly impressed by the 1,200 year old city of Magdeburg's diverse program at the summer party at the foot of the Atomiums. In the Palace of the Regions in Brussels, Dr. Gerhard Müller presented Fraunhofer IFF research projects at a thematic workshop on Magdeburg as a center of science. Over a live Internet feed, the guests in Brussels were able to witness the laying of the VDTC cornerstone, taking place in Magdeburg's Port of Science at the same time.

Dr. Gerhard Müller presented the center of research Magdeburg at a workshop on the occasion of the Summer Party.

June 28, 2005, Magdeburg
Workshop: "1st Expert Round on Emergency Management in Germany"
Hosted by: Federal Agency for Civil Protection and Disaster Relief (BBK)
Technical direction:
Dr. Martin Endig
Technical collaboration:
Mr. Frank Mewes

June 29 - July 1, 2005, Graz (Austria)
I-Know 2005: 6th International Conference on Knowledge Management
"Using Hypertext Organization to Link Knowledge Islands: Knowledge Management in Project Organization"
Technical collaboration:
Mr. Hans-Georg Schnauffer

June 30 - July 1, 2005, Magdeburg
VDI Workshop on
"Optical 3-D Metrology"
Technical collaboration:
Mr. Ralf Warnemünde
Mr. Erik Trostmann

July 1-3, 2005, Magdeburg
9th Saxony-Anhalt Day
Exhibits:
– Virtual City of Magdeburg
– Virtual Magdeburg Port of Science
Hosted by: City of Magdeburg
Technical collaboration:
Mr. Andreas Höpfner

July 5, 2005, Chonburi (Thailand)
"International Symposium on Spatial Data Infrastructure for Thai Provinces: Applications of Geographic Information Systems in Local Governments"
Hosted by: Burapha University
Technical direction:
Dr. Martin Endig
Technical collaboration:
Mr. Frank Mewes

July 14, 2005, Magdeburg
Workshop on "Virtual Technologies in Restoration and Monument Conservation"
Technical direction:
Dr. Rüdiger Mecke
Mr. Andreas Höpfner

July 18-20, 2005, Dublin (Ireland)
"HILAS" Kick-off Meeting
Technical collaboration:
Ms. Heike Kissner
Mr. Torsten Schulz

July 19, 2005, Magdeburg
Workshop on "Interactive 3-D Visualization in Plant Biology"
Technical direction:
Dr. Rüdiger Mecke

August 25-26, 2005, Magdeburg
"VIRTHUALIS" Project Meeting:
"Virtual Reality and Human Factors Applications for Improving Safety"
The Fraunhofer IFF was host to researchers from Denmark, Germany, France, Greece, Great Britain, Italy, Poland, Slovak Republic and Sweden.
The idea behind the project VIRTHUALIS is to reduce risks in manufacturing and storage facilities by developing new technologies. These connect knowledge about human factors and virtual reality technologies.
Technical collaboration:
Mr. Waleed Salem
Ms. Sabine Szyler
Ms. Antje Plock

August 23, 2005, Magdeburg
Kick-off for the Founding of a German-Russian Research and Development Lab

Together with the Russian Institute of Aviation Systems (GosNIIAS) and the Automobile and Road Technical University (MADI), the Fraunhofer Institute for Factory Operation and Automation IFF is founding a "Joint Lab", a joint research and development lab in Moscow. Two run-up projects intended to enable the lab to start substantive work will be supported initially. This was announced by the German Ministry of Education and Research (BMBF) at a press conference at the Fraunhofer IFF.

Director Michael Schenk (2nd from left) explains how the IFF Smart Box works to Ulrich Kasparick (3rd from left) and Dr. Uwe Küster (left).

In Magdeburg, Parliamentary State Secretary at the BMBF Ulrich Kasparick emphasized the importance of this cooperation: "Joint research activities with Russia represent important impulses for economic development for Germany." Both parties will profit from this. Russian institutes are known throughout the world for their basic and applied research findings. Germany will be providing its management know-how and technology. "The collaboration forms the foundation for reciprocal market access," said Kasparick. Thus, research results could be transformed into commercially utilizable innovations more quickly.

September 6, 2005, Peking (China)
BPO Conference Peking
"BPO of Logistics Processes"
Technical direction:
Mr. Kay Matzner

September 14-21, 2005, Hannover
Trade Fair EMO 2005:
The World of Machine Tools
Exhibits:
– Virtual Interactive Training
– Virtual Manuals
– ViVERA
Technical collaboration:
Mr. Marco Schumann
Ms. Michaela Schumann
Ms. Heike Kissner
Mr. Torsten Schulz
Mr. Waleed Salem
Mr. Matthias Strauchmann
Ms. Tina Haase
Mr. Ronny Franke
Ms. Sabine Szyler

September 20, 2005, Frankfurt a.M.
VDMA Day "Virtual Reality in Product Development"
Exhibit:
– Virtual Product Development
Technical collaboration:
Dr. Eberhard Blümel
Dr. Steffen Strassburger
Mr. Ronny Franke

September 21, 2005, Vienna (Austria)
EIRAC Conference on Intermodal Transport
Technical collaboration:
Dr. Eberhard Blümel

September 20-22, 2005, Hanoi (Vietnam)
Final Project Assessment Meeting:
"Life Cycle Plant Management/LCPM"
Hosted with: BBPV (Vietnam), InWEnt gGmbH, Cologne
Technical direction:
Mr. Ralf Opierzynski
Mr. Friedrich Hülsenbeck

