

TOMORROW TODAY

Developing the technologies, methods and tools of tomorrow



Uwe von Ahsen
Senior Expert Advisor at the
AIT Health & Environment
Department

→ HEALTH & ENVIRONMENT

SENSOR SOLUTIONS FOR TOMORROW'S MEDICINE

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AIT's intelligent sensor systems are providing valuable support in the prevention, diagnosis and treatment of diseases.

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OPEN SYSTEM RISK – NEGLECTED SECURITY CONCERNS

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The global web and the abundance of open systems greatly facilitate communication, but they provide data thieves with countless targets for attacks. AIT develops smart and responsive safety & security procedures.

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THE NEW LIGHTNESS IN VEHICLE CONSTRUCTION

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In the Austrian town of Ranshofen innovative components for the vehicle concepts of tomorrow are created from aluminum and magnesium by means of novel alloys, processes and design approaches.

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Within innovation systems, networks are coming to be increasingly recognized as an effective form of organization. AIT has longstanding experience in applying highly developed methods for analyzing complex structures of this kind.

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THE NEW INTELLIGENT ENERGY OF SMART CITIES

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The migration to cities is gathering pace at an enormous rate, with all its advantages and disadvantages. However, for the most pressing challenges in the field of energy and environment, AIT already offers the suitable research approaches.

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URBAN EUROPE

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The competition among locations to attract the best minds will be won with the right concept for the "city of the future". Urban Europe is an initiative with the objective of ensuring that this concept comes from Europe. Austria has been involved in developing this concept through AIT.

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ALL-TIME HIGH FOR THE AIT ORDER BOOKS

/// While the domestic economy was still ailing last year in the aftermath of the financial crisis, the AIT Austrian Institute of Technology is bucking the trend. At the balance sheet press conference held recently at TechGate Vienna, Austria's largest non-academic research institute not only presented a robust set of positive figures but showed a dynamic growth curve. ///



Photo (from left to right): Wolfgang Knoll (AIT Managing Director), Hannes Androsch (AIT President of the Supervisory Board), Anton Plimon (AIT Managing Director) und Alexander Svejkovsky (AIT CFO)

PHOTO: AIT Austrian Institute of Technology/APA-Fotoservice/Preiss

FOLLOWING THE REALIGNMENT WHICH DOMINATED 2009, last year the AIT Austrian Institute of Technology was able to concentrate fully on implementing the defined strategy. And with resounding success, as demonstrated by the latest figures, which were presented at the balance sheet press conference by the AIT Management Board and President of the Supervisory Board Hannes Androsch at TechGate Vienna.

AIT Managing Director Anton Plimon: "In 2010 for the third time in succession we made profits on ordinary activities, posting a figure of EUR 3.5 million. This was achieved partly by the reduction in central administration costs, which have fallen by 16%, i.e. EUR 1.8 million, since 2007. At the same time, research contracts last year worth EUR 122 million were up by EUR 15 million on the previous year. So

our strategy is clearly bearing fruit. There has been a marked increase in particular in major strategic projects. With profits on ordinary activities of over EUR 3.5 million, AIT has produced a stable and satisfactory operating result. For the current year we also expect profits on ordinary activities of some EUR 2.5 million despite reinvestments of some EUR 1.5 million in strategic research projects.

Full order books

"We have every reason for optimism," continued Anton Plimon, "thanks to the confidence in AIT shown by our customers from industry and public sector clients, which is reflected in an all-time high of work in progress and existing projects.

This was made possible by our positioning at the interface between science and industry. The grand challenges of Energy, Mobility, Safety & Security, Health & Environment and Foresight & Policy Development, clustered into five eponymous departments, thus mirror precisely those fields in which answers will be sought to the current challenges confronting both Austria and Europe. Says Anton Plimon, "With our focus on eleven research topics in five Departments we achieve the critical mass necessary to produce excellent results."

AIT BECOMES AN INDISPENSABLE PARTNER

AIT Managing Director Wolfgang Knoll: "It is networking with international research bodies, technology platforms and universities from many different countries that ensures that in these select research fields AIT has become an indispensable partner. As a member of the European Energy Research Alliance (EERA), AIT is one of 14 leading institutes that together have taken up the challenge of developing new energy technologies, with the aim of successfully combating climate change and putting Europe's energy supplies on a sound footing in future. In the Sim Tech Laboratory AIT has established a new research infrastructure for smart grids to link decentralized renewable energy sources and distributed energy storage systems into active distribution grids. And as a follow-up to the Expo in Shanghai last year we are working with Nanchang, a city of five million inhabitants in China, on developing a low-carbon city. AIT is acting as the portal in this exercise for Austrian companies in the planning and consultancy market."

MEETING THE CHALLENGES OF TOMORROW

Finding solutions to the grand challenges frequently means devising entirely new concepts and technologies. AIT is currently working, for example, on the development and implementation of e-Health applications to enhance efficiency and optimize costs in the health care system. One of the objectives here is to narrow the gap between patients, doctors and carers.

Emerging technologies often demand new tools in order to develop innovative solutions. For example, the trend towards electromobility requires a new approach to the development cycle of vehicles. An integrated simulation and hardware-in-the-loop test environment for the design and development of the entire powertrain, including individual components such as the battery or electric motor, provides the basis for developing optimum components and vehicle concepts. The simulation-based approach thus is a cutting-edge policy for industry to convert emerging technologies into innovative solutions with a reduced time-to-market.

COMPETITION FOR THE BEST MINDS

In any case, the stated objective of AIT in all its research activities is to create the basic innovations in infrastructure-related technologies for the next generation. This will be achieved mainly by active networking with the best minds in the world. Hannes Androsch, President of AIT's Supervisory Board, comments: "AIT is keen to bring globally recognized experts on board and it cooperates in many different fields with the best in the world. Only those in the first or second rank can aim for global excellence. That's why the strategy of focusing on clear research objectives is proving effective. At the same time AIT has succeeded as a business in putting itself on a sound financial footing. AIT is not a corporation with shareholders expecting dividends of six, seven or more per cent; it reinvests its profits in new research, with the aim of creating even bigger advantages for its clients' competitive edge. AIT is also an important factor in reinforcing Austria's position as an economic powerhouse!" ///

THE FIVE DEPARTMENTS OF AIT ARE



ENERGY

The AIT Energy Department takes a holistic approach to secure environmentally friendly electric power, heating and air conditioning for the buildings and cities of tomorrow. Using high-quality measurement engineering and innovative simulation tools our interdisciplinary research teams link decentralized generators, efficient distribution grids and smart buildings with efficient heating and ventilating technologies in a sustainable energy system.

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MOBILITY

The AIT Mobility Department covers those research areas necessary for an all-round approach to the mobility system. They range from improvement of the transport infrastructure in terms of increased safety and cost-efficiency, through optimization of co-modal transport systems encompassing every form of transport, to the development of integrated vehicle concepts with the two key technologies of electric drive systems and lightweight construction.

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SAFETY & SECURITY

The AIT Safety & Security Department makes a significant contribution to ICT, committed mainly to achieving the operational efficiency and reliability of critical infrastructures. Its internationally recognized core competences range from development and testing processes through image processing systems to the latest generation of IT systems, with the objective of meeting the major challenges for our society: health care systems, digital data streams and safety and security in our connected society.

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HEALTH & ENVIRONMENT

The AIT Health & Environment Department focuses its research activity on health and environmental issues, seeking solutions to the challenges arising from the depletion of environmental resources and demographic change through to an aging society - for example by developing new molecular sensor systems.

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FORESIGHT & POLICY DEVELOPMENT

The AIT Foresight & Policy Development Department researches innovation and sustainability issues associated with the major challenges of the future, including finite resources, climate change, the increasing complexity of social and natural systems and globalization. The Department thus fulfils the functions of a valuable think-tank for Austrian and European policy-makers.

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SENSOR SOLUTIONS FOR TOMORROW'S MEDICINE

/// Intelligent sensor systems are providing valuable support in the prevention, diagnosis and treatment of diseases. In this field, researchers at AIT are applying biomathematical models, self-learning algorithms and nanotechnological sensor systems. ///



CARDIOVASCULAR DISEASES are responsible for more than 40% of all deaths and are thus among the leading causes of death in Europe. Blood pressure measurement is an important aid in early diagnosis and targeted treatment. Conventional measurement devices register blood pressure and pulse only at the upper arm. Yet, for an optimum medical prognosis, measuring blood pressure in the immediate vicinity of the heart would be critical, as Manfred Bammer, an expert in medical technology, explains: "This pressure level affects vital organs such as the heart, liver and kidneys immediately, and can vary appreciably from the pressure measured at the upper arm."

CENTRAL BLOOD PRESSURE

Up to now blood pressure at the heart could only be determined using pulse wave analysis, a costly and invasive process. Using biomathematical models, researchers at AIT have succeeded in deriving this value mathematically from blood pressure readings taken using conventional methods – pulse wave analysis in this case takes a mere 90 seconds. "This enables us to quickly obtain meaningful central blood pressure data along with the individual parameters underlying this value," Bammer explains. Specifically, in addition to systolic and diastolic pressure and pulse rate, factors such as arterial stiffness, stroke volume, vascular volume and peripheral resistance are important in order for doctors to effectively administer medication.

● IN A NUTSHELL

As our society ages, physical conditions such as cardiovascular diseases, cancer and Alzheimer's disease are also on the rise, leading to an increase in the costs of medical care. The experts at the AIT Health & Environment Department are developing intelligent sensor technologies and solutions to aid medical practitioners in the prevention, diagnosis and treatment of such diseases. Research topics range from biomathematical models for interpreting biosignals and complex algorithms used in analyzing behavior patterns to highly advanced nanosensors to enable rapid diagnosis. Attention is focused on portable, intelligent solutions that deliver results quickly and cost-efficiently, thus reducing the pressure on the health care system.

SUCCESSFUL MARKET LAUNCH

The new method also offers the option of obtaining a 24-hour blood pressure profile. This is done using the Mobil-O-Graph®NG, which was developed jointly with AIT's industrial partner I.E.M. and has been successfully marketed for a year now. In a

**MANFRED BAMMER ///
Head of Biomedical
Systems Business Unit**

“With the technology developed by us pulse wave analysis takes a mere 90 seconds and nevertheless provides meaningful data on central blood pressure.”



further stage, experts are working on a solution for correlating pulse wave analysis with ECG signals in order to derive additional information. “The initial results from our new CardioCube research platform are very promising,” Bammer notes, and he is confident that the method will lead to enhanced knowledge useful in the diagnosis of cardiovascular diseases.

ASSISTANCE WITHOUT BIG BROTHER WATCHING

Many elderly people wish to continue living in their homes as long as possible. Ambient Assisted Living (AAL) is dedicated to integrating intelligent technologies in the living environment in order to help residents meet their daily needs in a way that considers their individual situation and provides unobtrusive assistance. Work at AIT in this area is focused on identifying and analyzing patterns of behavior based on sensor data, with the aim of enhancing the convenience and safety of living environments and providing support in treatment and diagnosis. To protect privacy, no use is made of microphones or cameras. Instead, the researchers at AIT rely on devices such as intelligent infrared sensors that, with the aid of complex algorithms, derive and analyze behavior patterns.

