Fraunhofer
INT

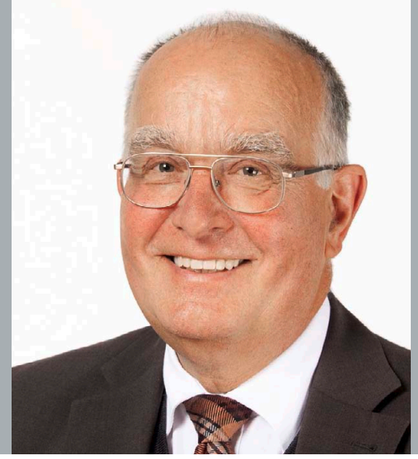
FRAUNHOFER INSTITUTE FOR TECHNOLOGICAL TREND ANALYSIS INT

ANNUAL REPORT 2010



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The technological research area that deals with security and defense is currently undergoing change. This change had been long foreseen, but time was clearly needed before the research institutes felt the effects in their routine work. For years, basic research has considered a general distinction between civilian security problems and military questions to be of little use. So with the security research programs of the Federal Government and the European Union, the "dual use" aspect is becoming more significant, occupying more and more of the agenda in defense-oriented institutes. This is all the more important as financial leeway in defense spending is shrinking in the face of the political demand for cuts, and because defense research is dependent on the synergy effects of a broader research landscape.

Against this background, 2010 showed that the many years of effort that have gone into civilian security research also bore fruit for INT. In particular, there has been much greater integration into the international "dual use" networks, providing opportunities for cooperation and forming consortiums. Also for the 8th Framework Programme, INT remains a member of the Security Advisory Group for Civilian Security Research in the EU. Regarding acquisition, INT was internationally successful, both as a consortium leader and as partner. Throughout the whole range of INT's business units, it was possible to win projects on EU level (EU Security Research Programme, EU Commission, European Space Agency ESA, and European Defence Agency EDA).

As well as the satisfying growth in work that has no direct connection with security and defense, INT achieved considerable increases in the volume of contract research (outside Federal Ministry of Defense BMVg) which is relevant to the Federal and State Basic Funding Program. On the one hand this concerned the vulnerability analysis of electronic and opto-electronic systems and components for ionizing radiation and their analysis for industry, the analysis of metamaterials for ESA, cooperation with the European Organization for Nuclear Research CERN (Organisation Européenne pour la Recherche Nucléaire) on the radiation sensitivity of optical fibers, and on the other hand it concerned support for public and private sector clients in long term planning and decision-making. With regard to the Fraunhofer-Gesellschaft's objectives, the significant rise in the proportion of contracts from industry was particularly gratifying. In 2010 it was again possible to increase the number of staff financed by contract research. We are very confident that INT's current dynamic development can be secured on a lasting basis.

Strategically, the BMVg remains outstandingly important for INT. Through its basic funding, BMVg guarantees the continuity of the Institute's work. Nevertheless, the tight budgetary situation has not failed to have its effect on us either.

INT again increased its support for national civilian protective bodies (such as the Protection Commission of the Federal Ministry of the Interior BMI, the Federal Office for Radiation Protection BfS, the Federal Office of Civil Protection and Disaster Assistance BBK, the Federal Criminal Police Office BKA), and International cooperation on integrating long term technological developments in EU and NATO defense planning was also intensified.

The strategic further development of INT's specialist research in nuclear and electromagnetic threats was also positive. There was again an increase in the volume of SME company projects analyzing the suitability of components for use in radiation environments (space). Under the second Economy Stimulus Package, it was possible to secure an additional € 1.24 million of investment capital, which was used for procurements in 2010. This considerably widened INT's experiment scope in the major fields "the vulnerability of space systems through ionizing radiation" and "the electromagnetic threat to aerospace systems".

In November 2010, a groundbreaking ceremony for a new office building was the first step for new extensions to the Institute, part of the master plan launched in 2008 in cooperation with the Fraunhofer-Gesellschaft's Central Administration and the Federal Ministry of Defense (BMVg). During 2011, we hope to begin building work on the larger seminar room and a larger library, as foreseen in the plans.

At this juncture, I wish to thank the Ministry of Defense personally for its fruitful and friendly cooperation. I also thank all other friends of the Institute, especially the members of the Advisory Board, for their support. At the same time, I would like to thank all the Institute staff for their unfailing commitment.

After extensive preparation, an appointments commission of the Fraunhofer-Gesellschaft took up work at the beginning of 2011 in order to find a successor for me as Institute Director (I turned 65 in September 2010). I therefore consider it likely that the foreword for the next Annual Report will not be written by me. In consequence, I would like to use this opportunity to take my leave of the circle of cooperation partners of the past 36 years. I thank everyone for their support, and for the friendly, interesting and (ongoing) motivating atmosphere that my working environment generated for me.



Prof. Dr. Uwe Wiemken

ANNUAL REPORT 2010

02 Foreword
06 Fraunhofer INT in Profile
07 Organigram
08 Fraunhofer INT Facts and Figures
10 Board of Trustees
11 The Fraunhofer-Gesellschaft
12 Fraunhofer VVS – Group for Defense and Security

BUSINESS UNITS

14 TRENDS IN RESEARCH AND TECHNOLOGY
18 Assessment of Potentially Disruptive Technologies for Defence and Security
20 Enzyme Technology

22 PLANNING, PROGRAMS AND STRUCTURES IN RESEARCH AND TECHNOLOGY
25 The Information System "European Security Research"
27 Recognizing Tomorrow's Innovations Today
28 Activities in European Security Research and in the FP7 Security Research Program

30 NUCLEAR EFFECTS, THREATS AND DETECTION SYSTEMS
34 Investigation of Single Event Effects with Very High Energy Ions

36 ELECTROMAGNETIC EFFECTS AND THREATS
40 Optical Applications of Metamaterials

42 SCIENTIFIC-TECHNICAL INFRASTRUCTURE

44 BUSINESS ADMINISTRATION AND CENTRAL SERVICES
48 Technical Upgrade of Department NE

50 NAMES, DATES, EVENTS
50 Future Security
52 ILA 2010
53 New Construction Office Building
54 Short Notes

56 APPENDIX
56 University Courses
56 International Cooperation
57 International Reviews
58 Collaboration in Committees
59 Participation in Norming Processes
60 Lectures and Presentations
66 Publications
71 Personalia
71 Other Events
72 Institute Course
74 Business Units and Contacts
78 How to reach us
80 Publishing Details

FRAUNHOFER INT IN PROFILE

The Fraunhofer Institute for Technological Trend Analysis INT creates and continuously updates a comprehensive overview of the general research and technology landscape and of the entire spectrum of national and international technological developments. In addition to this general overview, we generate our own specialized analyses and forecasts in selected technological areas.

For more than 35 years, the institute has advised the German Federal Ministry of Defense on questions of technology and on how to plan and realize new research and technology projects. In recent years, there has been an increase in the volume of research carried out for other public institutions involved in security precautions and long-term changes in society. In addition to this, the INT performs its own experimental and theoretical research on the effects of ionizing and electromagnetic radiation on electronic components and systems.

The Institute is equipped with state-of-the-art measurement technology. The major laboratory and large-scale devices are radiation sources and electromagnetic simulation facilities which cannot be found in this combination in any other civilian institution in Germany. Our main clients include authorities and organizations concerned with security affairs and precautions, as well as aerospace companies and their suppliers.

THE INSTITUTE'S SERVICES ARE STRUCTURED IN FOUR BUSINESS UNITS:

BUSINESS UNIT

TRENDS IN RESEARCH AND TECHNOLOGY

BUSINESS UNIT

PLANNING, PROGRAMS AND STRUCTURES IN RESEARCH AND TECHNOLOGY

BUSINESS UNIT

NUCLEAR EFFECTS, THREATS AND DETECTION SYSTEMS

BUSINESS UNIT

ELECTROMAGNETIC EFFECTS AND THREATS

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FRAUNHOFER INT FACTS AND FIGURES

INT staff numbers grew slightly in 2010, with 44 fulltime positions now providing employment for 47 scientists. The proportion of scientists on the staff is now at more than 60 %. In addition to permanent staff, approximately 15 people work permanently at INT as student or scientific assistants. There are also 2 trainees. In addition, a network of freelance scientists regularly supports the Institute's research work.

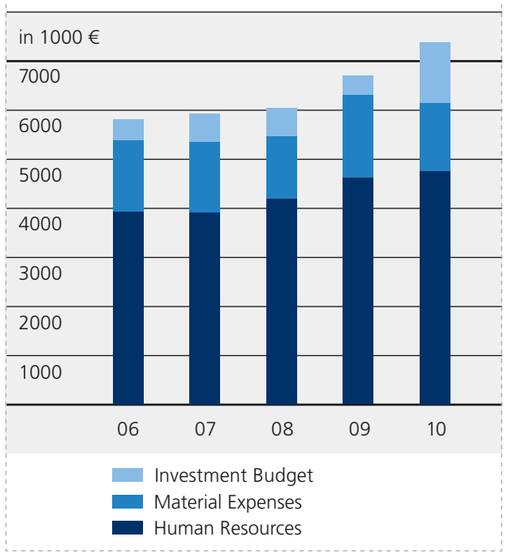
Budget

The Fraunhofer Gesellschaft distinguishes between operating and investment budgets. The operating budget covers all staffing and administrative expenditure, the investment budget concerns the procurement of capital goods such as scientific apparatus and computers. Thanks to a grant under the Economic Stimulus Package, there was considerable investment in new irradiation facilities, considerably widening the scope of our scientific research work. For the first time, the total budget amounted to more than € 7 million.