September 20-24, 2005, Husum
HUSUMwind:
International Trade Fair for Wind Energy
Exhibits:
– RFID in Maintenance: Memory Motor
– Neuronal Networks for Wind Power Forecasting
– Statelogger
Technical collaboration:
Mr. Frank Ryll
Mr. Rico Schady

September 22-23, 2005, Garching
CARV 2005: Conference on Changeable, Agile, Reconfigurable and Virtual Production
Hosted by: Technical University of Munich
Technical collaboration:
Dr. Steffen Strassburger

September 26, 2005, Bernburg
Symposium on
"Potentials of Biomass Utilization"
Hosted by: State Agency for Agriculture and Garden Architecture
Technical collaboration:
Dr. Ina Ehrhardt
Mr. Roman Bystricky

September 26-27, 2005, Chonburi (Thailand)
Final Project Assessment Meeting:
"Life Cycle Plant Management/LCPM"
Hosted with: Thai-German-Institute (TGI) (Thailand), InWEnt gGmbH, Cologne
Technical direction:
Mr. Ralf Opierzynski
Mr. Friedrich Hülsenbeck

September 26-27, 2005, Aachen
2nd Workshop of the GI Professional Group VR/AR
Technical collaboration:
Ms. Heike Kissner
Mr. Wolfram Schoor

September 28-30, 2005, Malang (Idonesia)
Final Project Assessment Meeting:
"Life Cycle Plant Management/LCPM"
Hosted with: Vocational Education Development Center (VEDC) (Indonesia), InWEnt gGmbH, Cologne
Technical direction:
Mr. Ralf Opierzynski
Mr. Friedrich Hülsenbeck

September 29-30, 2005, Oschersleben
PITECH 2005
Exhibit:
– Virtual Interative Training
Technical collaboration:
Mr. Ronny Franke
Mr. Steffen Masik

October 3-5, 2005, Vienna (Austria)
7th Conference on Optical 3-D Measurement Techniques
Hosted by: Technical University of Vienna
Technical collaboration:
Dr. Rüdiger Mecke
Mr. Wolfram Schoor

October 4-6, 2005, Düsseldorf
Intergeo 2005: Congress and Trade Fair for Geodesy, Geoinformation and Land Management
Hosted by: German Association of Surveying
Exhibits:
– Saxony-Anhalt Wood Demonstrator
– (Logistics) Platforms
Technical collaboration:
Dr. Ina Ehrhardt
Mr. Mike Wäsche
Mr. Frank Mewes

October 5-8, 2005, Vienna (Austria)
ISMAR 05: 4th IEEE and ACM International Symposium on Mixed and Augmented Realtiy, Workshop on Industrial Augmented Reality
Technical collaboration:
Mr. Marco Schumann

October 4, 2005, Magdeburg
"Exhibition in the Saxony-Anhalt State Parliament"

With the objective of consolidating and expanding Saxony-Anhalt's potentials for business and tourism, the CDU party in the state parliament started a series of events entitled "EuroMagnet". At the "EuroMagnet" kick-off, Dr. Gerhard Müller, Deputy Director of the Fraunhofer IFF presented research and development services of the Magdeburg Fraunhofer Institute's in the foyer of the Saxony-Anhalt state parliament.

Exhibits:
- Design Study of the Facade Cleaning Robot $Sirius_C$
- Electronic Javelin
- Model Memory Motor
- VR Scenarios (Virtual City Model of Magdeburg, Virtual Gear System)

Technical direction:
Dr. Gerhard Müller
Organization:
Mr. Herbert Siegert

Walking through the exhibition in the foyer of the Saxony-Anhalt state parliament, Dr. Gerhard Müller explained the exhibits of the Fraunhofer IFF. In the background is the electronic javelin with "on-board electronics" used in training by athletes at the Olympic Training Center.

October 11-13, 2005, Magdeburg
7th Magdeburg Mechanical Engineering Days "Virtual Product and Process Development"
Technical collaboration:
Dr. Eberhard Blümel

October 11-15, 2005, Hannover
CeMAT: World's Leading Fair for Intralogistics
Gemeinschaftsstand mit:
Siemens Business Services
Exhibits:
- IFF Smart Box
- Test System for RFID Certification

Technical collaboration:
Dr. Klaus Richter
Mr. Helmut Röben
Mr. Friedrich Hülsenbeck

October 12, 2005, Vilémov (Czech Republic)
"Forests and Their Contribution to the Development of Regions"
Hosted by: Research Center for Forestry and Hunting, Vilémov
Technical collaboration:
Mr. Roman Bystricky

October 13-14, 2005, Berlin
6th Berlin Workshop on "Human – Machine – Systems"
Exhibit:
- Learning in Virtual Interactive Environments

Technical collaboration:
Ms. Michaela Schumann

October 13-16, 2005, Miskolc (Hungary)
"OVOTRAIN" Kick-off Meeting
Technical collaboration:
Dr. Steffen Strassburger
Ms. Sonja Hintze

October 13-14, 2005, Magdeburg
"Central German Automotive Industry at the 5th MAHREG Innovation Forum"

The 5th MAHREG Innovation Forum was held at the Fraunhofer Institute for Factory Operation and Automation IFF on October 13 through 14, 2005. The forum presented specialized lectures and workshops on the subject of "Reliable: Faster and More Reliable Processes in the Automotive Industry". More than 100 representatives from national and international automotive suppliers and representatives from well-known carmakers such as Porsche and VW discussed future developments and trends in carmaking. Dr. Eberhard Blümel, Division Director of "Virtual Development and Training" (VDT) at the Fraunhofer IFF spoke on "Virtual Techniques: A Regional Competence and Service for SME".