BEHAVIOR PATTERN ANALYSIS IN THE MODEL HOME

AAL solutions can provide valuable assistance, for example, when an elderly person living alone takes unusually long in the bathroom or fails to keep an appointment outside of the home. In such events, depending on the scenario, either relatives, neighbors or a mobile nursing or emergency medical service could be notified as required via text message or by phone. In the diagnosis and treatment of Alzheimer’s disease and other neurodegenerative disorders, any change in typical behavior patterns is also an important clue for doctors. At Vösendorf near Vienna, in cooperation with the pre-

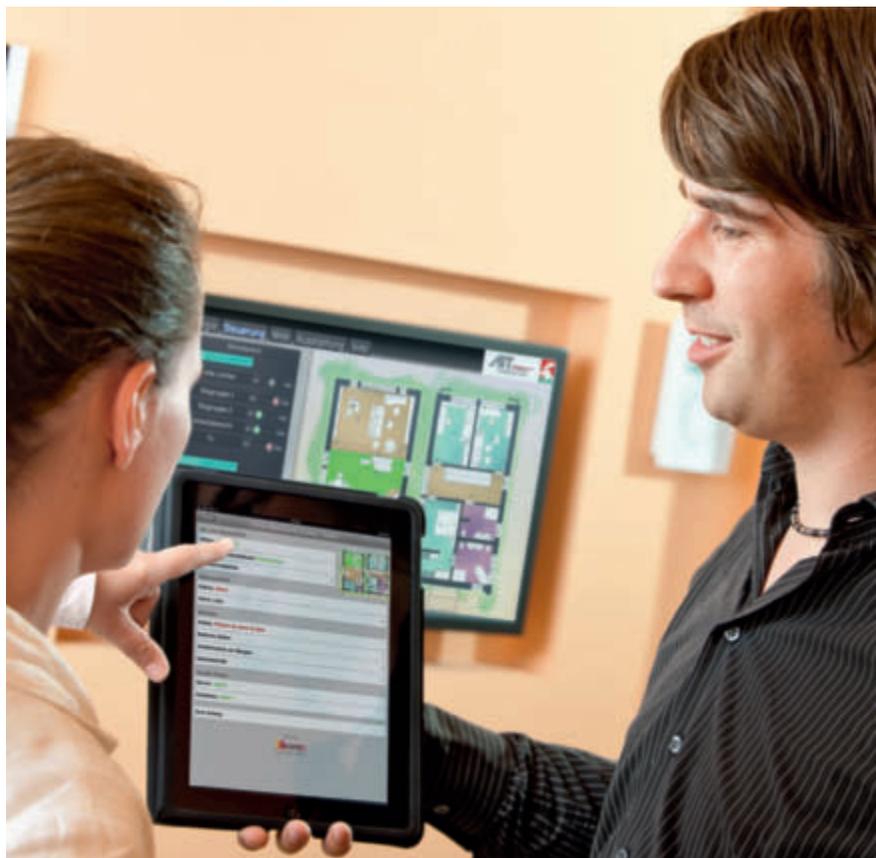
fabricated home builder Elk, a model home known as NovaHome has been furnished with more than 100 sensors in order to test the AAL systems of the future in practice.

“With AAL, usability is a particularly important consideration,” Bammer notes, adding, “After all, the smartest technologies are worthless if users fail to take advantage of them.” To help the elderly overcome any inhibitions in the face of technical systems, the experts employ photorealistic avatars or novel contact-free transmission technologies such as near field communication (NFC) and similar systems that support intuitive, interactive operation.

PLUG AND PLAY FOR SMART HOMES

At the foundation of every AAL application is the middleware, an operating system platform for smart homes that supports interfaces for a wide range of components and services. The researchers have set the goal of standardizing sensor interfaces and service technologies to such an extent that plug and play AAL solutions become viable. With the HOME Event Recognition (HOMER) system, the experts at AIT have already developed such an open platform. They are now working with partners in industry and research on a European platform standard for the smart homes and AAL services of tomorrow as part of universAAL, a large-scale EU project.

With the technology developed by us pulse wave analysis takes a mere 90 seconds and nevertheless provides meaningful data on central blood pressure.



NANO-SCALE SEPSIS DETECTION

Researchers at AIT are taking advantage of the features offered by the nanoworld in order to develop tiny, sensitive and cost-efficient sensor systems for early detection and prevention of illness. At the focus of these efforts are highly miniaturized gas sensors and biomedical "nanolabs" that facilitate fast diagnosis. "This can be a lifesaver particularly in the presence of sepsis," nanoscientist Hubert Brückl explains. "If blood poisoning is suspected, the pathogens need to be detected in the blood as swiftly as possible, but currently this takes up to two days." In cooperation with Magna Diagnostics of Germany, the Fraunhofer Institute and other partner institutions, a compact device is being engineered that allows immediate sepsis detection directly at the patient's bed, the doctor's office or in an ambulance.



THE POWER OF ATTRACTION

In this case, experts are utilizing magnetic nanoparticles embedded in tiny polymer beads. Biomarkers attached to the surface of such magnet beads bond with specific DNA sequences of frequent pathogens in the blood sample. They are drawn by a magnetic coil to the sensor unit, where the integrated nanoparticles generate a magnetic signal which provides the physician with a direct reading of the number of bonded DNA sequences. As Brückl observes, "The major challenge is to develop sensors that are highly sensitive and specific in order to swiftly and reliably detect individual nanoscale particles." The individual modules are currently being integrated in a prototype, with the clinical evaluation phase for the sepsis test in credit card format slated to begin in 2013. The findings gathered

through these efforts will also provide the groundwork for developing a diagnosis platform for cancer that is similarly based on magnetic detection.

HUBERT BRÜCKL /// Head of Nano Systems Business Unit

"The challenge is to develop sensors that are highly sensitive in order to reliably detect individual nano-scale particles."



THERE'S SOMETHING IN THE AIR ...

Miniaturization additionally offers completely novel options in the field of gas sensor technology. "Sensors currently have the great disadvantage of being an average of one square centimeter in diameter – which is relatively bulky, at least for our purposes," nanoscientist Brückl observes. In joint efforts with partners from industry such as austriamicrosystems and Siemens, researchers at AIT are looking into heterogeneous integration as a way of "marrying" nanotechnology and microelectronics. The union has resulted in sensors a mere half millimeter in size, which includes the electronic analysis system, enabling completely novel portable services for use in health care and environmental medicine. "One could imagine, for example, an ozone sensor built into a wristwatch that notifies runners of elevated ozone levels in the air or streams data continuously via mobile phone to enable ozone mapping for an entire area," Brückl points out as potential applications.

NANO GAS SENSORS TO SNIFF OUT CANCER

Breath diagnostics is a very hot topic in medical circles these days. Scientists have already succeeded in detecting cancer by analyzing patients' exhaled breath and even distinguishing different types of cancer. The tests are based on the principle of detecting a variety of volatile organic compounds, which is nowadays still done at specialized laboratories using mass spectrometry. Particularly in breath diagnostics, full advantage could be taken of the features offered by nanosensors. "Due to their large surface area, they are highly sensitive and could be explicitly equipped with molecules that react to very specific organic components," Brückl postulates, convinced that smart sensor solutions from the nanoworld will play a key role in future medicine. ///

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RESEARCH SERVICES

Early risk detection of cardiovascular diseases

Early risk detection of cardiovascular diseases requires a combination of intelligent sensor systems and advanced biomathematical models for processing biosignals. This comprehensive approach to measurement methodology enables the development of innovative diagnostic solutions that provide AIT's industrial partners with key advantages in competing at the global level.

- Identification and study of new cardiovascular risk parameters
- Developing sensor/actor systems for detecting biosignals
- Developing biomathematical models for analyzing biosignals
- Novel methods in diagnostics and certified hardware applications for clinical research and extramural medical care

AAL technologies

Demographic changes are giving rise to a growing need for assistance systems that allow elderly people to continue to live safely and independently in their own homes. The smart solutions developed at AIT aim to enhance the level of convenience and safety experienced by residents as well as to support doctors in the prevention, diagnosis and treatment of conditions. Activities in this field focus on three main areas:

- Behavior pattern recognition: developing self-learning algorithms and models for detecting and analyzing patterns of activity in daily living based on information provided by sensor systems integrated in the living environment
- Middleware: designing standardized middleware platforms for the integration of a wide variety of sensors, components and services, including active contributions towards defining international AAL standards
- User interfaces: developing innovative intuitive approaches to user interaction

Nanosensor systems for medical diagnostics and treatment

Heterogeneous integration of nano- (bio-) technology and microelectronics is providing a basis for advances in medical diagnostics. The goal is to develop sensors with a superior level of sensitivity and specificity as well as miniaturization, which will subsequently enable the production of reasonably priced portable devices. In these efforts, the Center of Thin Film Technology (CTFT) at AIT provides a highly advanced laboratory infrastructure for chemical and electronic research. Projects are focused on magnetic diagnostic systems and gas sensor systems.

- Sensor development: production and optimization of demonstrators, supported by computer-assisted simulation
- System integration: sensor systems in combination with functional coatings, surface patterning, customized micro- and nanofluidics and embedding in readers and analyzers
- Testing and validation: testing of demonstrators for specific biomedical applications at AIT or, jointly with partner institutions, in external settings, e.g. at clinics ///



PROF. MAXIMILIAN FLEISCHER, RESPONSIBLE FOR RESEARCH AT SIEMENS AG, DISCUSSES THE APPLICATION AREAS OF SENSORS WITHIN HEALTH CARE.

Professor Fleischer, how do you envision the health care system of the future, and what role could intelligent sensor systems play?

The health care system of the future will need to meet major challenges. Demographic change is a megatrend: for example, the proportion of the global population over 65 is expected to double by 2030, with life expectancy increasing sharply. To respond to these challenges in a cost-efficient way, we need to place a stronger focus on continuous health monitoring and early detection of incipient illness. The potential provided by novel sensors will play a key role in this context – both in accompanying individuals on a day-to-day basis and during visits to the doctor's office.

AIT is developing jointly with Siemens heterogeneous sensors that combine microelectronic systems with nanotechnology. What role do you see these developments playing in the global market in the next few years?

A big one. Integrating microelectronic signal processing with the superior detection capabilities offered by nanotechnology will open up a whole new dimension in terms of sensor capability and miniaturization. Sensors of this kind will prevail in the global market, because they are inexpensive to manufacture and because their compact size supports use in a wide variety of applications.

Nanosensors are fast and sensitive, which in breath diagnostics makes them a promising alternative to mass spectrometry. For what areas of medicine is continued development of this technology particularly significant?

It is a known fact that breath composition provides a range of information about an individual's state of health. And we will need to increasingly utilize this potential for non-invasive health monitoring. This requires the development of cost-effective and powerful sensors using nanotechnology. These could then be used at doctors' offices, for example to be able to detect and diagnose illnesses at an early stage. Examples of use being discussed include early diagnosis of lung cancer, testing for pneumonia, sinusitis or even tuberculosis as well as timely recognition of a variety of metabolic disorders. Once inexpensive devices employing such nanosensors are developed which patients can take home with them, it will be possible to significantly improve treatment of illnesses such as asthma. Such sensors will also benefit healthy individuals in the future, for example in measuring a person's exhaled breath to determine whether they are exercising in the fat-burning zone or are overdoing it. ///

OPEN SYSTEM RISK – NEGLECTED SECURITY CONCERNS

/// The global web and the abundance of open systems greatly facilitate communication. Yet, interfaces and complex networks provide data thieves and cyber criminals with countless targets for attacks. The IT Security team at AIT is

developing procedures for avoiding security gaps early on during software development. ///

“STILL TODAY, MANY COMPANIES PAY TOO LITTLE ATTENTION TO THE SECURITY OF THEIR SYSTEMS,” Thomas Bleier, Head of the IT Security Research Service within the Safety & Security Department at AIT, points out. With no dearth of headlines about hacker attacks in recent years, even major corporations such as Sony, Sega or the Austrian Broadcasting Corporation have fallen prey recently. In these cases, cyber criminals were able to steal millions of customer data records with relative ease.

ease.