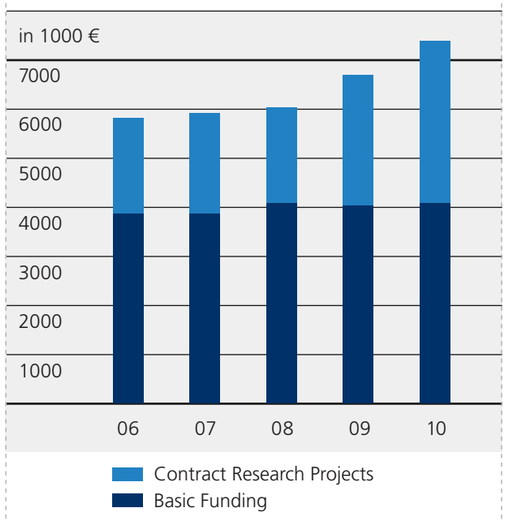
Expenditure was financed in part by basic funding from the Federal Ministry of Defense (BMVg) and from the Federal Ministry of Education and Research (BMBF) in the case of contract research for civilian clients, as well as from proceeds from research projects. In contract work, research is being carried out for both defense projects and civilian projects for the public sector and clients from industry. The volume of research for defense declined again in 2010, a reduction that was more than compensated for by the increase in research for the civilian sector. Civilian contract research is meanwhile the dominant factor. The marked increase in our business income is especially gratifying, covering approx. 64 % of the operating budget for civilian contract research in 2010.

In the year under review, a total of 74 contract research projects were processed, of which 40 were for industry and 34 for the public sector and other clients. BMVg remains the major client.

Budget from 2006 to 2010



Financial Development from 2006 to 2010



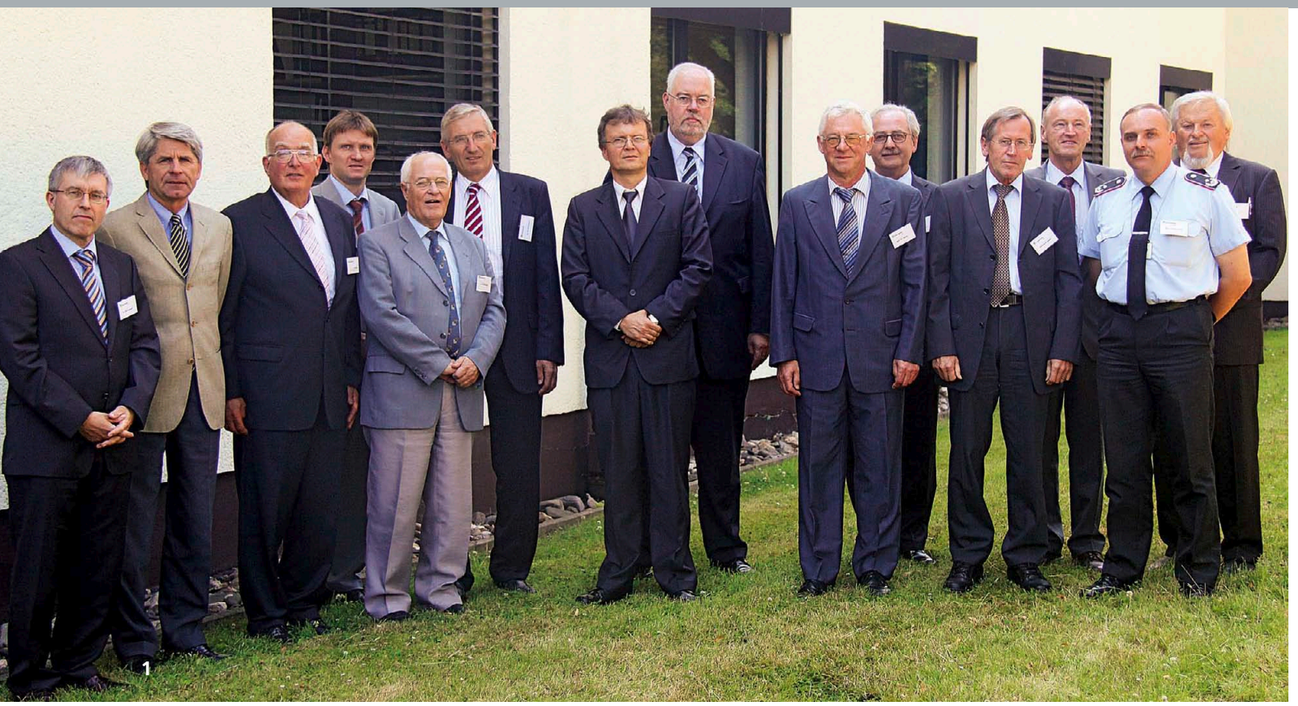
Human Resources

	2008		2009		2010	
	Manned Positions	People	Manned Positions	People	Manned Positions	People
Scientists	42.7	45	42.5	45	44	47
Graduates	12.5	13	15.5	16	15.5	16
Technicians / Others	11.5	15	11.5	14	12	13
Total	**66.7**	**73**	**69.5**	**75**	**71.5**	**76**

Budget

in 1000 €	2006	2007	2008	2009	2010
Expenses					
Operating Budget	5379.5	5356.8	5453.6	6297.3	6111.0
of which Human Resources	3930.3	3931.1	4177.8	4606.5	4718.0
of which Material Expenses	1449.2	1425.7	1275.8	1690.8	1393.0
Investment Budget	425.3	560.2	569.2	391.1	1230.0
Total	**5804.8**	**5917.0**	**6022.8**	**6688.4**	**7341.0**
Funding					
Basic Funding	3881.0	3881.0	3881.0	4071.0	4047.0
Contract Research Projects	1923.8	2037.0	1951.8	2646.4	3295.0

BOARD OF TRUSTEES



1

The Institute is advised by a board of trustees which is composed of people from industry, science, politics and administration.

Chairman:

Prof. Dr. Horst Geschka; Geschka & Partner

Members:

- Herr Manfred Braitinger;
  IABG -Industrieanlagen-Betriebsgesellschaft GmbH
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- Dr. Walter Kroy; THARSOS
- MinR Rainer Krug; Bundesministerium der Verteidigung (BMVg)
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- Dr. Stefan Mengel; Bundesministerium für Bildung und Forschung (BMBF)
- Prof. Dr. Eckard Minx; Daimler AG
- Dr. Ulrich Wiese; formerly: Fraunhofer Gesellschaft
- Dr. Dr. Axel Zweck; VDI-Technologiezentrum

1 *Board of Trustees meeting on June 25.2010.*
Representative of the Executive Board:
Prof. Dr. Alfred Gossner

THE FRAUNHOFER-GESELLSCHAFT

Research of practical utility lies at the heart of all activities pursued by the Fraunhofer-Gesellschaft. Founded in 1949, the research organization undertakes applied research that drives economic development and serves the wider benefit of society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration.

At present, the Fraunhofer-Gesellschaft maintains more than 80 research units in Germany, including 60 Fraunhofer Institutes. The majority of the more than 18,000 staff are qualified scientists and engineers, who work with an annual research budget of € 1.65 billion. Of this sum, more than € 1.40 billion is generated through contract research. Two thirds of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. Only one third is contributed by the German federal and Länder governments in the form of base funding, enabling the institutes to work ahead on solutions to problems that will not become acutely relevant to industry and society until five or ten years from now.

Affiliated international research centers and representative offices provide contact with the regions of greatest importance to present and future scientific progress and economic development.

With its clearly defined mission of application-oriented research and its focus on key technologies of relevance to the future, the Fraunhofer-Gesellschaft plays a prominent role in the German and European innovation process. Applied research has a knock-on effect that extends beyond the direct benefits perceived by the customer: Through their research and development work, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by promoting innovation, strengthening the technological base, improving the acceptance of new technologies, and helping to train the urgently needed future generation of scientists and engineers.

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop the professional and personal skills that will allow them to take up positions of responsibility within their institute, at universities, in industry and in society. Students who choose to work on projects at the Fraunhofer Institutes have excellent prospects of starting and developing a career in industry by virtue of the practical training and experience they have acquired.

The Fraunhofer-Gesellschaft is a recognized non-profit organization that takes its name from Joseph von Fraunhofer (1787–1826), the illustrious Munich researcher, inventor and entrepreneur.