More than 100 international representatives from the automotive and supplier industries met at the 5th MAHREG Innovation Forum at the Fraunhofer IFF.

October 18-20, 2005, Magdeburg
Annual Fraunhofer-Gesellschaft Convention "New Dimensions: Virtual Worlds"

The highpoint of the annual convention was the awarding of the Fraunhofer-Gesellschaft's research prize on October 19, 2005. More than 600 guests from politics, business, research and culture came to witness the awarding of the three Joseph von Fraunhofer Prizes, the three Hugo Geiger Prizes and the prize for "Technology for People" at a multimedia show. Magdeburg was the perfect choice for the venue of the annual convention with the motto "New Dimensions: Virtual Worlds". The new building for the Fraunhofer IFF Virtual Development and Training Centre VDTC is under construction in Magdeburg at this time. With an investment volume of around 15.5 million euros, a VR center is being built, which will set new standards in this technology in the Fraunhofer-Gesellschaft and throughout Germany.

The highest Fraunhofer-Gesellschaft body, the Senate, met at the Fraunhofer IFF on October 18, 2005. Prof. Michael Schenk, Director of the Fraunhofer IFF, welcomed the guests to the Magdeburg Institute and used the opportunity to present the institute and selected research projects. Members of the Senate are high ranking individuals from business, research and the public sector. In his welcoming remarks, Prof. Klaus Vöhringer, Chair of the Senate, emphasized the excellent reputation the Magdeburg institute enjoys in the Fraunhofer-Gesellschaft.

In the Magdeburg institute's testing facility, Prof. Michael Schenk (left), Director of the Fraunhofer IFF, explains current projects to the Chair of the Fraunhofer-Gesellschaft Senate Prof. Klaus Vöhringer (center) and Fraunhofer-Gesellschaft President Prof. Hans-Jörg Bullinger. The picture shows components and models of an inspection system for sewer systems.

October 17-19, 2005, Magdeburg
International IBA Congress
Hosted by: IBA-Büro GbR
Technical collaboration:
Mr. Andreas Höpfner

October 18, 2005, Prien
"Prien Logistics Colloqium"
Hosted by: Fraunhofer IML
Technical collaboration:
Mr. Roman Bystricky

October 18, 2005, Munich
Transponder Roadshow 2005
Technical collaboration:
Mr. Christian Eins

October 19, 2005, Wernigerode
"Drive Systems" Forum
Hosted by: Harz University of Applied Sciences
Technical collaboration:
Ms. Sonja Hintze

October 24-25, 2005, Munich
"KnowTech 2005": 7th Conference on Knowledge Management in Business and Administration: Integrated Competence Management, Informal Structures and Integration in Processes as Success Factors of Knowledge Management
Technical collaboration:
Mr. Mark Staiger
Mr. Stefan Voigt

October 18-21, 2005, Munich
"Maintain" International Trade Fair for Industrial Maintenance

At the international trade fair for industrial maintenance, more than 160 exhibitors from six countries presented intersectoral state of the art solutions for the maintenance, inspection and repair of machinery and plants.

Together with its industry partner Enigma GmbH Munich, the Fraunhofer IFF presented the following exhibits at a joint Fraunhofer-Gesellschaft stand:
- RFID Applications for Maintenance
- Tools for Condition-based Maintenance: Statelogger
- PMO: Plant Maintenance and Operation Services

Technical collaboration:
Dr. Martin Endig
Ms. Cathrin Plate
Mr. Frank Ryll

October 28, 2005, Berlin
Meeting of ERFA Groups: Exchange of Experiences for Apothecary Companies
Hosted with: brain-insi GmbH, Halle
Exhibit:
- Prototype Interface and Process Standards for Optimizing Collaborative Buying and Sales Processes

Technical collaboration:
Mr. Holger Mattke

October 19-21, 2005, Berlin
22nd German Logistics Congress
"Generating Growth – Shaping the Future"

More than 3,000 attendees, over 150 moderators and speakers and around 260 exhibitors met for the first time in Berlin from October 19 through 21, 2005. The Fraunhofer IFF was represented with two stands at the 22nd German Logistics Congress and used RFID applications from the LogMotionLab to present intelligent logistics solutions from Magdeburg.

Exhibits:
- IFF Smart Box
- Container Management
- Memory Motor
- RFID Sample Case
- Logistics Intelligence from Magdeburg (secure chains of goods, intelligent assets, mobile knowledge)

Technical collaboration:
Prof. Michael Schenk
Mr. Holger Seidel
Mr. Helmut Röben

On the DVZ red sofa, Björn Helmke, editor in chief of LOG.Punkt and the DVZ Deutsche Verkehrs-Zeitung discussed current logistics issues with Prof. Schenk. The conversation especially dealt with the tremendous potential of RF technologies to make international chains of goods more secure, more transparent and more efficient.

Ms. Manuela Wahl
Mr. Christian Eins
Ms. Katja Barfus

A brisk crowd at the Fraunhofer IFF LogMotionLab stand. The exhibits, above all the IFF Smart Box, aroused the congress attendees' interest.