Yet the recent cases involving the jet fighter manufacturer Lockheed and RSA, a corporation specialized in security solutions, demonstrate that even enterprises with highly protected systems are not entirely beyond the reach of cyber attackers. Behind some such hack attacks, which require a great deal of effort, are enemy intelligence agencies. US-based Lockheed Martin got off once again with only a slap on the wrist, as the intruders purportedly did not compromise the system enough to get at critical data. Encryption specialist RSA, in contrast, now has to replace some 40 million SecurID tokens as a consequence of the cyber attack. Such examples demonstrate that even highly secure systems can



● IN A NUTSHELL

Internet use is rapidly becoming ever more prevalent. Even control systems and machinery at factories are increasingly being linked via the internet. Smart grids will play a greater role in the future energy sector. However, this level of interconnectivity and these interfaces represent new sources of vulnerability for potential abuse. The experts at AIT are consequently relying on model-based technologies and similar systems that enable security to be integrated easily and using automated procedures, already during software development. A related initiative is MoSeS4eGov, an Austrian project with the goal of rendering the development of e-Government applications easier and more secure. The AIT Safety & Security Department focuses particularly on developing systems for the protection of critical infrastructures, such as control systems used in the energy and transport sectors. In this regard, the EU project PRECYSE will be launched this fall.

be cracked. “Unfortunately, there is no such thing as absolute security, but a high level of security discourages potential attackers from putting forth the effort, so that they look instead for other, easier victims,” Bleier says.

REMEDYING OLD WEAKNESSES

One of the main problems with the global web and with many applications is that they are based on technology dating back to a period when the term “cyber crime” did not even exist.

Yet, the fact that many companies do not even have simple security barriers in place is a cause for concern. “Although there is in the meantime a wealth of methods and recommendations for making programs and systems more secure, the same mistakes still happen time and again,” the AIT security expert observes. There are many reasons for this. One is that up to now future IT experts have been confronted too little with the issue of security during training. And the common notion of “that won’t happen to us” does not necessarily encourage security-mindedness.

“We are especially interested in the question of how to devise technical solutions that prevent security issues from arising in the first place,” Bleier says. In this context, the IT Security team at AIT focuses primarily on the underlying question: “Why is software often so vulnerable to attacks?”

A MODEL FOR ENHANCED SECURITY

“Highly secure systems can be developed in labs,” Bleier notes, adding, “But the real issue is how to devise security that works in practice as well.” This requires that security implementation become easier for users to apply and understand. One way that the experts at AIT achieve this is through model-based technologies. This method involves first defining the security requirements at an abstract level before then implementing them with the assistance of software. Not only does this facilitate the entire development process, it also reduces the risk of error.

“To achieve a high security standard, we don’t necessarily need to develop entirely new methods,” Bleier explains. After all, many solutions for improving system security already exist. Problems only exist with properly implementing the required processes and procedures.

THOMAS BLEIER /// IT Security expert of the Safety & Security Department

“Unfortunately, there is no such thing as absolute security, but a high level of security discourages potential attackers from putting forth the effort, so that they look instead for other, easier victims.”



Model-based technology offers the great advantage of allowing existing, tested sub-components to be reused. Every newly developed and implemented component entails the risk of inadvertently introducing errors into the overall system, which provides hackers with new targets for attack.

SECURE AND EFFICIENT E-GOVERNMENT

The experts at AIT are developing such model-based technologies as part of projects such as KIRAS, an Austrian security research program funded by the Ministry for Transport, Innovation and Technology (BMVIT). The aim of the Model-based Security System for e-Government (MoSeS4eGov) project is to enable new applications to be created to the greatest possible extent using automation, while still meeting with the required security standard. This facilitates further enhancement of the security of infrastructure serving e-Government applications.

A large number of information and communication services as well as services for the electronic processing of submitted documents are available to the public, to businesses and to the authorities today. Christian Wagner and Zhendong Ma, IT Security experts at AIT, have the goal not only of enhancing the security of applications running in the government network. A positive “side effect” of the new system is to eliminate a large number of the manual tasks required for implementation and adaptation, in this way reducing maintenance costs.

To vividly demonstrate the potential offered by model-based technologies, a pilot application was developed for use in disaster relief. One aspect that is important for those coordinating disaster operations is to have access in emergencies to the data stored in the residence registry and building registry databases. “If, for instance, there is flooding on the Danube in a certain region, the head of operations



has immediate access to data such as the number of children and elderly individuals living in a certain area or whether there is a chemical plant or similar facility in the vicinity," Bleier explains.

PROTECTING CRITICAL INFRASTRUCTURES

Another focus of the work carried out by the IT Security team at AIT is the IT systems servicing critical infrastructures such as the control centers of energy providers and transport enterprises. In the past, such systems were usually very isolated. With the introduction of new business models and technologies, increasing accessibility is required.

"We are studying in particular the new requirements that are arising in the energy sector, for example, as a result of smart grids and smart metering," Bleier says. IT Security collaborates with the AIT Energy Department in this respect. Intelligent metering devices and power grids enable tremendous energy savings through improved load control and optimized scheduling of electrical appliances such as refrigerators and washing machines. Yet, such systems require information flows and interconnectivity, which represent new sources of vulnerability.

Within the energy and automation sectors, IT security has not traditionally been at the top of the priority list. Nowadays though, the internet has found its way into building systems and manufacturing plants. And machinery control systems have also become the target of hacker attacks. "It is difficult to retrofit such systems with security features," Bleier points out. "Yet that task is unavoidable." When a web shop crashes, it is annoying and irritates a few customers. When the energy control system at a chemical plant crashes, however, there can be dramatic consequences. A new three-year, Europe-wide project is consequently being launched at AIT this fall with the title "Prevention, Protection and Reaction to Cyber Attacks to Critical Infrastructures" (PRECYSE). The focus will be on Supervisory Control and Data Acquisition (or SCADA) systems within critical infrastructures which are responsible for monitoring and controlling machinery and technical processes. In order to improve processes and create secure control loops for such systems, the first stage will involve a kind of benchmarking for the purpose of validating the systems against existing standards and requirements. These findings are then to serve as the basis for a system evaluation method that, for example, will allow existing control systems to be improved.

EASY SATELLITE IMAGE ACCESS

Another project being carried out by the IT Security team at AIT goes far beyond the earth's horizon. In a joint project with the European Space Agency (ESA), a simple, low-cost but nonetheless secure access system is being developed for satellite image data. The standardized protocols for the system are being developed by AIT expert Arndt Bonitz. Instead of creating a huge user database, which would require additional management overhead, users are able to log in simply by entering their user access information for an Austrian university account, for example. Sometimes simple and inexpensive methods are all that is needed to achieve markedly enhanced security. ///

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RESEARCH SERVICES

IT-Security

Distributed ICT systems are everywhere today, and these systems are getting ever more complex. In the future, conventional methods will no longer be able to ensure security in these systems – but only if security is ensured can the advantages of complex ICT systems be utilized.

The IT Security research service is consequently working on new approaches and technologies to be able to implement security aspects efficiently in the IT systems of the future. In addition to a unified approach to IT security topics at all levels, the experts in this area focus particularly on security in service-oriented architectures. An example of this is the use of modern software development approaches such as Model-Driven Architecture (MDA) in order to enhance efficiency in implementing security goals as well as overall system security.

Contract research and innovations are offered in the following fields of expertise:

- Technology consulting
- Development of security solutions

Technology consulting

In its research projects the team develops expertise in and evaluates the most advanced technologies for IT security in a variety of application areas. Objective advice can thus be presented to customers concerning the use of security technologies, allowing the best suited technology for the specific application case to be determined. The service is offered independently of any manufacturer, ensuring that the focus stays on the capabilities of the technology and its usability for the given scenario.

Development of security solutions

If no suitable technology is available for an application case, appropriate solutions are developed at the request of customers. In doing so, it is ensured that the solutions are designed in consultation with the customer and are based on existing products and standards, to the end of identifying the optimum solution – not only from a technical but also from an economical perspective. Thanks to continued networking with individuals from science, industry and standardization bodies, developing customer applications that turn out to be one-way streets is avoided at all times, but instead customers are provided with solid solutions that employ suitable technologies. ///



BERTHOLD HABERLER, OF INNOVATION MANAGEMENT/TELECOMMUNICATIONS TECHNOLOGY AT LINZ STROM GMBH, THE POWER SUPPLY SUBSIDIARY OF LINZ AG, TALKS ABOUT THE NEW CHALLENGES FACING POWER SUPPLIERS AND THE PROTECTION REQUIRED AGAINST CYBER ATTACKS.

Mr. Haberler, LINZ STROM GmbH, as part of LINZ AG, is the partner from practice in the new PRECYSE EU project, working jointly with the IT Security research team at the AIT Safety & Security Department.

What motivated you to take part in this project?

IT security for critical infrastructures is an issue that fits very well with the strategy at LINZ STROM GmbH. As part of the project, two critical infrastructures are being specifically investigated, and we are acting as work package leader in this task. The subjects are the public transport system in Valencia, Spain, and the power distribution system in Linz, Austria. In this project we first identify the legacy systems still in use and then we determine the new requirements to be expected. We then define new sets of measures designed to identify and counter cyber attacks, in this way improving IT security for the entire the system. LINZ STROM GmbH has been heavily involved in smart metering and is also participating in the EU project "Energy Efficiency in Social Housing". The issue of smart grids is also of high relevance to us, as is the topic of ICT services in the energy sector. A prerequisite for all these new systems is to put in place an ICT infrastructure that is genuinely secure. When Thomas Bleier of the IT Security team at AIT approached me at an event to talk about the PRECYSE project, it soon became clear that the project was ideally suited to our development plans.

What added value are you expecting for your company?