FRAUNHOFER VVS – GROUP FOR DEFENSE AND SECURITY

The Fraunhofer-Gesellschaft is indebted to society, state and economy in equal measure. On the grounds of this selfconception, it also assumes corporate social responsibilities next to its support of the economy. Since its foundation, the Fraunhofer-Gesellschaft has not only been committed to the German Ministry of Education and Research, but also to the German Ministry of Defence (BMVg) and, within its range of tasks, it covers the major part of institutional research for the BMVg. For some of the institutes in the Fraunhofer-Gesellschaft, this means that their scientific work is focused on military applications.

In addition to this, the recent developments in the field of security policy have created a new threat level. In the face of multilayered threats, today's industrial society and its highly complex and networked public or private infrastructures have become ever more vulnerable and increasingly call for solutions to provide for its citizens' security. At the same time, formerly clearly defined boundaries between internal and external security are fading, which has far-reaching consequences for the nature and deployment of modern security technologies. Present-day threat scenarios often originate outside the borders of Germany and have led to a new understanding of security. The challenges arising from these circumstances form the framework of contemporary security research. Particularly, the German Armed Forces, which are mainly active in the field of conflict prevention and the handling of crises, are confronted with various threats regarding technological as well as logistic questions in many operational areas. It is the declared aspiration of security research to develop the necessary solutions for the Armed Forces to address these tasks while being assured of the required protection.

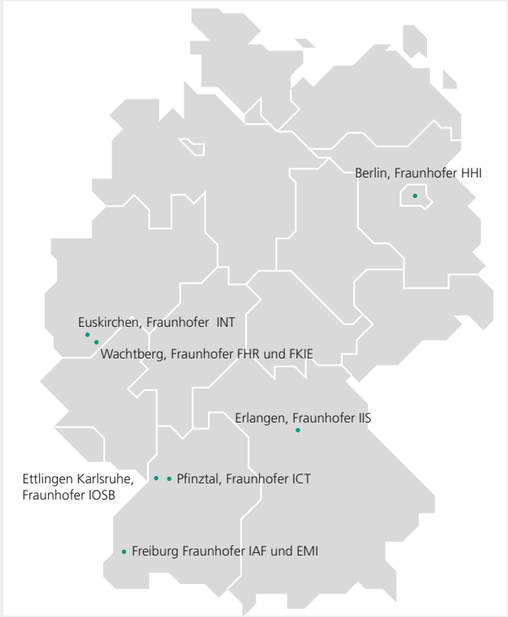
With this in mind, five Fraunhofer Institutes joined forces in November 2002 to coordinate their research activities in the field of defense and security research and to put them into action, with the additional premise to strengthen the position of military-technology research. The following institutes are the founding members of the Fraunhofer Group for Defense and Security: Fraunhofer IAF (Applied Solid State Physics), Fraunhofer ICT (Chemical Technology), Fraunhofer INT (Technological Trend Analysis), Fraunhofer EMI (High-Speed Dynamics, Ernst-Mach-Institut) and Fraunhofer IITB (Information and Data Processing). Fraunhofer IIS (Integrated Circuits) joined the group as guest member. The group's central office is located at Fraunhofer EMI.

According to longterm plans of the BMVg to bundle the government-funded research capacities in this sector and to open defense-related institutes to the civil market, the three institutes of the former Society of Applied Sciences FGAN were integrated into the Fraunhofer-Gesellschaft network. This way, the Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR, the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE – both located in Wachtberg close to Bonn – and the Fraunhofer Institute for Optronics and Pattern Recognition FOM in Ettlingen entered into the group. In January 1, 2010, FOM and IITB have merged into the newly created Fraunhofer-Institute of Optronics, System Technologies and Image Exploitation IOSB. The integration of these institutes massively sustains the group by increasing the performance in the area of reconnaissance and guidance systems and, thus, the whole field of competence concerning defense. Likewise, the connection of the institutes to the Fraunhofer science system permits to improve and expand civil application of research findings.

In addition to the intensive cooperation with the German Ministry of Defence and the support it provides in the development of new technologies for the protection of soldiers, the group considers its main tasks and objectives as follows:

- Guarantee dual-use research and civil/military know-how transfer
- Provide excellent academic quality through integration into the international scientific community
- Support the defense-related industry by means of joint research
- Research strategic orientation as regards application in the fields of:
  - Command and control capability
  - Intelligence and reconnaissance
  - Mobility
  - Effective engagement capability
  - Support and perseverance
- Align the strategic orientation of the member institutes against the background of a future European security and defense policy.

Fraunhofer VVS overview



- Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut, EMI
- Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR
- Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE
- Fraunhofer Institute for Applied Solid State Physics IAF
- Fraunhofer Institute for Chemical Technology ICT
- Fraunhofer Institute for Integrated Circuits IIS
- Fraunhofer Institute for Optronics, System Technologies and Image Exploitation IOSB
- Fraunhofer Institute for Technological Trend Analysis INT
- Fraunhofer Institute for Telecommunications HHI

TRENDS IN RESEARCH AND TECHNOLOGY

Dr. Matthias Grüne



The services of the Business Unit "Trends in Research and Technology" are based on a balanced overview and an interdisciplinary assessment capability of all technological developments relevant for state and industry. By analyzing the current state and expected future in technology, we offer orientation to planners and decision-makers in an ever-more complex environment. The Business Unit mainly concentrates on the substantive debate on research and technology themes and on creating a working dialog with researching scientists and clients (technology planners). The business unit's services are mainly provided by the department "Technology Analysis and Foresight (TAV)".

The year 2010 was strongly shaped by the development and implementation of a new concept for the "Wehrtechnische Vorausschau" (Defense Technologies Forecast), which Fraunhofer INT produces in support of planning within the German Federal Ministry of Defense (BMVg), as described below. The network status that the Business Unit has meanwhile achieved in the futures researchers' community was made apparent in two conferences of "Netzwerk Zukunftsforschung e.V.", an association for science-based futures research, held at Fraunhofer INT. Our own methodological competence was put to use advising (amongst others) the Federal Ministry of Education and Research (BMBF) and the Bundeswehr Transformation Center (ZTransfBw).

Our expertise in the scientific contents of technology foresight was also in demand. Consequently, unit staff was invited to take part in workshops at the Federal Criminal Police Office (BKA) and as part of an EU project to assess the security relevance of future progress in technology.

Owing to the widening awareness of our technology foresight services, the quantity of industrial projects (including follow-on orders) increased to such a positive level in 2010 that a few orders had to be spread over longer periods. Our view of future technology was introduced in detail in two conferences for industrial clients, planned and staged in cooperation with Fraunhofer Academy and the consultancy firm "Geschka & Partner Unternehmensberatung". Regarding technology foresight as the front end of innovation management, unit staff was invited to contribute to a book published in 2010, and to speak and take the chair at a highly-regarded conference.

Work in the Business Unit subdivides into the following four fields.

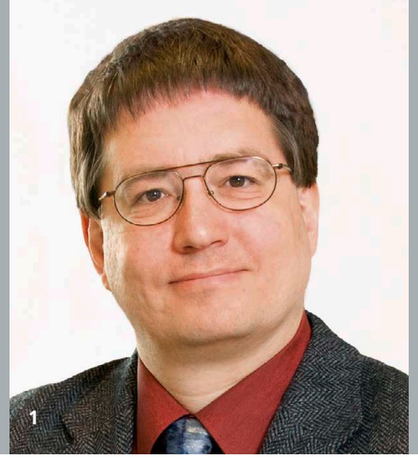
Technology Foresight: Overview of Future Themes

Technology Foresight serves to create the most comprehensive overview of future scientific and technological progress and its application potential. This calls for the continuous assessment of all relevant sources (scientific papers, conferences, etc.).

The most important result of this work is the so-called "core topics". These are highly dynamic research and high-tech development themes that show great application potential. These themes provide the basis for further investigation. Results from technology foresight are usually published, e.g. in the form of the monthly INT column "Neue Technologien" („New Technologies") in the professional journal "Strategie und Technik" („Strategy and Technology"). More than 150 articles on individual core topics were thus published between 1996 and 2009, and summarized in 2010 in the book "Neue Technologien" (publisher: Report Verlag). The book provides a good overall view of technological progress in the past years, with numerous longer-term trend statements still being up-to-date.

Advancement in Methodological Tools

The critical examination of one's own methodological basis and its further development is a self-evident part of the work of



a scientific institute. In 2010, the spotlight was on our own bibliometric processes and tools, which were formed into a practical toolbox that constantly undergoes improvement. With progress on the principles of text mining, the foundation was laid for developing existing instruments to the level of relationships between keywords.

In-depth Technology Analyses

In Technology Analyses, a series of technological questions undergoes long-term, in-depth examination with regard to their future potential and/or defense relevance. The focus is currently on materials, energy technologies, unmanned systems/robotics, information and communications technology, biological technologies/life science and optical technologies.

The unit's comprehensive, in-depth competence in all material types illustrates its unique selling proposition regarding materials. This competence is regularly documented in our own series "Werkstofftrends" (Materials Trends) in the specialist journal "Werkstoffe in der Fertigung" (Materials in the Production Process), as well as in presentations at materials conferences. A large proportion of the industrial projects was acquired in this area of competence.