October 26, November 2, 9, 16, 23, 30 and December 7, 2005, Magdeburg

2nd Virtual Reality Guest Lecture Series 2005
"Human and Machine in Interactive Dialog"

Modern virtual engineering technologies are among the most important factors behind innovation. Like cornerstones, these technologies help secure competitiveness in Germany as a land of high-tech. Speakers from the business and research communities demonstrated that the use of VR and AR applications provides a crucial advantage: Long development times and high development costs can be cut. They reported on the forms in which and the extent to which virtual technologies have entered their enterprises and their assessment as users and developers of the technology trends in this field.

Minister of Economics and Labor Horst Rehberger assumed the patronage of the Guest Lecture Series and opened the first lecture with welcoming remarks.

Patron:
Dr. Horst Rehberger, Saxony-Anhalt Minister of Economics and Labor and State Innovation Commissioner

Technical Direction:
Prof. Ulrich Gabbert, Head of the Department of Mechanics, Otto von Guericke University Magdeburg
Prof. Karl-Heinrich Grote, Chair for Engineering Design, Otto von Guericke University Magdeburg
Prof. Klaus Jenewein, Head of the Department of Vocational Education and Human Resources Development, Otto von Guericke University Magdeburg
Prof. Roland Kasper, Chair for Mechatronics, Otto von Guericke University Magdeburg
Prof. Bernhard Preim, Chair for Visualization, Otto von Guericke University Magdeburg
Prof. Michael Schenk, Director Fraunhofer IFF and Chair for Logistic Systems, Otto von Guericke University Magdeburg
Dr. Eberhard Blümel, Division Director of VDT, Fraunhofer IFF

Organization:
Ms. Antje Plock

October 31, 2005, Moscow (Russia)

Opening of the "Fraunhofer Representative Office"

The Fraunhofer-Gesellschaft opened an official foreign representative office in Moscow on October 31, 2005. Russian researchers and enterprises have been collaborating closely with Fraunhofer researchers for years. The "Fraunhofer Representative Office" will support future technology transfer and the development of strategic partnerships. The Fraunhofer IFF in Magdeburg will also profit from the newly opened office and the Fraunhofer-Gesellschaft's stepped up activities in Russia.

Together with the Russian Institute of Aviation Systems (GosNIIAS) and the Automobile and Road Technical University (MADI), the Fraunhofer IFF presented in Moscow the "Joint-Lab", a joint research and development lab. In an initial phase, the joint lab will collaborate in the field of spare parts identification for the aviation industry and in the development of optical measuring systems for manufacturing and quality inspection.

At the opening of the Fraunhofer Representative Office and in the presence of prominent figures from science and politics, Prof. Michael Schenk gave a presentation on projects and cooperations between Russian research organizations and the Fraunhofer IFF.

November 2, 2005, Birlinghoven
2nd Fraunhofer Expert Colloquim on Innovation – Knowledge – Qualification
Technical collaboration:
Mr. Hans-Georg Schnauffer
Mr. Mark Staiger
Mr. Stefan Voigt

November 3, 2005, Wernigerode
School Student Forum 2005
Exhibits:
– Virtual Steam Locomotive Controls
– Virtual Interactive Training
– Learning in Virtual Environments
Technical collaboration:
Mr. Marco Schumann
Ms. Michaela Schumann

November 7-8, 2005, Magdeburg
Power Quality Training, Module 2: "Influence of Decentralized Energy Producers on Power Quality", Seminar in the EU Continuing Education Program LPQIves with Option of International Certification.
Technical direction:
Mr. Jens Kroitzsch
Technical collaboration:
Mr. Przemyslaw Komarnicki

November 7-10, 2005, Magdeburg
"smE-MPOWER" Kick-off Meeting
Technical direction:
Ms. Katrin Reschwamm
Mr. Andreas Wolf

November 8-9, 2005, Ludwigsburg
6th Professional Conference on Factory Planning
Technical collaboration:
Mr. Holger Seidel
Mr. Eyk Flechtner
Mr. Rico Schady

November 9, 2005, Hürth
4th Industry Research Group: "Cooperation in Plant Engineering"
Technical direction:
Ms. Andrea Urbansky
Ms. Mira Kleinbauer

November 10, 2005, Darmstadt
1st Congress on "3-D City Models"
Hosted by: ZGDV Computer Graphics Center
Technical collaboration:
Mr. Andreas Höpfner

November 15-17, 2005, Zakopane (Poland)
KOMTECH: International Conference on Systems Reducing Hazards in Operational Processes of Machines and Equipment.
Technical collaboration:
Mr. Waleed Salem

November 17, 2005, Magdeburg
Saxony-Anhalt Innovation Day 2005 "More Growth and Employment through Innovation"

The Saxony-Anhalt Ministy of Economics and Labor and Ministry of Education and Culture hosted the first Saxony-Anhalt Innovation Day 2005 on November 17, 2005. Under the motto "More Growth and Employment through Innovation", factors for successful innovation were discussed in order to make the state's innovation system even more efficient in the future.

The event was held at the Fraunhofer IFF in Magdeburg. Fifty-two enterprises also took part in the accompanying poster exhibition. Minister of Education and Culture Jan-Hendrik Olbertz listened to explanations of several inventions during a tour through the exhibition.