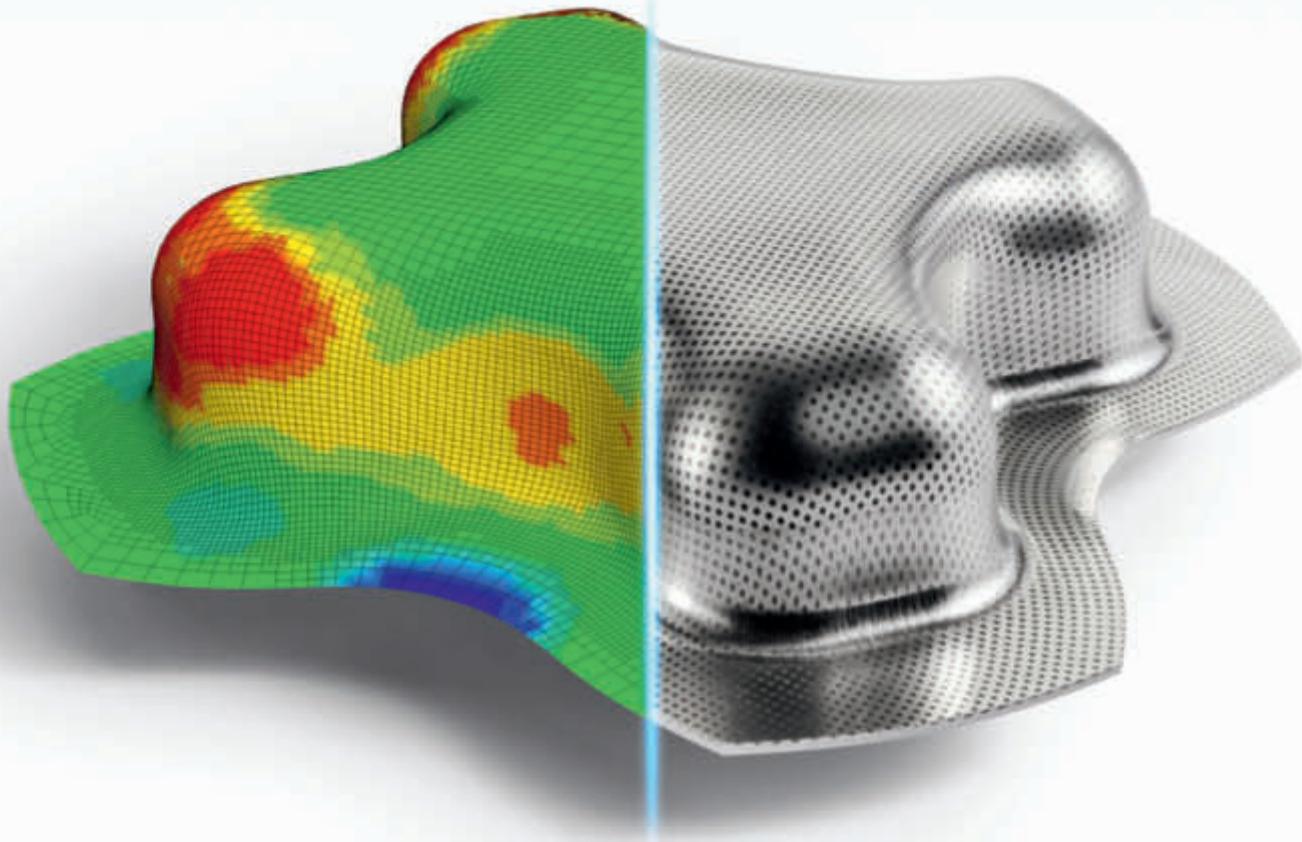
The issue of IT security for critical infrastructures is becoming increasingly important. Systems are becoming more and more interconnected in order to make power distribution systems more intelligent and efficient. We are introducing smart metering and smart grids to be able to offer modern, energy-efficient solutions that meet customer needs. To do this, it is necessary to open up access to systems, which also involves risks. The EU project helps us specifically in this area, so that we can find ways of adapting the security of our infrastructure to meet the new requirements and of extensively improving it. The first step is to closely analyze the reliability of our IT infrastructure in order to then systematically identify potential weaknesses. A methodology has been defined in detail so as not to overlook any item. Appropriate protection measures are then developed on the basis of these insights. Another item is timely detection of attacks. The question here is: when is a system in a normal and when is it in an abnormal state?

What part do the developments by the AIT experts play in this question?

LINZ STROM GmbH is an organization strongly focused on operational tasks. We have few resources for getting involved in research and development. We are therefore hopeful that our partners will identify new aspects and contribute new ideas. Collaborating with experts from other organizations helps us broaden our horizons. One of our aims here is to prepare for issues that might become relevant for us, say in five years. We are hoping that the AIT IT Security team will provide a wealth of input and knowledge transfer. The experience gained in the project will certainly help us in a number of areas to make critical infrastructures more secure. ///

THE NEW LIGHTNESS IN VEHICLE CONSTRUCTION

/// In the town of Ranshofen in Upper Austria, aluminum and magnesium are being used to create innovative components for the vehicle concepts of tomorrow. With novel alloys, processes and design strategies, the AIT light metal experts are laying the groundwork for safe, environmentally compatible forms of mobility. ///



● IN A NUTSHELL

To achieve the goal of substantially reducing the CO₂ emissions caused by road traffic, the vehicles of tomorrow will need to be even lighter and make more efficient use of energy. In this context high expectations are being placed on light metals such as aluminum and magnesium, which enable considerable weight savings. The AIT experts at Ranshofen have the specialized knowledge in light metals necessary for fusing the advantage of light weight with the key requirement for crash safety. The research and development work taking place in this area takes into account each and every aspect of lightweight construction – from the material and the manufacturing process to design. The researchers deploy both numerical simulations as well as experimental methods in order to endow lightweight materials with customized properties, thereby paving the way for new areas of use in vehicle construction.

LIGHTWEIGHT CONSTRUCTION IS REGARDED AS ONE OF THE MOST PROMISING TRENDS,

in the automobile industry – the lighter the vehicle, the lower the fuel consumption – and the less CO₂ emitted as well. A growing number of automobile manufacturers are consequently coming to depend on light metals such as aluminum and magnesium in body and chassis design. “An example is aluminum, which has only a third the density of steel and is thus the material of choice for efficient forms of mobility with low environmental impact,” Christian Chimani, expert for light metals

at the AIT Mobility Department, believes. According to current estimates, the use of aluminum materials in vehicle construction allows weight savings of as much as 40% and a considerable reduction of CO₂ emissions as a result. Aluminum also displays excellent corrosion resistance and can be processed at low temperatures when using any conventional manufacturing method - a factor which greatly reduces the energy costs incurred in processing and recycling.

A LIGHTWEIGHT – THAT WILL TAKE A BEATING

“At Light Metals Technologies Ranshofen, we wish to take full advantage of these features while at the same improving other key material properties that are important in vehicle construction,” Chimani says, outlining the challenge facing research and development. In these efforts, crash safety heads up the priority list: the ideal material must exhibit exceptionally high strength, and yet be deformable enough to absorb as much energy as possible upon impact in an accident. Other target properties include superior thermal stability to allow use at even higher temperatures and improved formability to enable complex shapes to be produced. Finally, new joining technologies need to be developed that allow modern hybrid vehicle constructions consisting of steel, light metals, plastics and fiber composite materials.

AN INTEGRATIVE APPROACH

To find solutions for all of these issues, the center at Ranshofen has a wide range of methods and expertise to draw on – from numerical simulation to laboratory methods for exhaustively characterizing materials and components. “An integrative approach is an absolute must in materials research because the material, the processing and the construction need to be precisely coordinated in order to obtain the required set of properties,” Chimani states. In consequence, when engineering new vehicle components, the entire developmental history of the components needs to be modeled in simulations and verified in experiments – from the microstructure of the material and the casting and forming process to component design.

DEVELOPING ALLOYS IN THE VIRTUAL MELTER

The microstructure of a material is the most important determinant for its mechanical properties

CHRISTIAN CHIMANI /// Managing Director LKR Ranshofen GmbH

„An integrative approach is an absolute must in materials research because the material, the processing and the construction need to be precisely coordinated in order to obtain the required set of properties.“



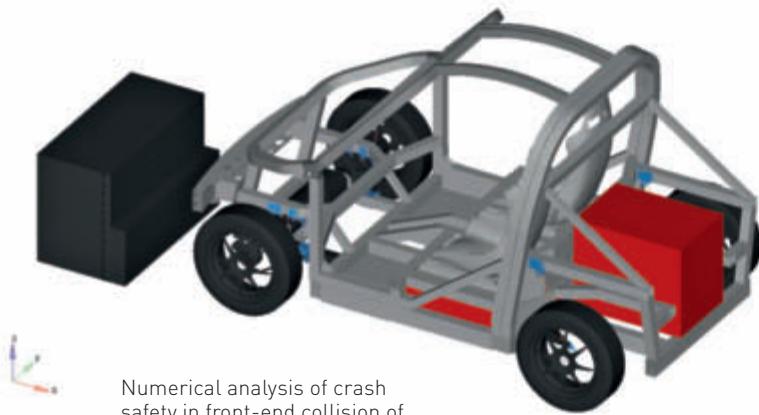
as well as its behavior during processing and in operational use. For this reason, the light metals experts are working on detailed models rendering physical and mathematical descriptions of the inner structure of materials at the micrometer level. In addition to other applications, such detailed material models are used in developing alloys. In this context, the computer serves as a sort of “virtual melter” to predict the effects on properties of combining materials in varying proportions, and to subsequently “compute” the appropriate material mix for new alloys.

CUSTOMIZED PROCESSES

Material models also serve as the basis for simulating the casting and forming processes through which molten metals or sheet metals are transformed into finished components. The wide array of tools used for this purpose range from casting and solidification simulations, supported by thermodynamic models, to finite element computations. “Such numerical methods allow the shape, tensions and any deformation of the material to be monitored in detail over the entire process chain, up to final heat treatment,” Chimani says. The knowledge gained in this way is used to create customized processes in response to the needs of project partners and customers.

OPTIMIZING DESIGN BY THE RULES OF EVOLUTION

Lightweight is primarily about reducing the component weight without compromising its mechanical properties. To make this “diet” work, one of the methods used by researchers is numerical topology optimization. This involves running the component as a computer model through a series of evolutionary cycles: component mass continues to be distributed until the specified values for strength and rigidity are achieved at a minimum of weight. “Our major advantage is to have experts from a wide variety of fields, who are able to trans-



Numerical analysis of crash safety in front-end collision of hybrid electric vehicle



late the theoretical findings obtained through topology optimization into a manufacturing process that is feasible in practice," Chimani points out.

ACID TEST IN THE LAB

Yet the virtual findings need to stand up in the real world. In addition to facilities for performing casting trials and optical measurement engineering, Ranshofen has a superior infrastructure for the metallographic characterization of materials and components. The experimental methods provide an important basis for validating the results obtained from casting, forming and crash simulations as well as for continuously adapting the corresponding models. "Our longstanding working relationship with AMAG Austria Metall AG is particularly important in this context, specifically in the area of high-strength alloys," Chimani notes. "This collaboration provides us with important feedback from practice in the industry."

DOUBLE THE ADDED VALUE

Light Metals Technologies Ranshofen (LKR) contributes its profound expertise to endeavors such as AdvAluE (Advanced Aluminium Applications within ECO Transport), a COMET project in which LKR Ranshofen serves as consortium leader and research partner. This project involves joint efforts with Austrian universities and automotive suppliers and with German auto manufacturers to develop aluminum components and structures that meet the highest standards in crash safety and environmental sustainability. "New cast and wrought alloys as well as novel manufacturing processes and design methods play a major role in this work to improve the energy absorption capacity of safety-relevant components," explains project manager and senior engineer Ziad Khalil

as the goal. The aim in combining light weight and superior crash safety is to generate added value both in economic and ecological terms, paving the way for aluminum to be used in a wider variety of areas within the automotive industry. Construction guidelines, industrial manufacturing processes as well as the first prototypes of the new generation of lightweight components will be on the

ZIAD KHALIL /// Senior Engineer at the AIT Mobility Department

„New cast and wrought alloys as well as novel manufacturing processes and design methods play a major role in our work to improve the energy absorption capacity of safety-relevant components.“



table at the end of the project, which was scheduled for four years.

"The project also meets another important need, that is, for networking," says Khalil in conclusion. The joint efforts with major automobile manufacturers and research partners will provide a significant contribution towards strengthening the position of Austria's automotive suppliers, who are so important for the national economy, in competing at the global level. ///

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RESEARCH SERVICES

Material development

For developing and processing new light metal materials, a comprehensive understanding of the relevant micro-metallurgical aspects as well as their impact on material and component properties is required. At AIT, the most advanced simulation tools are employed to model materials at the micrometer level and, based on these models, to custom-develop new alloys for specific manufacturing processes and specification requirements. These developments are complemented by experimental material and component characterization.