Analysis of Future Defense Technology – The Technology Radar for the Federal Ministry of Defense

The task of Future Defense Technology Analysis is to assess and describe the (especially long-term) relevance of future technology progress for the Federal Armed Forces (Bundeswehr) in the light of foreseeable threats and the capabilities required. The main result is a document called Defense Technologies Forecast (Wehrtechnische Vorausschau – WTV). From the beginning of 2011, this is to be published in a modernized form, better adapted to the changed requirements of the users in the Federal Ministry of Defense. Appearing quarterly in a compact and well structured form, the document examines key technological topics that have been identified as especially relevant regarding general technological and defense-related potential, as well as for ministerial planning. Relevance is analyzed and recommendations are generated in cooperation with the Business Unit "Planning, Programs and Structure in Research and Technology".

The Business Unit's participation in various international bodies cooperating in defense technology prognoses serves the continuous improvement and updating of assessment standards. In 2010, results from Future Defense Technology Analysis were also incorporated into the technology assessment process of the Round Table of BMVg-financed institutes and into the General and Admiral Staff Courses at the Führungsakademie (Staff College) of the Bundeswehr.

1 *Dr. Matthias Grüne*

ASSESSMENT OF POTENTIALLY DISRUPTIVE TECHNOLOGIES FOR DEFENCE AND SECURITY

Dr. Ulrik Neupert



1

Technological development is a major driver for enhancing the capabilities of armed forces. In the NATO states, there are consequently many projects concentrating on technological forecasting. Accordingly, for more than 35 years, Fraunhofer INT's defence technology forecast has generated an overview of global development in research and technology, from which implications for planning and decision-making in the Federal German Ministry of Defence are derived.

Among NATO partners, the fact that the application relevance and effects of newly appearing technologies are not adequately analyzed was considered to be a deficit in technology forecasting. This is especially so when such developments are not made comprehensible by extrapolating observed trends. Demanded is close cooperation between scientists and military users, in order to achieve a common understanding of technological possibilities and military requirements.

For this purpose, the activity SAS-062 "Assessment of Possible Disruptive Technologies for Defence and Security" was launched in 2006, under the Systems and Analysis Studies Panel (SAS) of NATO's Research & Technology Organization (NATO-RTO). The result was the generation of a method of assessing new technologies, called "Disruptive Technology Assessment Game" (DTAG). Since 2009, this method has been used in the follow-on activity SAS-082 "Disruptive Technology Assessment Game: Extension and Applications" for assessing technologies in a military context. Fraunhofer INT's business units "Trends in Research and Technology" and "Planning, Programs and Structures in Research and Technology" have been involved in both activities.

Of particular interest is the earliest possible identification of technologies with disruptive potential. In this military context, "disruptive" means that a technological development within a short time period forces radical changes for the planners, e.g. in assessing the threat, planning protective measures or capacity requirement.

The entire process of new technology assessment is conducted in four phases. First is technology monitoring within the individual states.Technology progress is identified and intuitively assessed for its defence technological relevance for a period beyond approx. 2020 (the Bottom-Up Approach). The second approach is to identify disruptive capabilities and to analyze them for their corresponding enabling (and therefore disruptive) technologies (Top-Down Approach).

In a second creative stage, system ideas are generated on the basis of the technologies identified. The background is that it is impossible directly to determine the effects of technologies. Instead, all that can be analyzed is the influence of systems and capabilities that can be realized in the future through such technologies. These system ideas are developed in the form of what are called "Idea-of-System-Cards" (IoS Card). The first page of an IoS Card gives a brief description of the system as needed for the following DTAG phase. The second and third pages contain more detailed information on the technologies, operational interest, performance parameters etc. that lie behind.

The third, central stage of this activity is the Disruptive Technology Assessment Game, where military personnel ("Blue" and "Red" Teams) with practical operational experience interact with technology experts in a fictitious conflict scenario to test the potential of the system ideas. These DTAGs each last one week, during which varying military operations, mostly four in number, are played out. The focus is on the course of the conflict simulation and on the qualitative assessment of the system ideas. This distinguishes the DTAG from the much more extensive "War Game", in which the technical specifications are much more sharply defined and where simulation-based quantitative statements are made. This approach, however, is less suited for more distant future technologies, where the systems derived cannot be so easily modeled with a sufficient depth of detail.

In the final phase, evaluation is made of information collected and documented in detail from several DTAGs with regard to system application, effects on the course of military operations, possible countermeasures and improvement suggestions etc. Against this background it now becomes possible to make sound statements on the disruptive potential of the technologies behind the system ideas. This is the basis on which recommendations for R&T Planning can be made.

The phases of this approach (identifying promising technologies, creating system ideas, assessment game, analysis with a view to planning support) incorporate characteristics of greatly varying foresight methods, which makes the approach favorable from the methodological viewpoint. The approach includes creative elements of unlimited thinking, and the DTAGs present an open communications platform. At the same time, bringing together technology experts and military personnel can avoid the drawing of unrealistic technological or tactical conclusions. During the latest DTAGs, NGOs (Non-governmental Organizations) such as the Red Cross were additionally included, to create an even more realistic situation.

The Disruptive Technology Assessment Game has proved to be a fruitful discussion forum for technologists, analysts and military commanders of varying backgrounds regarding education, nationality and experience. It has created a challenging atmosphere that makes participants look beyond their daily horizons. Such a structured form of assessment has also shown itself to be a cost effective way of advising decision-makers on investments in military systems or their underlying technologies. The NATO-SAS DTAGs thus far conducted have logically concentrated on military scenarios. However, the method can in general also be applied to civilian security scenarios.

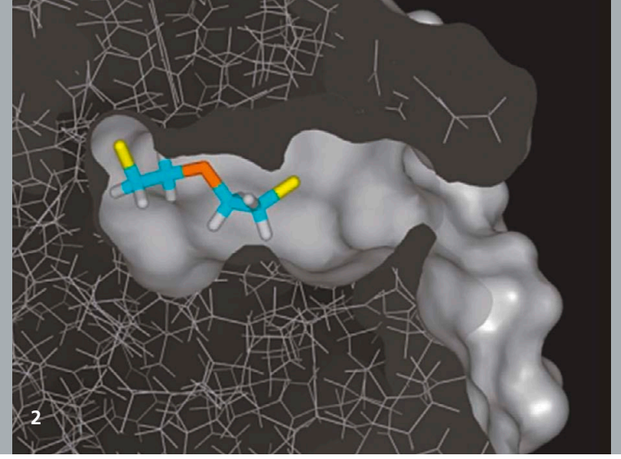
1 *Disruptive Technology Assessment Game, Stockholm 2009*

ENZYME TECHNOLOGY

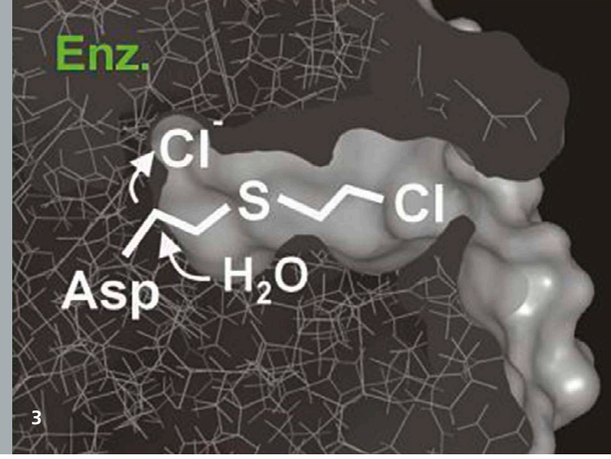
Dr. Roman Kernchen



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Enzymes have long been successfully used in a variety of applications in food and animal feed production, and in the agriculture, paper, leather and textile industries. The number of applications is increasing dynamically. Simultaneously, the rapid progress in key areas such as protein engineering, bioinformatics and genetic technology, together with the considerable degree of new insights in molecular biology in the last few years, have stimulated a greater pursuit of enzyme technology approaches in pharmaceuticals and chemistry.

Enzyme technology also has various defense technology applications, currently being examined by Fraunhofer INT with regard to their importance to Germany's Federal Armed Forces. The initial step for this in-depth examination was an expert's report ordered from Fraunhofer IGB in 2009. Important defense applications of enzyme technology are NBC protection and bioremediation for soils and water contaminated by toxic explosive and propellant components. In addition, following stricter environment legislation, development in enzyme-based antifouling paints for high-speed ships is being pursued more intensively.

Enzymes are capable of acting as effective, environment-friendly catalysts in the detoxification of organophosphates such as the nerve gas agents Sarin, Soman, Tabun and VX, and other combat and hazardous materials. With C-decontaminants, they have for some time thus been a focal point for research and development; the first products are already marketable. Also in B-decontamination, enzyme-based materials are currently being developed and tested with success. Enzymes continue to play a major role in developing biosensors for detecting biological and chemical combat and hazardous materials.