In a lecture on "Innovation Strategies for Tomorrow", Dr. Gerhard Müller, Deputy Director of the Fraunhofer IFF, presented the Fraunhofer-Gesellschaft's approach to producing innovations in Germany faster and better. Drawing on examples, he showed, among other things, how companies from Saxony-Anhalt have used cooperation with the Fraunhofer IFF to develop new products and successfully position them on the market.

A lively exchange of ideas in the foyer of the Fraunhofer IFF during the 1st Saxony-Anhalt Innovation Day 2005.

Technical collaboration:
Dr. Gerhard Müller

November 22, 2005, Magdeburg
Saxony-Anhalt Quality Prize 2005

On November 22, 2005 Minister of Economics and Labor Horst Rehberger awarded Mechanische Werkstätten Gerhard Zorn in Stendal the Saxony-Anhalt Quality Prize 2005. At the awards ceremony, Dr. Rehberger emphasized that "Quality always pays. With the Quality Prize, we recognize outstanding achievements in quality management. Quality is a decisive factor for measuring oneself against the competition on the global market."

The ceremony was held at the Fraunhofer IFF, which organized the Quality Prize on behalf of the Saxony-Anhalt Ministry of Economics and Labor. Three speakers from the field presented the specific quality requirements and -features in the particular industries to the public at the awards ceremony. On the basis of his company's history, Rainer Thiele from Kathi reported on the importance of the brand name for his company's success in the food processing industry. Wolfgang Welsch explained the requirements on the employees of Otto mail order center in Haldensleben, which with around 540,000 shipped articles per day is the world's leader. Gerhard Schlager from BMW Werk Leipzig gave a presentation on how strongly the importance of suppliers in the automotive industry has increased in recent years.

At the awards ceremony at the Fraunhofer IFF, Minister of Economics and Labor Horst Rehberger (left) congratulated the entrepreneur Bernd Zorn, owner of the Mechanische Werkstätten Gerhard Zorn in Stendal.

The honorary jury chaired by Prof. Michael Schenk, Director of the Fraunhofer IFF, included thirteen members from universities, research institutes, industry associations and chambers of industry.

November 24, 2005, Senlis (France)
INTUITION Workshop 2005
Technical collaboration:
Dr. Eberhard Blümel

November 24-25, 2005, Bangkok (Thailand)
International Symposium on Corporate Sustainability Management (CSM)
Hosted with: Asian Society for Environmental Protection (ASEP) (Thailand), Centre for Sustainability Management, Lüneburg, InWEnt gGmbH, Cologne, Asia Pacific Roundtable for Sustainable Consumption and Production (APRSCP), Manila (Philippines), Vietnam Productivity Centre (VPC), Hanoi (Vietnam), Indonesian Society of Environmental Professionals (ISEP), Jakarta (Indonesia)
Technical direction:
Mr. Ralf Opierzynski

November 24-25, 2005, Magdeburg
11th Magdeburg Logistics Symposium
"Intelligent Logistics Processs: Concepts, Solutions, Experiences"

The most important topic at the 11th Magdeburg Logistics Symposium was the integration of intelligent information and communication technologies in logistics processes. While individual subprocesses are often optimally organized to a great extent, the intelligent planning, coordination and control of these subprocesses constitute a central challenge of logistics management in which RFID technology plays a crucial role.

The evening event was held on November 24 at the Fraunhofer IFF where the Magdeburg Fraunhofer Institute's LogMotionLab had organized an RFID user forum. Manufacturers of RFID technologies and providers of services based on RFID technology presented their solutions to an interested and enthusiastic audience.

Symposium guests were able to experience RFID technology up close at the RFID user forum at the Fraunhofer IFF LogMotionLab.

November 28-29, 2005, Prague (Czech Republic)
8th Annual International Conference on the Present and Future of Crisis Management 2005
Hosted by: T-SOFT
Technical collaboration:
Dr. Martin Endig

November 28 - December 2, 2005, Bangalore (India)
Logindia Training on
"Logistics Networks"
Technical collaboration:
Mr Kay Matzner
Mr. Tobias Reggelin

November 29, 2005, Barleben
Status Seminar on "Feeling Tools: Generative Manufacturing Technologies for Integrating Sensors in Shape Adaptive Tools"
Technical collaboration:
Ms. Susan Gronwald
Dr. Uwe Klaeger

December 4-7, 2005, Orlando (USA)
Winter Simulation Conference
Technical collaboration:
Dr. Steffen Strassburger

December 8-9, 2005, Jena
Fraunhofer Network "Vision"
Workshop "Optical 3-D Metrology"
Technical collaboration:
Mr. Dirk Berndt
Mr. Ralf Warnemünde
Mr. Tino Müller

December 11-12, 2005, Leipzig
15th Leipzig Building Seminar at the University of Leipzig: "Digital Planning – Virtual Reality"
Exhibits:
– Virtual City of Magdeburg
– Virtual Magdeburg Port of Science
Technical collaboration:
Mr. Andreas Höpfner

December 21, 2005, Magdeburg
Construction Workers and Fraunhofer Employees Celebrate the Topping Out of the VDTC

On December 21, 2005, work at the VDTC construction site didn't progress as speedily as usual for a change. No surprise: Tables and benches had been brought in and heaters and spotlights set up. Numerous helpers gave their all to make it possible to celebrate a properly festive topping out ceremony at the wintry construction site. And so it came to happen as it should: Construction workers, architects and Fraunhofer IFF employees all made the night day. The principal used the traditional topping out ceremony to express his deep thanks to everyone involved and wished a successful conclusion to construction. True to the saying "The moment this glass is broken on the ground is the hour this building is dedicated", once the carpenter's nail had been successfully hammered in, toasts were drunk and the topping-out wreath was hoisted.
The next time numerous guests gather in Magdeburg's Port of Science will be to open the new Virtual Development and Training Centre VDTC building. The date is already set. On November 22, 2006, the interested public will be able to find out how development, testing and train-ing functions in virtual environments. Thus the VDTC will not only arouse interest in Saxony-Anhalt but also in all of Germany – and perhaps throughout the world. As one of the 365 landmarks in the "Land of Ideas" the VDTC is allowed to represent Germany in the world as part of this initiative in the year of the World Cup.