- Alloy development and optimization through simulation, verification in an industry-based environment and characterization
- Optimization of heat treatment parameters with the aid of thermomechanical and thermodynamic models
- Improvement of mechanical and dynamic properties through targeted modification of the micro- and macrostructures
- Alloy microstructure optimization

Process development

To optimally adapt processes to customer needs while utilizing the material's potential, attention needs to be given both to material development and to structural design. AIT has for many years been amassing experience in materials technology, and specifically in the light metals aluminum and magnesium. This experience forms the basis for identifying optimum solutions in response to the process needs of project partners and customers. The focus is on developing and optimizing processes used in casting and forming. For this purpose, numerical process simulation methods are employed, which are accompanied by laboratory experiments and consistently validated in production plants in an industrial setting.

- Development and improvement of casting processes, e.g. die casting, squeeze casting, new rheocasting and composite casting
- Evaluation and optimization of forming technologies, e.g. rolling processes, extrusion processes, sheet forming
- Simulation of process technologies
- Process evaluation and optimization of external production lines
- Validation and prototyping

Material-based design

AIT develops methods for designing light metal components and structures in order to make the vehicles of the future as light, efficient and safe as possible. Using the methods developed in this way, both computer models and prototypes of safety-relevant components and structures can be created for alternative vehicle concepts.

- Design of lightweight structures
- Crash simulations of vehicle components and structures
- Topology and structure optimization towards weight reduction
- Joining technologies for hybrid vehicle constructions consisting of steel, light metals, plastics and fiber composite materials
- Construction of close-to-production prototypes for use in testing, modeling or design testing ///



CARSTEN MELZER, HEAD OF CORPORATE TECHNOLOGY AT AMAG AUSTRIA METALL AG, DISCUSSES THE IMPORTANCE OF LIGHT METALS FOR FUTURE DEVELOPMENTS.

Mr. Melzer, AMAG is Austria's leading manufacturer of aluminum products for use in the processing industry. How do you see the

international importance of light metals, especially in the automobile industry?

The demand for primary aluminum has doubled in the last 15 years. This trend will continue for the next ten to twelve years. Two factors are driving this trend: first, the regional imbalance in demand for aluminum and, second, the growing importance of aluminum in the transport industry, especially in the automobile industry. The main considerations here are vehicle weight, and with it fuel consumption, and CO₂ emissions. The next generation always needs to be lighter than the previous one, with a simultaneous increase in passive safety, in comfort and in the weight of components used in additional assistance systems. Another factor behind the rapidly growing use of aluminum is the increasing popularity of hybrid drive systems: batteries cause a substantial amount of extra weight that needs to be compensated for by lightweight construction. Another important aspect is recycling, and AMAG is in a unique position to respond to this need.

Highly dynamic developments and requirements are typical for the aluminum industry. Where do you see the biggest need for future research?

Referring to automobiles as an example, a composite construction consisting of aluminum, steel and CFRP/GRP will probably become standard. Aluminum has good, reliable forming properties at high and ultra-high strengths, which will be increasingly important. Joining technology will make a major contribution, especially structural adhesion, which requires specific surface qualities and functional coatings. Improved corrosion resistance and corrosion protection systems, in particular for high-strength alloys, are at the top of car manufacturers' wish lists.

To meet these requirements, detailed knowledge of metal science as well as advanced tools for simulating metallurgical and thermomechanical production processes are vital. Without this knowledge and the appropriate tools, too much effort would be required in the laboratory and development progress would be practically inconceivable within an acceptable period of time. The use of recycling materials or scrap metal is another issue receiving a growing amount of attention. We will need to develop semi-finished aluminum products and cast alloys consisting to the greatest possible extent of scrap metal, while offering an array of properties that have been optimally balanced at a superior level, which are, in the optimum case, comparable to materials consisting of primary aluminum.

Your company has been working closely with Light Metals Technologies at AIT for many years. Has this resulted in innovations in recent years?

Working together with AIT and specifically with the Light Metals Technologies Business Unit has made specific contributions towards a profound understanding of the metal science involved in employing aluminum as a material and of the way corresponding manufacturing processes need to be optimized and run. These insights have found their way into a large number of alloys and customized solutions. ///

UNDERSTANDING NETWORKS

/// Within innovation systems, networks are coming to be increasingly recognized as an effective form of organization. The Foresight & Policy Development at AIT has longstanding experience in applying highly developed methods for analyzing complex structures of this kind. ///



WHETHER THE GLOBAL ECONOMY, the infinite data highways interconnecting the World Wide Web or the billions of neurons in the human brain – networks are almost a universal structural form in natural and social systems. Network complexity increases with the number of participants. At the same time, networks do not display strictly deterministic behavior patterns but rather the typical features of self-organization. Consequently, the uneducated

eye often perceives networks as a confusing muddle of mysterious mechanisms. They can, however, be approached through investigations complying with very stringent scientific standards. The “Development and application of methods und tools” research field at AIT has a command of the underlying theory and the methodology for carrying out such studies. The researchers in this field also have longstanding experience in applying methods and tools to provide clients in the public and private sectors with valuable insights into networks. In this way these clients receive important information that allows them to intervene in and shape the development of interconnected innovation systems.

PUTTING VARIOUS QUESTIONS TO NETWORKS

“The importance of network analysis continues to grow,” says Josef Fröhlich, Head of the Foresight & Policy Development Department at AIT. “It allows us to answer a variety of questions related to organizations. It also reveals how organizations are embedded in a regional or international context.” In formal terms, networks can be described as a set of nodes and links. They can then be studied at this abstract level using a variety of methods from mathematics, econometrics, social network analysis and statistics. What the nodes and links in the formal model actually represent depends on the specific purpose or subject of the analysis. Once the network model has been defined, a variety of questions can be put to it. Clients are sometimes primarily interested in the network structure per se. They might, for instance, wish to know how intensively individual participants are interconnected, or whether key organizations with an especially high degree of interconnection exist. Another approach is to look at the way networks are formed, i.e. the processes through which networks emerge. Network performance is also the

● IN A NUTSHELL

Network structures are a typical feature of innovation systems. State-of-the-art methods and tools for network analysis are required in order to better understand the complex relationships among individual network participants. In this way it is possible to visualize patterns of interrelationship and interaction, thereby supporting decision-makers in the public and private sector in making the right choices. Understanding how networks form, as well as the mechanisms governing their working, results in a valuable advantage in competition. This provides a lead in marketing innovations.

subject of great interest, that is, the question of whether cooperative efforts result in any measurable output. To intuitively grasp these issues, the formal models are usually visualized as some sort of network graph. Yet, the methods obviously work on the basis of the precise data underlying the visualization.

UNIQUE DATABASE

A focus of research at AIT is on national and international research networks. The nodes in the underlying models stand for organizations, such as universities, businesses or non-university research institutions. The links represent relationships among these organizations, for instance, jointly conducted projects, patent applications, conferences or publications. "Today, when knowledge is generated and innovations are developed, it is to a large degree the result of interactions among various actors," researcher Thomas Scherngell notes. "That is because technologies are becoming ever more complex and the global demand situation is changing constantly." As innovation is a central factor in successfully competing in the market, policy-makers are called upon to create the necessary preconditions for efficient network structures to emerge.

In the EU this need is met by the Framework Programmes, which since 1984 have been promoting cooperative research projects. AIT is the only European research institution having a database, known as EUPRO, which contains comprehensive, systematic information in a machine-readable format about every one of the approximately 61,000 projects and 60,000 organizations participating in the Framework Programmes, from the First to the current Seventh. Information about the institutions is contained in a great depth of detail, down to the level of individual university institutes. Setting up and maintaining this database has required a lot of time, but it is worth the effort. From the information contained in the databases, valuable insights can be reaped about research activities throughout Europe, even down to the regional level.

"A highly significant question is whether the Framework Programmes have resulted in the emergence of a European Research Area," Scherngell says. "That is the aim of the Programmes, after all." AIT has done a number of investigations into this question on behalf of the Institute for Prospective Technological Studies, a Joint Research Centre of the European Commission. It was thus revealed that about 90% of all or-

ganizations are interconnected, either directly or indirectly (i.e. through intermediate organizations). "That is a typical feature of social networks," AIT expert Barbara Heller-Schuh explains. "Our analysis has also revealed that the degree of interconnectedness grows with each Framework Programme." The number of research assistants in projects is also growing. This fact can be interpreted as a sign of existing cooperation becoming intensified. Another finding is that universities and non-university research institutions play a key role in certain research areas

such as life sciences. In this field, such institutions have succeeded in becoming strong partners for industry. Information and communication technologies (ICTs), in contrast, are dominated rather by businesses. Analyses such as these provide the European Commission with information that is useful for precisely defining future programme priorities in order to achieve the desired effects.

THE EUROPEAN RESEARCH AREA: A MODEL FOR SUCCESS

A recently completed study, carried out as part of a research project funded by the Austrian Science Fund (FWF), also provides evidence that the European Research Area has developed well in certain ways. "We have focused the investigation on effects that can lead to separation and obstruction of knowledge flows," Thomas Scherngell explains. "Such barriers can be of a geographical, technological, cultural or institutional nature." For this type of analysis, the researchers defined a number of indicators for which changes were subsequently studied over the course of several years. By combining several methods from the field of spatial econometrics, it was possible to improve the models and filter out uncertainties. The analysis reveals that the probability of research cooperation decreases as geographical distance increases. The significance of this factor, however, has weakened considerably over the past ten years. "The negative effect of spatial distance is thus decreasing," Scherngell says. "That is an indication of the effectiveness of the Framework Programmes in this regard."

THOMAS SCHERNGELL /// Scientist at the AIT Fore- sight & Policy Development Department

"Generating knowledge and developing innovations is to a large degree the result of interactions among various actors."



WELL-CONNECTED ORGANIZATIONS ARE COVETED

As part of another project, the network experts at AIT investigated how Austrian organizations are participating in the Seventh Framework Programme. Of particular interest was the question as to which of the ten themes of the COOPERATION program Austria focuses on to an above-average extent. This applies to information and communication technologies (ICT), for example. Whereas 35% of all Austrian projects are carried out in this field of research, the average for the remaining

European countries is only 30%. "This is then a case of Austria specializing," Heller-Schuh observes. Another item investigated was the extent to which the Austrian research scene is connected to "backbones", i.e. organizations that keep the overall network stable through their many relationships. The significance of backbone organizations can be visualized graphically by weighting them according to size and successively eliminating them from the dataset. The network subsequently disintegrates rapidly into substructures that are separated from one another and have hardly any connecting relationships. "Such organizations are of particular interest," Josef Fröhlich notes, "Because they represent switching points for knowledge flows." "It is particularly advantageous for companies and research institutions to work with such network participants as a way of quickly obtaining information." Funding organizations and policy-makers are also interested in identifying such

ences, economic sciences, humanities, ICT, safety & security and the environment, Austria has many organizations that participate in a large number of projects and are thus well connected to key actors at the European level. In transport and aerospace, project participation is also high, but the distance to the specialized backbone organizations is far greater in this case. Both of these aspects are comparatively underdeveloped in the research fields of health and biotechnologies. There is a clear relationship between a high degree of network integration and the financial success of organizations. "In successful research areas, a disproportionately large amount of money flows back to organizations through project procurement," Barbara Heller-Schuh states. "This should be further encouraged through targeted funding."