Apart from this general analysis of the technology's importance in defense, Fraunhofer INT was also involved in two scientific NATO programs which conducted closer examination of several enzyme technology application areas. Under NATO's Research & Technology Organization (NATO-RTO), experts from several NATO member states worked on the project AVT-177 "Munition and Propellant Disposal and its Impact on the Environment", investigating environmentally-friendly approaches for disposing of munitions and propellants. In this context, Fraunhofer INT presented the theme "Biological Approaches to Degradation of Explosives and Propellants" at the 2010 ATV Panel Meeting in Antalya (Turkey). Already in the previous year, the author was present at the Advanced Study Institute (ASI) in Tashkent, Uzbekistan - organized under the NATO program "Science for Peace and Security (SPS)" – to lecture on the theme "Biodefence: Advanced Materials and Methods for Health Protection". The author presented the importance of new nanotechnology approaches for enzyme stabilization (published at Springer Verlag).

1 *A first-aid worker decontaminating a vehicle, using an enzyme-based, marketable decontamination material developed by the Edgewood Chemical Biological Center (ECBC). The decontamination foam can neutralize nerve gas agents containing organophosphates as well as various pesticides. Source: ECBC (http://www.ecbc.army.mil)*

2 *Enzyme-based decontamination: Haloalkane dehalogenase, an engineered enzyme that uses a hydrolytic mechanism to convert toxic sulphur mustard into non-toxic thiodiglycol. The binding site for the enzyme and the chemical agent sulphur mustard is shown above. The reaction mechanism* **(3)** *as the molecule is split when the enzyme catalyzes the chemical reaction by reacting with water is also shown. The enzyme was developed in Loschmidt Laboratories in the Faculty of Science at Masaryk University in Brno. Source:*
Dr. Zbynek Prokop, University Brno

PLANNING, PROGRAMS AND STRUCTURES IN RESEARCH AND TECHNOLOGY

Dr. Joachim Schulze



The business unit Planning, Programs and Structures in Research and Technology (R&T) supports clients in their R&T planning and strategic decision-making. To this end, we produce in-depth analyses on the basis of the methodic and substantive competence we have acquired in security and defense research.

We have hitherto evaluated various types of research management and written comparative studies, for example on national defense and security research programs in Europe. We present the results in computer-based information systems in order to make complex connections plain for the client.

Another major area is evaluating emerging technologies with regard to their special relevance for the client and helping to position relevant technologies in the client's R&T planning.

A particular methodic strength of this area is scenario-based roadmapping, where we observe developments in up-and-coming technologies and systems against the background of a variety of future perspectives.

The area's tasks are carried out by our team of scientists from many different disciplines. The spectrum ranges from the pure sciences (Physics, Geophysics, Biology, Pharmacy, Biochemistry, Chemistry), Engineering and Humanities, to Economics, Informatics and Mathematics.

We monitor developments in a number of defense-relevant organizations and agreements, within and outside Europe, and we document such developments in information systems (e. g. esfo – European Security Research) and studies ("Germany's international Activities in Security and Defense", "NATO: Strategic Concept", etc.) The synergy effects that we observe through defense and security research comparison in Europe are profitably applied in national R&T and future cooperation areas.

With this information basis, clients such as BMVg commission us to act as national representative in international meetings, for example in R&T at the European Defense Agency or for the Letter of Intent 6 (LoI 6) Framework Agreement, Group of Research Directors.

We are active in the 7th Framework Programme of the European Security Research Programme: As part of the projects ETCETERA and CRESCENDO we support the development of future EU Framework Programmes by determining priorities and setting up networks. With the EU project ACRIMAS we are working towards improved crisis management procedures at European level (natural disasters, terrorist attacks and industrial accidents). In the EU's DEMASST project, we are examining risks to public transport (such as rail traffic) from catastrophes and terrorist attacks.

R&T Planning in Security and Defense, Structures, Programs and Markets

This business unit supports the German Federal Ministry of Defense (BMVg) in the design of its R&T processes. Changes in strategic or R&T environments regularly demand that R&T planning be adjusted to meet the current situation. For these adjustments we provide scientific support both methodically and concerning content.

Assessment Models for CBRN Threats and Critical Technologies

Our weighted bit assessment table of hazardous chemicals has found wide usage. We are planning to extend this software with new methods of evaluating critical technologies. We are chairing a working group of the Commission on Civil Protection of the Federal Ministry of the Interior. This is also an advisory group in the context of our feasibility study for the Federal Office of Civil Protection and Disaster Assistance (BBK)



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regarding an evaluation system to improve estimates of possible dangers and abuse regarding biological substances.

To evaluate critical new technologies, we use various methods in internationally staffed working groups (LoI6 Disruptive Technologies Group, Trilateral Cooperation).

Scenarios and Technology Roadmaps for new Technologies in Security and Defense

With expert workshops and the help of scenario technology, various future perspectives can be evolved into a number of consistent scenarios. For each selected scenario, these workshops highlight relevant influences and their possible changes for the years 2015, 2020 and 2025. The information that results leads to technology roadmaps.

The technology roadmap "Intelligent Mobile Systems" will be available in mid-2011. As with the roadmap "Self-healing Materials", it is primarily addressed to the decision-makers in research bodies, and it examines risks and opportunities for the development of intelligent mobile systems in security areas. One use, for example, is the distribution of emergency supplies to the population in case of natural disasters.

Owing the increasing demand from industry and industrial associations, we are planning to produce up to two roadmaps a year on selected technologies, in cooperation with the industries concerned.

Textmining and Bibliometry for R&T Planning

Business Unit 2 applies textmining and bibliometry in the case of R&T data on security and defense (e. g. from data banks on patents and publications, project and technology descriptions, the Internet, etc.). We use both tested methods and new methods developed by us to answer specific client questions. Among other systems, textmining and bibliometry have thus proved themselves useful supports for R&T planning at BMVg.

1 *Dr. Joachim Schulze*

THE INFORMATION SYSTEM "EUROPEAN SECURITY RESEARCH"

Dr. Joachim Burbiel

European security research is a complex and dynamic subject. Its primary purpose is to identify threats and dangers, and to counter them through research and development. Security research is closely related to the European security and defence market, since economic interests play a major role in its development.

For several years, the staff in "Planning, Programs and Structure in Research and Technology" have been analyzing Europe's security research landscape. As part of the project "Applying Defence Technology Competence to Civilian Fields", a program supported by the Federal State of North Rhine-Westphalia, Unit 2 scientists have condensed facts and data about actors, structures and programs, into a web-based information system. The system primarily addresses scientists and research planners in security-oriented companies and organizations.

The Information System „esfo"

"esfo – European Security Research" is an information system that provides an overview of:

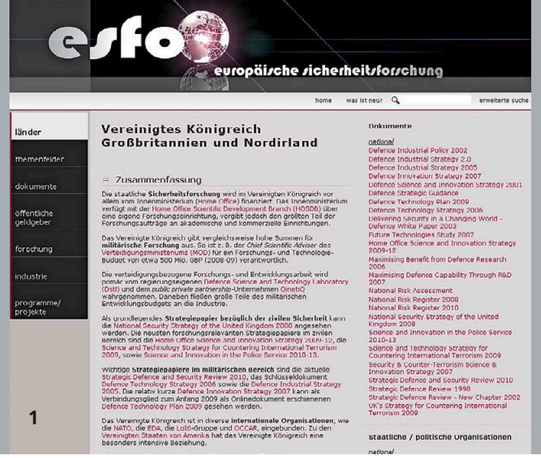
- the current state of security and defence research,
- relevant national and international research plans, priorities and strategies and
- the security and defence research and technology landscape of selected countries.

It currently contains relevant information on:

- eight "core states": Germany, France, Israel, Italy, the Netherlands, Sweden, Spain and the United Kingdom
- the European Union as a political and economic actor
- approx. 60 strategy documents
- approx. 80 organizations and public finance sources
- approx. 50 research organizations and centers
- approx. 80 companies and industrial associations
- approx. 30 research programs and projects.

A special feature of esfo is that these data are linked by a complex ontology (for example showing that "nation a is participating in project b", or that "document a contains information on organization b"). These links enable the users to identify connections that would otherwise only be difficult to recognize.

Since January 2011, the major part of esfo has become available to the general public free of charge at www.sicherheitsforschung-europa.de. There is a charge for the premium sector, which offers a range of in-depth analyses on a variety of key subjects.



Outlook

As an information system, esfo is run permanently and updated on a regular basis. It is intended to help the work of Business Unit "Planning, Programs and Structures in Research and Technology" reach the outside world and increase public awareness of it. Through the creation of a new brand and by providing a free service to a broad range of users, the reaching of new customers and the retention of existing clients are facilitated. The "esfo" information system thus supports the medium term development of Business Unit 2.

1 *Page of the esfo information system (Homepage: www.sicherheitsforschung-europa.de)*

RECOGNIZING TOMORROW'S INNOVATIONS TODAY

Dr. Dirk Thorleuchter

Recognizing Innovative Ideas through Data and Text Analysis

Behind each of tomorrow's successful products is an innovative idea from today. Fraunhofer INT identifies those ideas in a variety of technology and application fields, and their future potential is evaluated by using data and text analysis methods. The results can show promising ideas for an individual company, and this can accelerate the company's innovation process.