Traditional customs at the topping out ceremony: The last hammer blow, delivered with remarkable precision from Deputy Director Dr. Gerhard Müller, a drink in honor of the occasion and naturally the hoisting of the topping-out wreath.

Outlook

Highlights 2006

March 2-3, 2006
Magdeburg, Maritim Hotel

Conference on "Plant Engineering of the Future: Gaining Competitive Edges in Plant Engineering – Future Scenarios and Field Reports"

Thematic emphases will be the eastward expansion of the EU, innovations in plant engineering and the use of virtual engineering to increase efficiency in plant engineering.

http://www.tagung-anlagenbau.de

April 11 - June 13, 2006,
every Tuesday at 5 p.m.
Magdeburg, Fraunhofer IFF

9th Logistics Guest Lecture Series 2006:
"Logistics as a Field of Work of the Future"

At this forum, high-ranking representatives from industry, the service sector, retail and transportation will present their ideas and concepts to a broad audience in a total of nine lectures.

http://www.gvr-log.de

June 21-23, 2006
Magdeburg, Fraunhofer IFF

9th IFF Science Days 2006:
"Virtual Reality and Augmented Reality for Planning, Testing and Operating Technical Systems"

The 9th IFF Science Days will revolve around the conference entitled "Virtual Reality and Augmented Reality in Product Life Cycle Management and the Digital Factory".

A two-day symposium on "Network Supporting Autonomous Mobility Services" will be held at the same time, which will present innovations from the field of logistics.

http://www.iff.fraunhofer.de

October 25 - December 6, 2006,
every Wednesday at 5 p.m.,
Magdeburg, Fraunhofer IFF

3rd Virtual Reality Guest Lecture Series 2006
"Human and Machine in Interactive Dialog"

Speakers from the business and research communities will present the range of uses of VR technology in companies and assess the technology trends in this field.

http://www.iff.fraunhofer.de

November 22, 2006
Magdeburg, Virtual Development and Training Centre VDTC

Virtual Development and Training Centre VDTC: A Landmark in the "Land of Ideas"

The Fraunhofer IFF VDTC in Magdeburg has been selected as one of 365 landmarks in the "Land of Ideas". As part of this national campaign, the research organization will open its new institute building in the Port of Science on November 22, 2006 and present itself to the general public.

"Germany: Land of Ideas" is the joint initiative of the Federal Government and German business represented by the Federation of German Industries. The initiative's objective is to present an image of Germany at home and abroad as a country that is innovative, open to the world and inspired. The Virtual Development and Training Centre VDTC was selected from more than 1,200 applicants and is now part of the unique series of landmarks, which will outstandingly represent Germany as a Land of Ideas.

For more information on the initiative "Land of Ideas" visit the website www.land-der-ideen.de.

Welcome to Germany
Land of Ideas

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Stuttgart : Fraunhofer IRB Verlag, 2004, ISBN 3-8167-6668-4

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Stuttgart : Fraunhofer IRB Verlag, 2004, ISBN 3-8167-6464-9

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Stuttgart : Fraunhofer IRB Verlag, 2004, ISBN 3-8167-6577-7

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Stuttgart : Fraunhofer IRB Verlag, 2005, ISBN 3-8167-6808-3

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Magdeburg : Fraunhofer IFF, 2004, ISBN 3-8167-6053-8

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Stuttgart : Fraunhofer IRB Verlag, 2004, ISBN 3-8167-6392-8

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Interactive Human and Machine.
Magdeburg : Fraunhofer IFF, 2004, ISBN 3-8167-6644-7

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Logistics Connects 2004: News and Prospects from the Fraunhofer IFF and the Otto von Guericke University IFSL (Logistics Connects).
Stuttgart : Fraunhofer IRB Verlag, 2004, ISBN 3-8167-6563-7, ISSN 1611-6631

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Mass Customization – Methoden, Wissen, Anwendungen.
Magdeburg : Fraunhofer IFF, 2004, ISBN 3-8167-6645-5

Schenk, M. ; Schlüter, W. (Ed.):
ProTT Schriftenreihe Band 5 – Vertrag bei internationalem Industrie- und Anlagenbau – Mustervertrag mit Kommentierungen für grenzüberschreitende Fabrikplanungsleistungen unter besonderer Berücksichtigung von Rechtswahl und Streitbeilegungsmechanismen.
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Blümel, E. ; Strassburger, S.:
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Management Decision Support for Critical Infrastructure – Integrierte Informationsbereitstellung als Basis einer modernen Entscheidungsunterstützung.
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Committee Work 2004/2005 (Selection)