RECOGNIZING STRENGTHS AND BOTTLENECKS

Network analysis is also useful for businesses as a means of gathering insights into their organization. Particularly for companies with more than one location, it is difficult to obtain a well-aimed overview, which can result in a loss of knowledge transfer and communication. The relationships to other market players are also becoming an ever more important factor in business success. "Organizations with a strong network are more easily able to market innovations at an earlier stage," Karl-Heinz Leitner notes. "We use network analyses to evaluate this relationship capital with the aid of indicators." Depending on the specific requirements, the data basis is provided by patent networks, project networks or publication networks. Yet a company's own knowledge management systems can also be an important source of data. Karl-Heinz Leitner has evaluated this type of information for, e.g., Siemens Austria. "The network analysis revealed to us the company's thematic strengths in Austria," Leitner reports. This information helps the management better position the company's locations in Austria within the Siemens group, as well as to build on strengths and work on weaknesses. "We are able to recognize, for example, the people and departments that work well together or the critical bottlenecks in information flow." This enables potential risks to be localized at an early point in time and measures to be taken in response. An example would be where the success of the company depends largely on a few individuals who are at a central location within the network, which could represent a risk in the long run.

BARBARA HELLER-SCHUH /// Scientist at the AIT Foresight & Policy Development Department

"There is a clear relationship between a high degree of network integration and financial success. In successful research areas, a disproportionately large amount of money flows back to organizations through project procurement."



KARL-HEINZ LEITNER /// Senior Scientist at the AIT Foresight & Policy Development Department

"Organizations with a strong network are more easily able to market innovations at an earlier stage."



organizations with a superior degree of network integration. When backbones are approached directly, information is usually disseminated much more quickly throughout the community. Viewing the extent to which Austrian organizations are connected to European backbones reveals a varying picture. In the thematic fields of social sci-

ABSTRACT METHODS – CONCRETE CONCLUSIONS

Complex systems often display network structures: only at first glance does this fact make networks appear difficult to comprehend. In contrast, experts with adequate experience are able to recognize in networks a valuable collection of detailed information that is potentially useful for controlling these systems. “We see time and again how important abstract methods are for defining concrete questions and drawing concrete conclusions,” Josef Fröhlich notes. “With our work, we provide our clients in the private and public sectors with the information they need to make well-informed decisions.” ///

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GÜNTER BURKERT, IN CHARGE OF RESEARCH POLICY AT UNIVERSITIES WITHIN THE AUSTRIAN MINISTRY FOR SCIENCE AND RESEARCH (BMWf), DISCUSSES THE BENEFITS OF NETWORK RESEARCH.

Mr. Burkert, how long have you been working with the AIT Foresight & Policy Development Department? What initially motivated you to draw on the expertise of that research team?

The BMWf has been involved with the team in various projects for a number of years, as the AIT Foresight & Policy Development Department is highly competent in the area of methodology, which can be seen in the theoretical approaches used in the projects.

The joint project “Uni-Netzwerke” (university networks) investigates how the individual universities participate in the EU Framework Programmes. How does fit this into your agenda? Why are such studies important?

The participation of Austrian universities in the European Framework Programmes (FPs) represents an increasingly significant avenue for carrying out and funding scientific research projects. The degree of involvement and the role of Austrian universities in the EU FPs reflect the high quality of university research as well as its interconnection and alignment with international research at universities. These cooperative networks can be viewed as benchmark indicators, but they can also serve as a means of identifying high-level university research as a potential funding target. At the same time, we need to turn the trend in the future, away from procuring as much third-party funding as possible and towards projects that corroborate the distinctive profile of the individual university. We thus need to move from a quantity of quality projects towards a distinctive quality of the individual university.

To what extent do Austria’s universities benefit in general from such EU Framework Programmes? How are the findings of network research utilized? Is there a potential for more profound analyses?

The greatest benefit continues to be knowledge transfer. Austria’s universities, and their partners in industry, benefit from knowledge of the most recent developments and research findings in the individual specialty fields. An image also emerges of how research at Austrian universities is interconnected within the European context, which allows individual universities to build a reputation in a particular geographical zone. The analysis of the participation and the network structure of the 22 public universities in Austria between 1998 and 2010 (during the 5th, 6th and 7th FPs) reveals the topical focuses of Austrian universities, the geographical distribution of their networks as well as changes in cooperation patterns over time. The findings from these studies provide important information for the third round of negotiations for the performance agreements between the BMWf and the Austrian universities. The analysis of Austrian universities’ participation in the EU FPs will also provide impulses for deciding the international areas for which the individual Austrian universities could be responsible as part of the Austrian university plan. ///

RESEARCH SERVICES

Systemic research, technology and innovation policy
 Research, technology and innovation policy plays a central role in advancing innovation systems, strengthening economic performance and the ability to tackle societal challenges. This requires designing, analyzing and evaluating effective and well-coordinated organizational structures, governance processes and policy instruments.

Research and innovation strategies

The focus of this Research Service is on developing research and innovation strategies for RTI policy-makers, knowledge-based organizations and research promotion agencies. Among the current issues addressed in the planning and implementation of strategy are: the intensive knowledge transfer between research institutions and businesses, internationalization of research and development, service innovation and the integration of customers in the innovation process.

Emerging technologies

The F&PD Department’s customers are introduced in a comprehensive, systematic way to new areas of technology and research and receive an orientation in activities and current developments within the scientific community as well as information about networks and potential partners. For businesses, but for public organizations as well, independent analyses represent a very useful resource in decision-making and orientation. ///



THE NEW INTELLIGENT ENERGY OF SMART CITIES

/// Urban energy concepts must be understood in all their complexity if they are to be designed in an efficient and environmentally compatible way. With its extensive systems and components know-how and its dedicated interdisciplinary approach, AIT has established itself as a pace-setter in the national and international arena, providing scientific support as solutions are sought to urban energy planning strategies fit for the future. ///

FOR A LONG TIME those responsible for urban energy supply concentrated primarily on the various individual technologies, whether the central supplier connected to a district heating network, the building design and technology, or transport; today we have

to aim for a deeper understanding of the entire energy system as a whole. It is a paradigm shift towards a holistic approach and planning of the overall energy system for the long term. This approach demands integrated thinking and expertise in all aspects impacting on this complex system.

● IN A NUTSHELL

More than half the approximately seven billion people on our planet now live in cities and the trend towards urbanization is gathering pace at an enormous rate. This has been leading to a drastic increase in energy consumption in cities and the CO₂ emissions they cause. If we are to reduce the negative impacts on the environment and guarantee the energy supply under these increasingly serious conditions in future, it is not sufficient to improve individual elements of the urban energy system. It has to be viewed and optimized as a whole instead. With its interdisciplinary approach, AIT has the expertise that cities need for an efficient and sustainable energy management policy.

TECHNICAL KNOW-HOW AND INTERDISCIPLINARY PRACTICE

As leaders in the development of a wide range of sustainable energy technologies AIT can call on the interdisciplinary knowledge needed to make urban energy systems fit to face the challenges of the next decades. "Our teams consist of electrical engineers, mechanical engineers, architects, urban planners,



mathematicians, physicists and others, who all work together on innovative customized energy concepts for cities,” explains Doris Österreicher, Head of the Sustainable Building Technologies Business Unit. “AIT also has extensive competence in the components field - whether photovoltaics, heat pumps, energy grids, buildings or mobility are concerned.” With the systematic linking of all these disciplines our cities can now be made fit to take a quantum leap towards becoming smart cities. A key role in the build-up of this new urban intelligent energy at AIT is the development of the appropriate simulation tools. “We are dealing with a highly complex matter here, involving an enormous number of different factors, so we can hardly rely on the existing tools,” says Doris Österreicher.

EUROPEAN COLLABORATION

In its commitment to smart cities, however, AIT not only uses internal networks but also has excellent connections and an active role at the European level. The Energy Department is the lead partner in the development of the new Joint Programme for Smart Cities under the European Energy Research Alliance (EERA), which aims to define jointly with other European research institutions the key topics in the field and initiate collaborative action.

“The idea is to bundle and maximize the existing re-

sources in order to establish a powerful European research effort in this field,” explains Doris Österreicher. And it was no coincidence that AIT coordinated the first EU project on the subject of “Energy and the City,” which studied not just individual elements but the energy system in a whole part of a city. “The CONCERTO project paved the way for the European research community to take a holistic view of the urban energy system,” Doris Österreicher underlines. “Meanwhile, however, we have taken another step forward: while CONCERTO was about energy management in districts and local urban areas, today we are looking at whole cities.”

FITNESS PROGRAM FOR AUSTRIA'S CITIES

One initiative that aims to put this holistic approach on a broader footing in Austria is the calls for proposals for “Fit4Set” initiated by the Austrian Climate and Energy Fund. In a first call Austrian cities were asked to devise a vision for their future energy provision, to produce a roadmap on that basis listing the measures required, and finally to draft a firm action plan for their city. A total of 19 Austrian cities are taking part in this ground-breaking project, half of them using AIT competence in the form of scientific support: Vienna, Salzburg, Innsbruck, Linz, Wörgl, Bruck an der Mur, Amstetten, Graz, Villach and Bregenz.

“The objectives of the exercise, the starting points and the progress already made vary widely in the different cities,” reports Ralf-Roman Schmidt, AIT’s expert in the field of Energy in Cities. “Some of them already have very firm ideas for their future energy

**DORIS
ÖSTERREICHER ///**
Head of the Sustainable Building Technologies Business Unit

"Our interdisciplinary teams develop innovative and customized energy concepts for cities."



management. In Wörgl, for example, a residential area dating from the post-war period is to become an energy-efficient showpiece project with micro-district heating grid and the latest building management systems." The city of Salzburg also has ambitious goals that can build on several forerunner projects already: "Smart Grids - Salzburg Model Region" and the CONCERTO project "Stadtwerk Lehen", the aim of which is to restructure the Lehen suburb of Salzburg on a low-energy house standard with energy supplied from a thermal solar plant.

AMBITIOUS PLANS IN VIENNA

In order to cater for the needs of all the relevant stakeholder groups in formulating the energy plan for the next 40 years in the Fit4Set cities, the projects include regular forums. At these forums, representatives from the city administration and planning departments, industry and research can express their wishes and ideas, as well as residential property developers, energy suppliers or NGOs.

Vienna, for example, which has already held the first

Researchers at the AIT Energy Department can call on interdisciplinary skills that will enable them to devise urban energy systems fit to meet the challenges of the next decades.

two forums to define the vision and the roadmap, hopes to cut back CO₂ emissions per inhabitant by 80% by 2050 (compared with 1990). "Generating renewable energy is also set to increase to over 50% in the

JESSEN PAGE ///
Expert Energy in Cities at the AIT Energy Department

"The ambitious CO₂ reduction goals for Vienna can be achieved only if coordinated action is taken at all levels."



next four decades," reports Energy in Cities expert Jessen Page. And how are these demanding goals to be achieved? "It will only work, of course, if coordinated action is taken at all levels," says Page. "This includes high energy standards for new buildings and thermal building renovation, greater use of renewable energy sources, improvement in public transportation systems and better solutions to the commuter traffic problem."