The innovation process – the path from a new idea, via research and development, to a new product and its introduction to the market – is both costly and time-consuming. Moreover, only few ideas lead to real innovation, to economically successful products. So the selection of an innovative idea as a starting point for the innovation process is vital for its success.

Broad Method Spectrum

The approach developed here is based on the philosophy of technology, according to which a new idea comprises not just a new means, but a combination of means and end. In addition, a characteristic of an innovative idea is that it leads a technology (means) to an application field (end) for the first time. We identify the technologies and applications behind the end and the means of an idea, thus discovering ideas that combine technologies and applications for the first time. In doing so, the search is restricted to just those technologies and applications that are relevant for a client company.

The Search for new Applications for existing Technologies or for new Technologies for existing Applications

Thus, for one client, we searched for new possibilities for extracting information from the very broad ultraviolet spectral range. To this end, reports in German and international research promotion data banks were surveyed with the use of automated data and text analysis. It was possible to find an innovative idea in an American SME promotion research project: for the first time, Focal Plane Array Technology, in which a sensor comprises a two-dimensional field of detectors in the focal plane, was examined regarding its application in the far ultraviolet spectral range (~130 nm), differing from the otherwise usual application in the infrared spectral range.

Further information is available at: www.text-mining.info

ACTIVITIES IN EUROPEAN SECURITY RESEARCH AND IN THE FP7 SECURITY RESEARCH PROGRAM

Dr. Ruth Schietke

For a considerable time, Fraunhofer INT has been working in European Security Research, in particular as an active member since ESRAB (European Security Research Advisory Board) and ESRIF (European Security Research and Innovation Forum). Against this background, Business Unit 2 that has above all constantly expanded its network in meetings and groups (e. g. in the Security Advisory Group SecAG and in EUROTECH (see below), participated in projects of the first Call (CRESCENDO, DEMASST), and taken over coordination for two projects of the third Call (ACRIMAS, ETCETERA).

An example of the high regard for Unit 2's support of Europe's security research process was already seen in October 2009, when a staff member was appointed to the European Commission's SecAG. This independent body advises the European Commission on the annual organization of its security research program in the 7th Framework Program (FP7, 2007-2013). Advisory work encompasses the continuation of the underlying research strategy, defining individual research targets and priorities in the annual programs, and selecting the subjects of calls for tender. Our contributions focus on Foresight & Scenarios and on Crisis Management, while upholding continuity at ESRIF.

INT's growing and increasingly successful networking in Europe is also demonstrated by its participation in the EUROTECH Security Research Group, a group of larger Research and Technology Organizations (RTOs) within the European syndicate EARTO, which focuses on security research. The main purpose of the EUROTECH Group, with its members AIT, CEA, DGA, FhG, FOI, IABG, JRC, ONERA, SINTEF, Tecnalia, TNA and VTT, is to enhance research, development and innovation in Europe. This occurs in cooperation with industry, the end-users and with government bodies. INT represents the Fraunhofer-Gesellschaft in the EUROTECH Group.

The RTOs in EUROTECH participate in a large number of EU security research projects. When a project consortium is set up, preferential treatment is given to EUROTECH Group partners, which reflects the useful and successful cooperation of RTO amalgamation. INT profited from our participation in the EUROTECH Group, successfully expanding our activities in European security research, e. g. in the following projects:

Participation in the EU FP7 Security Research Project CRESCENDO (Coordination action on risks, evolution of threats and context assessment by an enlarged network for an R&D roadmap) – which is coordinated by CEA (France) – concentrates on recommendations for continuing the European Security Research Program in respect of the CRESCENDO roadmap that is to be processed. The focus is again on the ESRIF themes mentioned above, in which Business Unit 2 was largely involved. It is now a question of making concrete future research fields of these themes.

INT also took part in the project DEMASST (Demo for mass transportation security: roadmapping study), coordinated by FOI, Sweden. This was Phase 1 of a demonstration project for security in mass transportation, focusing mainly on mass transportation by rail and subway. In this project, a threat analysis was produced considering the current security status for mass transportation. In turn, this led to a gap analysis, with technical solutions for the gaps being aligned with the wishes of the end-user, so that an integrated solution list could be produced. This paves the way for Phase 2 of the demo, the project which is being carried out in SECUR-ED (Secured Urban Transport European Demonstrator), and coordinated by the company Thales.

In addition, Business Unit 2 was successful in becoming coordinator for the EU Security Research Project ACRIMAS (Aftermath Crisis Management System-of-Systems Demonstration – Phase 1). This project, with 15 participating partners and running for 15 months, was launched in february 2011. The purpose is to prepare the demonstration program (Phase 2) for Crisis Management in Europe. Primarily, this will be achieved by developing a demonstration concept for crisis management and by identifying and structuring suitable plans for the demonstrations and experiments intended.

Unit 2 is also coordinator for the FP-7 Project ETCETERA (Evaluation of critical and emerging technologies for the elaboration of a security research agenda), which has two aims:

- Under the heading Critical Technologies, the intention is to identify technologies necessary for security, especially those technologies where European industry is dependent on other parts of the world. It is also a matter of looking for alternative technical solutions that will allow European-made security products to be applied, sold, and put into operation worldwide.
- The second aim is to identify Emerging Technology themes (over a time-frame of 10–20 years) which would rank as highly-speculative research fields (high risk, high payoff).

The project is planned to run for 24 months.

We are also participating in five project applications in the fourth Call of the EU's FP7 Security Research Program (SEC-2011).

NUCLEAR EFFECTS, THREATS AND DETECTION SYSTEMS

Dr. Wolfgang Rosenstock



This work area conducts theoretical and experimental research and development in the fields "nuclear radiation effects in electronics and optoelectronics" and "nuclear security policy and detection techniques". Besides basic research, numerous contract research projects are carried out for customers from industry (aerospace suppliers, nuclear research and nuclear technology) and from the public sector (largely for public bodies and organizations with security tasks, and for major research centers). With basic funding from the Federal Ministry of Defense (BMVg), BU 3 also deepens and expands the national ability to assess threats in the field of nuclear and radiological weapons and associated asymmetric threats. In addition, the Unit was present with a booth at the 2010 International Air-show (ILA) in Berlin. Demonstrated were both the influence of cosmic radiation on electronics and optoelectronics, and measuring methods for the early detection of "dirty bombs".

To fulfill these tasks, BU 3 operates various nuclear radiation-simulation- and irradiation-facilities:

- several neutron generators (14 MeV and 2.5 MeV)
- an X-ray-flash system for pulsed photon and electron radiation
- Co-60 irradiation facilities
- a proton cyclotron irradiation spot at the Nuclear Research Center (FZ) in Jülich
- a heavy ion irradiation spot at the Centre for Heavy Ion Research (GSI) in Darmstadt
- an isotope laboratory

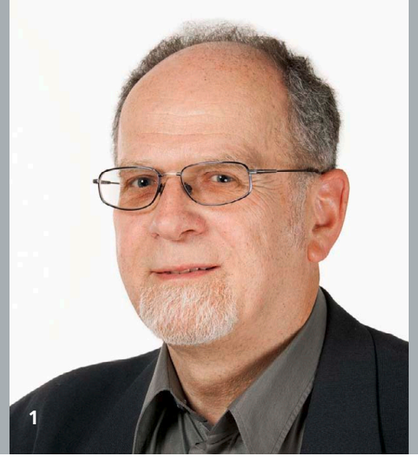
For the safe operation of these irradiation facilities and the handling of the numerous radioactive substances, INT has the appropriate radiation protection infrastructure and a permit to operate in third-party nuclear facilities. All experimental work is supported by a precision engineering laboratory which produces special mechanical parts for the experimental facilities, as well as by an electronics laboratory that handles custom-made production, maintenance and repair work for experimentation electronics.

Radiation Sensitivity of Electronics and Systems

Generally, further investigation deepened BU 3's knowledge of the impact of space weather (solar wind and galactic cosmic radiation) on satellites in general, and on avionics in particular. Also, the first steps were taken towards certification according to ISO 9001, which is expected to be finalized in the coming year. Thanks to the Second Economy Stimulus Package, experi-ment apparatus saw considerable expansion (see also p. 48). In January, the second workshop "The Space Challenge" was very positively received. As part of the program of the Carl-Cranz-Gesellschaft (CCG), our Institute is cooperating closely with Fraunhofer FHR (in Wachtberg) in staging a seminar titled "The Space Situation – Threats and Protection for Space Systems" in May 2011. Simultaneously, coopera-tion with the Federal Armed Forces' Space Situation Center (WRLageZ) was intensified. Together with the Fraunhofer Ernst Mach Institute (EMI), INT also began construction on the Fraunhofer Gesell-schaft's "Competence Center on Satellite Vulnerability".