Simulation Working Group
Mr. Marco Schumann – Member of the Professional Group for Distributed Modeling and Simulation
Dr. Steffen Strassburger – Deputy Spokesman for the Professional Group for Distributed Modeling and Simulation

Asian Society for Environmental Protection (ASEP)
Mr. Ralf Opierzynski – Member

ATV-DVWK – Research Group ES-8.12 Repair of Sewer Lines and Systems by Robotic Systems
Dr. Norbert Elkmann – Member

German Logistics Association (BVL)
Prof. Michael Schenk – Member of the Managing Board and the Board
Mr. Holger Seidel – Spokesman for the Saxony-Anhalt Regional Group

International Institute for Critical Infrastructures (CRIS)
Dr. Antje Orths – Member

German-Russian Forum
Prof. Michael Schenk – Member

DGfZP, Research Group Magdeburg
Mr. Dirk Berndt – Member

German Association for Solar Energy (DGS)
Dr. Antje Orths – Member

EU Commission 6th Framework Programme
Dr. Eberhard Blümel – Expert

European Intermodal Research Advisory Concil (EIRAC)
Dr. Eberhard Blümel – Member

Industrial Measuring Sensors Working Group (AMA)
Dr. Ulrich Schmucker – Member

Society for the Promotion of Renewable Energies (FEE)
Dr. Matthias Gohla – Member RG: Biogenic Gas Fuel Cells
Dr. Helmar Tepper – Member RG: Biomass Gasification

Association for the Promotion of Materials Cycle Management
Dr. Lutz Hoyer – Member of the Board

Fraunhofer Network "Vision"
Mr. Dirk Berndt – Member

Fraunhofer-Gesellschaft (FhG) Scientific-Technical Board (WTR)
Prof. Michael Schenk – Member of the Main Commission

Fraunhofer Energy Alliance EST
Dr. Lutz Hoyer – Coordination of Fraunhofer IFF Activities

Fraunhofer Production Alliance
Prof. Michael Schenk – Member

Fraunhofer Traffic and Transportation Alliance FVV
Mr. Daniel Reh – Member

Society for Computer Science (GI)
Mr. Ralf Opierzynski – Member RG: Industrial Environmental Information Systems

Society for Project Management
Ms. Katrin Reschwamm – Member of Magdeburg Regional Group

Comprehensive Center for Transportation Braunschweig (GZVB)
Mr. Eyk Flechtner – Member

Society for Knowledge Management
Mr. Mark Staiger – Member

Institute of Electrical and Electronics Engineers (IEEE)
Dr. Antje Orths – Member

IGZ Innovations- und Gründerzentrum Magdeburg GmbH
Prof. Michael Schenk – Member of the Advisory Board

International Green Productivity Association (IGPA)
Mr. Ralf Opierzynski – Member

Jenoptik AG, Scientific Advisory Board
Prof. Michael Schenk – Member

Karl Heinz Beckurts Foundation
Prof. Michael Schenk – Member

Central German Waste Management Competence Network
Dr. Eyck Schotte – Member RG: Renewable Energies
Dr. Lutz Hoyer – Member AG: Substitute Fuels

MLFU Coordination Office for Renewable Raw Materials KoNaRo,
Research Group: Biogenic Fuels
Dr. Lutz Hoyer – Member

LICON Logistics
Dr. Klaus Richter – Member of the Board

Pipeline and Plant Engineering Consortium
Ms. Andrea Urbansky – Member of the Coordinating Board

Open GIS Consortium (OGC)
Mr. Frank Mewes

Practical Forum for Competence Management
Mr. Mark Staiger – Coordinator

Saxony-Anhalt Satellite Navigation (SANASA)
Dr. Klaus Richter – Member of the Board

Society for Modeling and Simulation International
Dr. Steffen Strassburger – Member

Energy Alliance
Dr. Lutz Hoyer – Coordination of IFF-Activities (on behalf of institute management)

TKB Technologiekontor Bremerhaven R&D Company for the Utilization of Regenerative Energies
Prof. Michael Schenk – Member of the Advisory Board

Transfer Center for Automation in Mechanical Engineering (TAM)
Dr. Ulrich Schmucker – Member of the Board

VDE Association of Electrical Engineering, Electronic, Information Technology e.V.
Dr. Antje Orths – Member

Association of German Foundry Experts (VDG)
Prof. Michael Schenk – Member of the Research Advisory Board
Sonja Hintze – Member Foundry Technical Committee

Association of German Engineers (VDI)
VDI Society of Metrology and Automation (GMA)
Mr. Dirk Berndt – Member of the Technical Committee 3.32: Optical 3-D Metrology

Association of German Engineers VDI – Society for Industrial Engineering (ADB)
Dr. Gerhard Müller – Member of the Board and Advisory Board
VDI-ADB – Technical Committe on Factory Planning,
Ms. Claudia Falke – Member RG: Digital Factory
Mr. Daniel Reh,
Mr. Rico Schady – Member RG: Expanded Economic Feasibility Studies
Mr. Thomas Dengler – Member RG: VDI Factory Planning Guidelines
VDI-ADB Maintenance Technical Committee
Ms. Cathrin Plate – Member RG: VDI 2890 Guide for Preparing Maintenance Plans

VDI Environmental Engineering Coordination Office (VDI-KUT), Working Group on Industrial Performance Indicators for Environmental Management
Mr. Ralf Opierzynski – Member

VDI Magdeburg District Chapter
Dr. Klaus Richter – Ombudsman
RG Development Design Sales
Dr. Mirko Peglow – Ombudsman
RG Students and Young Engineers