ENERGY ACTION PLAN FOR NANCHANG

The urgency of a holistic approach to energy management for cities and the lead role of AIT in this field of research is attracting growing attention outside Europe as well. The Chinese city of Nanchang has signed a contract with AIT to prepare a "low-carbon city action plan". "Our job is to build on the exi-

**RALF-ROMAN
SCHMIDT ///**
Expert Energy in Cities at the AIT Energy Department

"Some cities already have very firm ideas for their future energy management."



isting studies and identify specific ways of curbing CO₂ emissions," says project manager Daiva Walangitang. "Also, researchers from the Energy Department will prepare carefully targeted energy action that will boost the energy efficiency of this megacity of five million inhabitants." The long-term energy roadmap includes proposals for concrete demonstration projects on building management, energy grids, supply technologies, waste management and mobility, to be implemented in Nanchang jointly with Austrian industry partners. AIT's researchers have plenty of challenges to face in the process: "For one thing, in a city of this size there is an enormous number of dynamic and simultaneous processes that must be taken into account," says Walangitang, an urban planner by profession. "For another, the social dynamics in China are completely different from those in Austria. You have to use a great deal of sensitivity." ///

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RESEARCH SERVICES

Urban energy planning

In planning urban energy systems the objectives must be to minimize negative environmental impacts, achieve high system resilience, avoid redundant systems and develop a flexible, appropriate energy infrastructure. The Department has proven expertise in all these areas, which supports the work of city administration authorities and energy consultants:

- Evaluation of the energy performance of cities and urban regions
- Geographical demonstration (GIS-based, i.e. deploying geographic information systems) of energy use in urban areas or whole cities based on metering exercises and/or modeling
- Evaluation of activities on the part of consumers and generators by tracking the dynamic behavior of energy systems and buildings with the aid of (coupled) numerical simulations and simulations of energy flows in urban areas

Thermal grids

Districting heating and cooling networks have the advantage that they can receive and distribute power efficiently from very different types of generator. The Department offers support in planning customized and innovative grid solutions.

- Scientific planning support
- Dynamic simulations of district heating and cooling networks
- Technical optimization of energy interfaces
- Overall assessment of energy system performance

Thermal power plants and industrial processes

Efficient energy systems are based on both optimized thermal processes in power plants and the use of waste heat from industrial undertakings. The Department uses computer-aided measurement, analysis and validation tools to analyze these thermodynamic processes, identify weaknesses and unused potential and so optimize the processes.

- Acceptance tests of thermal power plants in accordance with VDI 2048
- Evaluation of retrofit measures, proofs of guarantee
- Optimization and monitoring of power plant operation as a basis for appropriate maintenance planning
- Simulation of energy and mass balances in planned power plants
- Measurement of energy flows and overall energetic analysis of industrial processes
- Selection of the appropriate technology for using the waste heat of industrial processes for generating power
- Stationary cycle simulation ///



THOMAS MADREITER,
HEAD OF MA 18, THE
VIENNA MUNICIPAL
DEPARTMENT FOR URBAN
DEVELOPMENT AND
PLANNING, ON THE CHAL-
LENGES CONFRONTING
LARGE CITIES IN FUTURE.

Mr. Madreiter, what are the major challenges for urban planning

now and in future, in general - and in particular for Vienna?

Cities have always been a focal point of innovation and progress, a melting pot of different ethnicities and cultures and subject to constant change. Still today cities are facing major upheavals and challenges: more and more people are living in cities; by 2050 the percentage of urban population is expected to rise to two-thirds of the world population. In the EU area 80% of the inhabitants now live in cities. Globalization, climate protection, new technologies - all that and much more means new challenges for urban development. Vienna faces the issue that by 2035 it will have to provide space for some two million inhabitants. Vienna's urban planning authorities see this as an opportunity to reinforce its position in the central European region (CENTROPE) as a competitive and innovative metropolis. And it takes measures to maintain and enhance the quality of life for its inhabitants.

What is the relevance for you of the Fit4SET Vienna project with regard to urban planning?

The effects of climate change are getting more and more noticeable even in urban conurbations. In the CDP Cities Report 2011 about half the 42 major cities world-wide that were surveyed stated that the direct effects of climate change were clearly evident - for example in damage to the urban infrastructure caused by heatwaves, droughts or floods. As a city with a high quality of life and environmental quality, Vienna has a particularly vital interest in taking a leading role by adopting climate friendly technologies and participating in the relevant programs. Urban development means designing the city of the future on the basis of the latest findings and accordingly setting the course for the future. With this in mind, questions of how to use energy with respect for use of resources and climate protection can no longer be separated from questions of urban planning.

What sort of role does AIT play for you as a non-academic research institute? What is it about the collaboration that you most appreciate?

Collaboration with science and research - whether with academic or non-academic institutions - is extremely valuable for urban planning. The related skills in innovative technologies and developments have a vital significance for urban development, and collaboration with research institutions and the resulting knowledge transfer are extremely important to us as a planning department at municipal level. On the one hand, the know-how import keeps our fingers on the pulse of current research. On the other hand, we are obviously interested in bringing our experience from practice to bear on the scientific work. In this respect, AIT is a sound and competent partner for us in tackling the issues relevant for the future. ///



URBAN EUROPE

/// The race for the leading positions in the global economy is taking place in the cities. Today, it is the residents of cities that generate the major share of a country's prosperity. The competition among locations to attract new businesses will consequently be won with the right concept for the "city of the future". Urban Europe is an initiative with the objective of ensuring that this concept comes from Europe. And what is more, Austria has through the Austrian Institute of Technology (AIT) been involved in developing the concept from the very start. ///

URBAN REGIONS HOST 80% OF EUROPE'S POPULATION already today. In the rest of the world, forecasts see seven in ten people living in cities by 2050. In the global race for the lead in productivity and communications, the best minds and the heaviest investors are highly coveted, and it is the quality of life offered by the infrastructure of intelligent cities that will attract them.

At the same time, this magnetic attraction of urban areas gives rise to issues such as environmental damage, traffic and safety and security problems as well as the challenge of demographic change.

AGING SOCIETY IN THE CITIES OF THE FUTURE

"It's all about demography" were also the words used by Ingolf Schädler, in charge of innovation within the Ministry of Transport, Innovation and technology (BMVIT), to describe the situation. The occasion was a discussion meeting on Smart Cities recently held in Vienna. In Ingolf Schädler's view, the

INGOLF SCHÄDLER /// Head of Innovation at the BMVIT

"The rapid growth of cities and the shift in the population age structure pose a major challenge to our societies."



infrastructure of Central European cities continues to cater to a youthful population. Meanwhile, on the basis of current figures it has been forecast that by 2050 one in three Europeans will be over 60 and at least one in ten will be older than 80 years.

The rapid growth of cities and the shift in the population age structure thus pose a major challenge to our societies. To underscore how the BMVIT was responding to this challenge, Schädler cited a number of examples, including: the programs organized by the Austrian Climate and Energy Fund which are aligned with the European Strategic Energy Technology (SET) Plan; RTI programs such as "Haus der

Zukunft" (house of the future), some of which have been going on for several years; the e-Mobility and Smart Grids projects; and the BMVIT's co-responsibility for Urban Europe, a transnational research initiative.

NEW APPROACHES TO FUTURE URBAN DEVELOPMENT CONCEPTS

"The Urban Europe Joint Programming Initiative takes on these complex challenges by placing a special focus on the development perspectives for European cities within the global context," says Margit Noll, responsible for the initiative at AIT. Urban Europe contributes to the initiative by providing a platform for drawing up new methods to be used in future urban development and management, by integrating highly advanced technological developments with innovative urban images and by introducing novel interdisciplinary research approaches.

URBAN CHALLENGES

Europe's capacity to compete with other continents will depend on the key responses it is able to identify to meet the following challenges facing European cities:

- To ensure an attractive living and working environment for highly qualified staff and companies, European cities need to provide both a state-of-the-art infrastructure that meets superior standards of quality and corresponding overall conditions.
- International migration accounts for about one-third of urban population growth. Large cities in particular are challenged with developing new approaches to migration and integration in order to ensure social stability and to enable urban economies to grow.
- Demographic conditions in Europe are shifting and becoming skewed towards a growing number of elderly persons. This trend stands in contrast to population developments in other regions. To maintain its position in the long run, Europe requires specific concepts.

■ Climate change demands a new awareness of sustainability in a variety of areas, and specifically CO₂ emissions need to be reduced. As the source of roughly 70% of global CO₂ emissions, urban areas have tremendous potential for increasing energy efficiency and for utilizing renewable sources of energy. At the core of these visions are novel mobility concepts as well as energy-efficient buildings and cities that comply with sustainability principles. In a further step, additional material and information flows

to and from cities need to be integrated in an overall development concept.

To ensure Europe's position in the long run, new urban development and management concepts are needed to address these complex challenges. Building on the four

cornerstones of economy, ecology, society and mobility, Urban Europe pursues the objective of fostering research and innovation to the end of reinforcing European cities in their ability to compete globally. To meet this objective, in Urban Europe's view, research efforts are required at the interfaces between the cornerstones listed above, specifically:

- Foresight activities that include a broad number of stakeholders, to enable the development of realistic scenarios as well as viable paths leading to their realization
- Assessment of technological developments in terms of potential for implementation in various urban contexts
- New governance models for urban areas that make allowance for the complexity of the overall context
- New methods and instruments for urban planning and management that take into account highly advanced technologies and support their assessment
- New methods for modelling and simulating urban developments and scenarios
- Linking technological developments to socio-economic studies, to the end of achieving high acceptance upon the introduction of new technologies or concepts
- Demonstration projects to test the concepts developed

■ Coordinated evaluation and detailed definition of best-practice methods in order to facilitate the exchange of expertise beyond the regional level and support the development of a learning community

URBAN EUROPE MISSION

The competitiveness of European urban areas in a globalized world depends largely on how fast innovative knowledge can be created, deployed and implemented. The aim is to accelerate innovation by addressing the whole innovation cycle. Social innovations need to be emphasized to an extent that reflects their importance for effective and sustainable urban development. In this way European urban areas can continue to be the motors of Europe's economic growth and its ability to compete at the global level. Urban Europe complements existing research approaches and initiatives, which suits it to making a contribution, specifically:

- As a coordinated research initiative, geared towards the future and aligned with long-term developments, that rethinks urban development in times of global change
- As an integrative, interdisciplinary and horizontal approach across the interfaces of the four cornerstones that in research activities focuses on people and their needs
- By promoting intensive interactions between researchers, policy-makers, business and civil society, resulting in an innovative and impact-oriented approach.
- By endeavoring to becoming recognized as a European hub for issues related to urban development, open to all relevant stakeholders with an interest in this topic

For the purpose of deriving a strategic framework for research, the four cornerstones of Urban Europe, i.e. economy, ecology, society and mobility, have been translated into four related thematic city images that are intended as a stylized representation of urban profiles of the future, specifically in 2050. These are:

THE ENTREPRENEURIAL CITY 2050

The image of an entrepreneurial city refers to the conditions required for cities to compete sustainably in the market. To achieve this, they need to maximize their innovative and creative potential and identify innovative solutions, in this way positioning

MARGIT NOLL /// Assistant to the AIT Executive Board

"With its broad technology and foresight expertise in the relevant topics, AIT is a key player in developing Urban Europe."



themselves within the global race to attract new businesses. Cities are innovation hubs: the high density and diversity of a city results in the potential emergence and facilitation of a constant stream of knowledge and innovation. Through pooling (specialized) talent and by providing the necessary conditions and infrastructure, urban areas potentially have an edge in the production and utilization of new knowledge, so that new products, services and processes emerge more quickly.

However, these advantages of urban concentration come at a price – ultimately the concentration will lead to certain diseconomies of agglomeration. Land prices will soar as land becomes increasingly scarce, wage disparity will occur to a significant extent between urban and rural areas and increased population density will generally lead to negative environmental impact. The resulting urban dynamics, influenced by opposing forces, are consequently the focus of research activities. The objective is to address the overall conditions and key factors that create and foster an urban development strategy which is both successful in economic terms and ecologically sustainable.

THE CONNECTED CITY 2050

The image of a connected city refers to the fact that in a (locally and globally) interlinked world, cities can no longer be economic islands but rather need to position themselves as nodes or hubs in polycentric networks. The availability and reliability of urban networks is at the same time an important prerequisite for cities to be able to position themselves as attractive and innovative locations.