For the effects of ionizing radiation in electronic circuits, ex-tensive studies were carried out on components, circuits and assemblies, as well as on optoelectronic components. The in-vestigations were mostly conducted at the irradiation facilities of Fraunhofer INT, as well as at a proton irradiation station set up by INT on the cyclotron of the Nuclear Research Center FZJ in Jülich.

Under the direction of INT, a new irradiation station was con-structed at the Helmholtz Centre for Heavy Ion Research (GSI) in Darmstadt, as part of a multinational project of the Euro-pean Space Agency (ESA). This station is used for the study of electronics for space application, and goes hand in hand with considerable competence expansion and a further irradiation facility for external clients. This allows for new SEU (single event upset) and SEFI (single event functional interrupt) analy-sis methods in dynamic memory components, by irradiation with high energy heavy ions. Testing power semiconductors



to evaluate their use in radiation environments is also possible. Results show significant differences from the conventional tests at low-energy accelerators. Together with Fraunhofer EMI, work was done on an ESA project on the impact risks to solar cells from debris particles or micro-meteorites.

For the international research center CERN, further studies were carried out on radiation effects in fiber optics, especially at low temperatures.

Nuclear Security Policy and Detection Methods

Political and technological developments in nuclear disarmament and possible proliferation were constantly observed, with analysis concentrating particularly on physical-technological aspects. Nuclear developments in Iran were especially observed and analyzed. Of special note here was the Review Conference of the Non-Proliferation Treaty in New York in May 2010, with a total of 172 nations attending. In spite of many difficulties, it was possible to produce a common final document which, among other things, calls for a nuclear weapon-free zone in the Middle East. To achieve this, a conference is to be held in the region in 2012. In addition, the nuclear situation in Iran was monitored and evaluated. Meanwhile, uranium has been enriched to a level of 19.75 % to fuel the Teheran Research Reactor (TRR), where the annual requirement is 6 to 10 kg of uranium enriched to 19.9 %. As part of the work in the ESARDA Working Group on Verification Technologies and Methodologies (VTM) – organized by the Non Proliferation and Nuclear Safeguards Unit at the Joint Research Centre in Ispra, Italy - developments in international disarmament treaties, including export controls and new safeguard technologies for the IAEA, were reviewed.

For the prevention and early detection of terrorist activity involving nuclear or radioactive material, state-of-the-art detection and measurement systems for the non-destructive identification of such substances were studied with a view to their suitability for use in the field. In realistic tests under difficult conditions, the systems were tested to establish capability and limitations. In particular, radioactive and nuclear substances were measured behind various shielding to this end. It was demonstrated that the automatic analysis programs of many measuring systems fail to deliver the reliable results that ideal laboratory conditions certainly make possible. Neutron measuring systems well suited to gauging hidden fission material also experienced new developments, as featured in the "Fission Meter Workshop" staged by INT in September 2010.

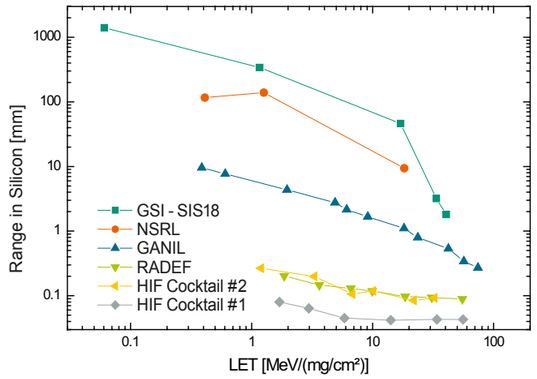
1 *Dr. Wolfgang Rosenstock*

At EU level, the issue of CBRN threats and their countermeasures was further pursued, with INT cooperating in the project DECOTESSC1 (Demonstration of Counter Terrorism System-of-Systems against CBRNE phase 1), which is part of the 7th EU Research Framework Program. This concerns the analysis of the CBRNE threat and suitable countermeasures (including R&T), as well drafting invitations for tender for a Phase 2 Project focusing on the demonstration of a consistent countermeasure system in the event of CBRNE attack.

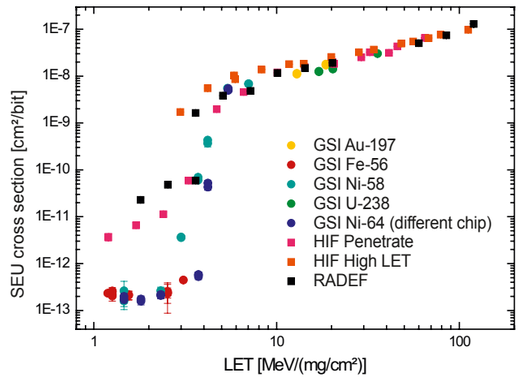
INT also filed corresponding tenders for the 4th call. In the project "Ukrainian border crossing station", aimed at strengthening the fight against smuggling radiological and nuclear material across Ukraine's border points, the requirements were compiled for the measurement systems to be installed. The project is being conducted under the European Commission program TACIS (Technical Assistance to the Commonwealth of Independent States). The project is organized by the European Joint Research Centre in Ispra, Italy.

INVESTIGATION OF SINGLE EVENT EFFECTS WITH VERY HIGH ENERGY IONS

Dr. Stefan K. Höffgen and Dr. Stefan Metzger



Range vs LET of several high energy ion accelerators



SEU cross sections of the ESA SEU Monitor for low energy (squares) and high energy (circles) ions

Galactic Cosmic Rays

For more than 100 years we have known that our solar system is being bombarded by galactic cosmic rays (GCR). These consist of electrons and nearly all the elements of the periodic table in a fully ionized state. The energy of the ions can be as high as 1020 eV, but they have their maximum fluence around 1 GeV/n (Energy of ion per nucleon). Here on Earth the atmosphere protects us from most of the GCRs, but in space they pose a serious hazard for satellites and manned missions. The primary effect of GCR on electronics comes from their ability to produce a considerable electrical charge inside a very small volume chamber, by direct ionization along their path within the device. This ability depends on particle parameters such as mass, charge and energy and is usually characterized by a quantity called linear energy transfer (LET). The higher the LET, the greater the charge per unit length produced by the particle by traversing some material.

If the LET is high enough it is possible that one particle is sufficient to significantly influence the condition of an electronic part. This is called a single event effect (SEE). There is a number of SEEs, but one of the most important is the single event upset (SEU). Here the particle causes the change of the logical state of a memory cell from 0 to 1 or vice versa.

The Experimental Advantages of Very High Energy Accelerators

Before electronic parts can be sent into space, they have to be qualified on earth to find out whether SEEs will cause a problem for overall system performance. These tests are usually done at heavy ion accelerator facilities. The ions at these facilities usually have energies of only a few MeV/n, very low compared to the energies of the GCRs.

Ions of this low energy have ranges of only a few cm in air and of only about 100 µm in silicon. These low ranges pose a lot of experimental problems necessitating complex tests which lead to large uncertainties of the result. As an example we describe the SEU test of a modern DDR2 SDRAM.

Because of the short range of the ions, the tests can only be done inside a vacuum chamber. This limits the number of parts to be tested during one beam time, because the chamber has to be evacuated after each change. It also makes it necessary to connect the device under test (DUT) inside the chamber to the test equipment outside the chamber via cables and feed-through connectors, but, e. g. modern memory chips such as DDR2 SDRAMs need to be very close (typically < 10 cm) to the test system because they have to be operated at high data rates.

The range of the ions is also too low to penetrate the package of the device. Even if the package is opened, the ions often still do not reach the sensitive region, because modern devices have too many metallization layers on top. The only way to test these devices with low energy ions is to reduce the substrate thickness on the back of the device to below 100 µm, which can destroy the device. But because the LET varies very rapidly at the end of the range of an ion, the so called Bragg peak, inhomogeneities of several µm along the chip can lead to significant differences of the LET at the sensitive region. Therefore, the inhomogeneities of the reverse side have to be interferometrically determined and the LET simulates individually for each memory cell.

Because of problems like these, the European Space Agency (ESA) has asked Fraunhofer INT to investigate the use of high energy accelerators for radiation testing. Figure 1 shows the range of ions versus the LET for several accelerators: The HIF and RADEF accelerators are official ESA radiation effects test facilities. They have the low ion ranges previously discussed. Ions with higher energy and longer range are available at GANIL, but the best accelerator to study effects of high energy ions is the SIS18 at the Gesellschaft für Schwerionenforschung (GSI) in Germany. Also shown is the NASA Space Radiation Effects Laboratory (NSRL) in America.

The SIS 18 is capable of accelerating almost every naturally occurring ion, from hydrogen to uranium, to energies of up to 1000 MeV/n, and even higher for the lighter ions. It thus covers the energy range of maximum GCR flux. The beam is delivered inside an experimental cave. Here experiments can be done in air, the devices can be used in their original condition and it is possible to have the measurement equipment very close to the DUTs.

Some of the experimental advantages mentioned above have been successfully shown by Fraunhofer INT for DDR2 SDRAMs and power MOSFETs. Fraunhofer INT is planning to offer irradiations at GSI to third parties in the future.