Windenergie-Agentur Bremerhaven/ Bremen e.V. (WAB)
Dr. Klaus Richter, Mr. Frank Ryll – Technical Collaboration

Association for the Promotion of Power and Environmental Engineering (VEU)
Dr. Lutz Hoyer – Member

Center for Neuroscientific Innovation and Technology ZENIT GmbH
Prof. Michael Schenk – Member of the Scientific Advisory Board

Association for the Promotion of Mechanical and Plant Engineering in Saxony and Saxony-Anhalt (FASA)
Prof. Michael Schenk – Chairman of the Board
Ms. Andrea Urbansky – Managing Director

International Research and Cooperation Partners 2004/2005 (Selection)

Aeronautical Institute Kharkov, Kharkov, Ukraine

Asia Pacific Roundtable for Cleaner Production (APRCP), Manila, Philippines

Asian Society for Environmental Protection (ASEP), Bangkok, Thailand

Atos Origin, Madrid, Spain

Baltic Container Terminal Ltd., Riga, Latvia

Beacontech Ltd., Tel Aviv, Israel

Beijing Hope Software Co., Beijing, China

Biomag, Ing. Cerny, Unícov, Czech Republic

Brno University of Technology, Brno, Czech Republic

Budapest University of Technology and Economics, Budapest, Hungary

Centrale Recherche SA, Paris, France

Centre for Renewable Energy CRES, Pikermi Attiki, Greece

Centre for Research and Technology Hellas CERTH, Ptolemais, Greece

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The Fraunhofer-Gesellschaft at a Glance

The Research Organization

The Fraunhofer-Gesellschaft undertakes applied research of direct utility to private and public enterprise and of wide benefit to society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration. The organization also accepts commissions and funding from German federal and Länder ministries and government departments to participate in future-oriented research projects with the aim of finding innovative solutions to issues concerning the industrial economy and society in general.

By developing technological innovations and novel systems solutions for their customers, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. Through their work, they aim to promote the successful economic development of our industrial society, with particular regard for social welfare and environmental compatibility.

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop the professional and personal skills that will allow them to take up positions of responsibility within their institute, in other scientific domains, in industry and in society.

At present, the Fraunhofer-Gesellschaft maintains some 80 research units, including 58 Fraunhofer Institutes, at over 40 different locations in Germany. The majority of the roughly 12,500 staff are qualified scientists and engineers, who work with an annual research budget of over 1 billion euros. Of this sum, more than €900 million is generated through contract research. Roughly two thirds of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and

from publicly financed research projects. The remaining one third is contributed by the German federal and Länder governments, partly as a means of enabling the institutes to pursue more fundamental research in areas that are likely to become relevant to industry and society in five or ten years' time.

Affiliated research centers and representative offices in Europe, the USA and Asia provide contact with the regions of greatest importance to present and future scientific progress and economic development.

The Fraunhofer-Gesellschaft was founded in 1949 and is a recognized non-profit organization. Its members include well-known companies and private patrons who help to shape the Fraunhofer-Gesellschaft's research policy and strategic development.

The organization takes its name from Joseph von Fraunhofer (1787-1826), the illustrious Munich researcher, inventor and entrepreneur.

Fields of Research

The Fraunhofer-Gesellschaft concentrates its research on these fields:

- Materials Science, Component Behavior
- Industrial Engineering, Manufacturing Technology
- Information and Communications Technology
- Microelectronics, Microsystems Engineering
- Sensor Systems, Test Engineering
- Process Engineering
- Power and Civil Engineering
- Environmental and Health Research
- Technical-Economic Studies, Information Brokering

The Target Groups

The Fraunhofer-Gesellschaft considers itself responsible not only toward the individual companies it serves and industry in general but also toward society as a whole. The target groups and hence the beneficiaries of the Fraunhofer-Gesellschaft's research work are:

Industry
Small, medium-sized and large industrial firms and service companies can all profit from contract research. The Fraunhofer-Gesellschaft develops ready-to-implement technical and organizational solutions and helps to spread the use of new technologies. For small and medium-sized enterprises unable to afford maintaining their own R&D departments, the Fraunhofer-Gesellschaft represents an important source of innovative know-how.

Government and Society
The Fraunhofer-Gesellschaft carries out strategic research projects for the Federal Government and the states. They help promote advanced and key technologies or innovations in fields of particular public interest such as environmental protection, energy production and healthcare. The Fraunhofer-Gesellschaft participates in corresponding European Union technology programs.

Services

The Fraunhofer-Gesellschaft develops products and processes right up to commercial maturity. Individual solutions are sought in direct contact with the customer.

The Benefits of Contract Research

Extensive internal collaboration ensures that the customer can call on the specialized expertise of all of the Fraunhofer institutes when required. Common quality standards and a professional approach to project management guarantee reliable results. The highly advanced equipment available in its laboratories makes the Fraunhofer-Gesellschaft an attractive partner for companies of all sizes and in all branches of industry. As well as the reliability of a strongly cohesive research network, collaboration also brings economic benefits. The Fraunhofer-Gesellschaft's contribution to the partnership includes valuable knowledge acquired through cost-intensive preliminary research.

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Published by

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We thank the employees of the Fraunhofer IFF and
our project partners for releasing their publications.

Translation

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Structure/layout/composition

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IFB Innovation, Forschung und Beratung AG