Research carried out in the context of connected cities considers urban connectivity specifically from an urban networks perspective. Sustainable connectivity of cities depends largely on the current and future development and functioning of physical and virtual networks. Within this context, it should be considered that these factors mutually affect one another: spatial development, the decisions of enterprises and households to locate and urban networks. Special attention is devoted to viewing the various networks as parts of an integrated system, in order to be able to identify the requirements for optimized overall systems. Aspects worthy of consideration in this context include: user requirements, new services arising from networking and new networks as well as the sustainability of these features.

THE PIONEER CITY 2050

The image of the pioneer city emphasizes the characteristic of cities as a focal point for creative forces and future-oriented solutions to current issues. Cities continue to succeed in positioning themselves as pioneers in the development and implementation of innovative solutions, technologies or markets. Analysis within the context of the pioneer city focuses on the special conditions that are required or are favorable for trying out and putting into practice new solutions to technical, economic and social challenges. The notion of living labs plays a key role in this regard as a means of: increasing user acceptance of these novel solutions; assessing the impact of business models; exploiting the potential represented by urban social capital; and better understanding change within the urban innovation system. As a next step, these findings will be integrated into new urban models and governance systems in order to selectively create incentives for such pioneers and groundbreakers.

THE LIVEABLE CITY 2050

Liveability itself denotes an integrating concept which emphasizes the necessity of considering and combining different perspectives in order to create and maintain attractive living and working environments. Particularly the interdependencies between technological and social developments need to be considered. Potential (technological) risks have to be systematically assessed, with new options being identified and utilized. Social issues should be put at the forefront in order to take best advantage of technological developments and innovations for improving the quality of life and all related aspects, thus creating a “city for all”.

Environmental issues have to be particularly considered, as developments and growth in multiple areas such as economy, mobility and energy supply are constrained by environmental limits. New technologies, adapted systems of governance and administration and a matching infrastructure are viewed as enabling functionalities for achieving the goals of liveable cities. Research topics are intended to contribute to the long-term goal of an ecologically sustainable and socially balanced city with a prosperous economy and dynamic interconnections to other regions. ///

CAREER PATHS AT AIT

/// Tomorrow Today asks AIT Senior Expert Advisor Uwe von Ahsen why he decided on a career at the Austrian Institute of Technology and how he views Austria's labor market for high potentials in general. ///



Uwe von Ahsen
Senior Expert
Advisor at the AIT
Health & Environ-
ment Department

Mr. von Ahsen, on the basis of roughly 17 years of experience at universities and in business you decided to work for AIT. What was your main reason?

Uwe von Ahsen: One consideration was the highly enticing responsibility, at the same time a challenge, to strategically position the H&E Department. This offers me a nice way of combining my specialized R&D experience with my expertise in the structure and setup as well as the processes of a company. On the same token I would like to emphasize that for me personally the fundamental restructuring of AIT in 2009, and here especially the new shareholder structure and shareholder influence, was a prerequisite for me to join AIT. I'd also like to mention that I had already worked with the new Head of Department, Michaela Fritz, in another professional context. That positive experience encouraged me to take on the structuring process jointly with her.

What in general makes high potentials start a research career – and what, on the other hand, drives them to take the road leading to setting up their own business or to join a private enterprise?

Von Ahsen: As I mentioned, I had the privilege of getting to know both sides: I can look back on scientific articles in leading journals such as Science and Nature, but I also co-founded a biotech corporation and held positions in pharmaceutical companies and as a business consultant. Only the individual can lastly identify their particular motivation for choosing research or business, while the general various pros and cons for each option are well known. In both areas I recognized that you need a full team of highly motivated and excellent people to get good results. My wish and goal at the H&E Department is to have that kind of environment.

You also used to be a business start-up advisor in the life sciences industry. What prospects do you see for Austria in this field as a research location in the global context?

Von Ahsen: First, Austria looks back on a long-standing tradition in the field of medicine. Second, with the recent founding of a great number of research institutions that are able to compete at the international level, Austria has established research beacons that are highly visible from afar. Yet, as far as commercial exploitation of scientific research is concerned, we obviously have a lot to catch up on. In this context, programs such as LIS – Life Science Austria and AplusB-Gründerzentren are clearly moves in the right direction. Particularly in the life sciences, research findings are competing at the international level for international customers and for global capital. ///

AIT CAREER MODEL SENIOR EXPERT ADVISOR

Senior Expert Advisors support the Business Unit management in the strategic development and positioning of the Business Unit. Responsibilities include the development and management of large, complex projects of strategic importance, as well as publishing articles and registering patents, developing concepts for applying and exploiting the findings and instructing Junior Engineers and Junior Expert Advisors. Success in this role depends in particular on a system-oriented appreciation of the available technological options as well as of customer needs and the market situation. Specialized training corresponding to the particular professional and strategic orientation is available. Individuals demonstrating superior leadership competence have the option of assuming additional management responsibilities as a Thematic Coordinator.

Requirements

- Completed Master level degree or equivalent
- Several years of professional experience in research and development
- Profound scientific or technical knowledge in the respective field coupled with a superior appreciation of systems
- Exceptional knowledge of the market and of customer needs
- Ability to successfully network both within the organization and beyond as well as to implement plans
- Ability to think and act strategically and in a business-minded manner

INNOVATION CALENDAR

AUGUST 30 – SEPTEMBER 2: AVSS – IEEE CONFERENCE SERIES ON VIDEO AND SIGNAL-BASED SURVEILLANCE

Advanced Video and Signal Based Surveillance (AVSS) is an international discussion platform with a focus on a variety of topics related to surveillance technology. Individuals from research and industry as well as users and policy-makers with interest in the topic are invited to participate. As an AVSS event, the AIT Safety & Security Department is organizing the Industrial Surveillance Day. Companies are invited to present their products and prototypes to participants from all over the world. Venue: Klagenfurt, Austria

Information: www.avss2011.org

AUGUST 31 – SEPTEMBER 2: EUROPEAN CONFERENCE FOR THE ADVANCEMENT OF ASSISTIVE TECHNOLOGY IN EUROPE, AAATE 2011

The topic of this international conference in 2011 is: "Everyday Technology for Independence and Care". Experts from all over the world will meet in Maastricht with the aim of further developing and implementing assistive technologies. At the conference, the AIT Health & Environment Department will host the special thematic session focused on "User Interfaces for Smart Homes".

Information: www.aaate2011.eu

SEPTEMBER 3-OCTOBER 22: ARS ELECTRONICA 2011 IN LINZ

Symposium and exhibition on "Sensing Place / Placing Sense – Media Arts and Urban Research" within the framework of Ars Electronica 2011. The event, originating in a cooperative effort among afo architekturforschung oberösterreich, the AIT Austrian Institute of Technology Mobility Department and the Ars Electronica Center (AEC), has been planned by Katja Schechtner of the Dynamic Transportation Systems Business Unit within the Mobility Department and by Dietmar Offenhuber of MIT. Investigating the potential for urban research entailed in experimental art and artistic approaches, the symposium and the accompanying exhibition will provide a forum for discussing various practical approaches for generating infrastructure and a variety of spatial designs.

Information: <http://new.aec.at/news/en/>

SEPTEMBER 5-8: 26TH EUROPEAN PHOTOVOLTAIC SOLAR ENERGY CONFERENCE AND EXHIBITION (PV SEC)

The European Photovoltaic Solar Energy Conference (PV SEC), taking place for the 26th time this year, is one of the most important international conferences in the field of solar energy. The researchers from the AIT Energy Department will be represented with an exhibition stand (hall B4G, stand A6) as well as a large number of poster displays and expert presentations at the CCH Congress Centre and International Fair in Hamburg. Venue: CCH Congress Centre and International Fair, Hamburg, Germany

Information: www.photovoltaic-conference.com

SEPTEMBER 6-9: 7TH IEEE VEHICLE POWER AND PROPULSION CONFERENCE (VPPC 2011)

The 7th VPPC will bring together individuals from academia, industry, and governments to discuss and exchange ideas in the fields of sustainable transportation systems and electric vehicles as well as air, space and marine vehicles. Two scientists from the AIT Mobility Department will hold a tutorial on the topic of "Object Oriented Modeling and Simulation of Electric and Hybrid Electric Vehicles with Modelica". Venue: Venue: JW Marriott Hotel, Chicago, IL., USA

Information: <http://vppc2011.com/>

SEPTEMBER 14 AIT HEALTH & ENVIRONMENT SEMINAR SERIES 2011

As part of professional development activities for its staff, AIT is inviting distinguished individuals from the international scientific community to hold workshops on a variety of topics related to areas of research under study at the AIT Health & Environment Department. Each of the scientists will additionally hold a lecture at the Tech Gate in Vienna, open to the general public.

Upcoming lecture: Sun to fuel conversion with microalgae as an alternative biomass; Olaf Kruse, University of Bielefeld, Germany.

Information: <http://www.ait.ac.at/departments/health-environment/?L=1>

OCTOBER 5-7: ECAA 11 – EUROPEAN CONFERENCE ON ALUMINIUM ALLOYS

The new Aluminium Science and Technology conference is the first "European Conference on Aluminium Alloys – ECAA" organized in 2011 by the DGM (Deutsche Gesellschaft für Materialkunde - German Society for Materials Science). The conference provides a platform for academic and industrial researchers, scientists and engineers to present and discuss the recent development and progress made in aluminium, covering: fundamental aspects of alloy development and (physical) metallurgy; microstructure evolution and related properties; industrial fabrication and processing; and conventional and advanced products and customer applications. Daniel Pöschmann and Manoj Kumar of the Light Metals Technologies Ranshofen Business Unit within the AIT Mobility Department will hold presentations on the topics of: "Implementation of sub-sized fracture specimen for characterization of hot forming experiments on 7050 aluminium alloy" and "Warm forming of pre-aged AW6016 alloy for deep-drawing application". Venue: Maritim Hotel & Congress Centrum Bremen, Germany

Information: www.dgm.de/dgm/ecaa/

OCTOBER 18-19: 4TH ANNUAL MIDDLE EAST HEALTHCARE EXPANSION SUMMIT 2011

The Middle East Healthcare Expansion Summit, with a focus on e-Health, is being organized with the support of healthcare facilities and hospitals in the region. The conference is intended for stakeholders from the industry and for members of senior management in the IT sector from the GCC region (Gulf Cooperation Council). Peter Kastner, e-Health expert at the AIT Safety & Security Department, has been invited to the Middle East Healthcare Expansion Summit to give a presentation on the topic "With AIT technologies toward closed loop healthcare". Venue: Qatar

Information: www.flemingulf.com (Bereich Conferences)

OCTOBER 19: AIT HEALTH & ENVIRONMENT SEMINAR SERIES 2011

As part of professional development activities for its staff, AIT is inviting distinguished individuals from the international scientific community to hold workshops on a variety of topics related to areas of research under study at the AIT Health & Environment Department. Each of the scientists will additionally hold a lecture at the Tech Gate in Vienna, open to the general public. Upcoming lecture: Application of phytoremediation technologies in Canada. Jim Germida, University of Saskatchewan, Canada

Information: www.ait.ac.at/health-environment



As a pioneer within the Austrian scientific community, AIT is presenting for the first time ever Webcast, a novel communication tool. Select Webcast at <http://www.ait.ac.at/?L=1>

AIT presentations and seminars can be viewed in full length with the complete information content, accompanied by the lecturer's Powerpoint slide presentation.

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If your company is looking for cutting edge innovations, then AIT Austrian Institute of Technology is your partner of choice. Because in our institute the most acute minds in Europe are working today on tomorrow's tools and technologies, laying the ground for the solutions the future demands.

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