Energy Effects

As well as experimental advantages from the much higher range of high energy accelerators, energy effects are another point which makes them so interesting for the radiation effects community. There are indications that particles with the same LET but different energies have a different SEU cross section.

There have been older studies showing a reduced cross section for high energy ions near the LET threshold. The threshold is the LET below which a particle does not produce enough charge to cause an SEE. Theoretically the cross section below the threshold should be zero. The shift of the threshold to higher LETs was explained by the fact that ions with higher energy produce secondary electrons with higher energy which can travel a greater distance. The electron density in the track core is therefore slightly reduced, which means there are not enough electrons to upset the memory cell.

A reduction in cross section for higher energy ions would mean that current low energy tests are worst case. But more recent studies found a surprising increase of the cross section below the LET threshold for ions with energies of about 45 MeV/n compared to ions of about 10 MeV/n. This was explained by nuclear reactions. Apart from ionization, high energy ions are also capable of disintegrating both themselves and the target nuclei into smaller fragments. If these fragments have a higher LET than the primary particle they are able to induce SEUs. If these nuclear processes contribute significantly to the SEU cross section then LET is no longer a valid parameter for SEU tests.

The interesting question is whether these increases of the cross section are significant for really high energy ions in the range of several 100 MeV/n. To study this, Fraunhofer INT conducted measurements with what is known as the ESA SEU Monitor. This is a system based on an SRAM chip that is used to compare the dosimetry of different accelerators. The results can be seen in Fig. 2. The low energy data is represented by squares and the high energy data by circles. For this chip and energy range the cross section for the high energy ions is about two orders of magnitude lower than for the low energy ions.

ELECTROMAGNETIC EFFECTS AND THREATS

Dr. Michael Suhrke



With basic funding from the Federal Ministry of Defense (BMVg), the Business Unit Electromagnetic Effects (EME) has the task to contribute to the development in the ability to assess electromagnetic effects regarding military threats. Since this task is not addressed at all in the non-military sector and only in small subsections in the military sector INT conducts its own theoretical and experimental research. Besides, measurement technology and the control and analysis of measurement instrumentation are being developed continuously. In addition to basic funding, project research for clients outside BMVg (authorities and organizations with security tasks, space flight area) becomes increasingly important. The Unit has the support of its own mechanical laboratory, as well as an electronics laboratory.

The Unit's experimental work on electromagnetic threats (in particular the threat from high power microwaves, HPM) is coordinated with Section IV 2 in the Armaments Directorate of BMVg, in part through the Virtual Competence Center EME of the Bundeswehr (VCC EME). Work is done as well in cooperation with companies from the defense field. Research is conducted on coupling electromagnetic fields (e.g. HPM) into structures and specific systems, as well as on the vulnerability of electronics by HPM and other high intensity electromagnetic fields. This takes account of basic circuit technology and component families, as well as of effects in actual devices and systems. The current emphasis is on studies of EME vulnerability in IT devices and systems on the basis of state-of-the-art technology, and in particular on wired and wireless data transmission technology (network technology). Basic studies and experiments are also conducted on detection techniques for electromagnetic threats, especially HPM threats, as well as on EME susceptibility tests on HPM detectors.

INT operates a self-developed TEM waveguide field simulation facility, housed in a shielded hall which is suitable for the frequency range from 1 MHz to 8 GHz. The facility allows linear coupling measurements to determine transfer functions, and investigations on electromagnetic compatibility (EMC) as well as susceptibility measurements with constant and pulsed fields with field strengths of up to several kV/m on objects with volumes up to several m^3. For external measurements, such as in the EMC hall at Bundeswehr Technical Center 81 in Greding or at airports, INT developed its own mobile HPM irradiation facility. Using horn antennas, this generates field strengths of up to 5 kV/m within a frequency range of 450 MHz to 3.4 GHz. The facility is built into a Bundeswehr telecommunications shelter that can be transported to a measuring site. INT also owns a reverberation chamber, a small absorber room for radiation up to 40 GHz, and extensive high frequency and microwave measuring equipment. Funded by North Rhine-Westphalia's investment promotion legislation and the second Economic Stimulus Package, the capability of HPM sources and measurement equipment is being extended to higher frequencies, in order to account for the growing number of applications for modern sensor and communications technology in higher regions up to 18 GHz.

Further studies on the operation of the reverberation chamber procured in 2008 also served to expand measurement capacity for INT. In the working volume of approx. 1 m^3, INT's pulse generator can couple high energies of approx. 10 kW into the chamber in a range between 520 MHz and 18 GHz. This facilitates field strengths of more than 20 kV/m in the empty chamber. Apart from basic studies on usage with pulse modulated microwave signals, the chamber is intended for susceptibility tests on small test objects. A contribution on investigations of the pulse operation of the chamber earned a Best Paper Award at the 2010 EMV Conference in Düsseldorf, and was presented at the AMEREM 2010 in Ottawa. With the new pulse amplifiers, field strengths of about 10 kV/m can be produced between 4 and 18 GHz. A broadband antenna developed by INT to couple high power signals into the chamber was investigated and subsequently optimized in 2010 by a student at the University of applied sciences Bonn-Rhein-Sieg as documented in the graduation paper "Simulation and measurement technological Characterization of a Discone Antenna".



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Cooperation in NATO's RTO SCI-198 Task Group "Protection of Military Networks Against High Power Microwave Attacks" was continued in 2010 with evaluations of measurement results from INT investigations from the previous year which were part of an international test campaign on HPM sensitivity of a modern military IT network. Measurements on an HPM detector developed by TNO, NL in the TEM waveguide and in the reverberation chamber served to verify the sensitivity and robustness thresholds from earlier measurements. In the same context, a further test was carried out in the INT waveguide, investigating a sensor for high field strengths in the microwave range, as developed by a Lithuanian member of NATO's RTO SCI-198 Task Group.

Also in connection with NATO's RTO SCI-198 Task Group, investigations started on the susceptibility of network components (media converters) that had proved to be particularly sensitive in prior investigations. Various types of media converter were tested. In addition, INT began cooperation in NATO's RTO SCI.227-ST "Directed Energy Weapons (DEW) Related Capabilities: Near, Mid, Long Term Prospects".

In the civilian security research, INT took up its tasks in a working group on electromagnetic effects in European Reference Network Critical Infrastructure Protection (ERN-CIP). Also, in compliance of the European Commission's call under the 7th Framework Program on Security Research on the "Protection of Critical Infrastructures against High Power Microwave Threats", INT is a partner in the consortium HIPOW submitted under the leadership of FFI Norway. In Germany's national program "Research for Civilian Security", which is part of the high-tech strategy of the Federal Ministry of Education and Research (BMBF), INT is contributing on the subject of the electromagnetic threat by participating in the working group on air traffic within the innovation platform "Protecting Transport Infrastructures".

With the support of start-up funding from the State of North Rhine-Westphalia, numerical investigation continued on the coupling of electromagnetic pulses in the INT waveguide, as well as on the electromagnetic properties of metamaterials with an artificial refraction index. In order to describe the waveguide, measurements started of electromagnetic properties of the absorber material with the help of coaxial cells.

Simulations were conducted with the program packages CST Studio Suite and CONCEPT II. Replacement was finalized of INT's Linux cluster by a modern blade system, thus expanding numerical capacity.

The work begun in 2010 on the ESA project "Metamaterials for Optical and Photonic Applications in Space" has meanwhile led to the selection and examination of a favored application. Sub-contract work was finished in 2010 for Fraunhofer EMI on the ESD sensitivity of solar cells in a space environment, part of the ESA project "Susceptibility of Solar Arrays to Micrometeoroid & Space Debris Impact". In addition, theoretical studies were conducted on NEMP and HPM threat scenarios, on HPM source development and in answer to specific questions from BMVg.

1 *Dr. Michael Suhrke*

OPTICAL APPLICATIONS OF METAMATERIALS

Dr.-Ing. Grzegorz Lubkowski

Metamaterials are artificial structures with unusual properties not observed in the constituent materials and not readily available in nature. The term metamaterial became popular at the beginning of the third millennium, when negative magnetic permeability structures were proposed and negative refraction experiments were demonstrated. Interesting novel ideas followed the initial experiments, e.g. light focusing with a planar lens or electromagnetic cloaking.

The first metamaterial geometries occurred in the microwave regime characterized by the relatively easy mode of fabrication and test. Due to the scaling properties of Maxwell equations and the progress of manufacturing technology, in the following years the metamaterial geometries were downscaled in order to work in infrared and optical regimes.

In Fraunhofer INT, theoretical studies and analyses are conducted regarding potential applications of optical metamaterials. These studies reveal what kind of optical applications may profit from the novel metamaterial technology. The investigated metamaterials cover fishnets, nanorods, nanoscopic plate pairs and nanostructured surfaces. Metamaterial geometries provide freedom of shaping the values of constitutive material parameters – consequently, the main optical parameter of interest is the effective refraction index. Another important factor describing optical properties is figure of merit related to the quality of metamaterials. For shorter wavelengths, transmission loss becomes significant and limits the area of potential applications.

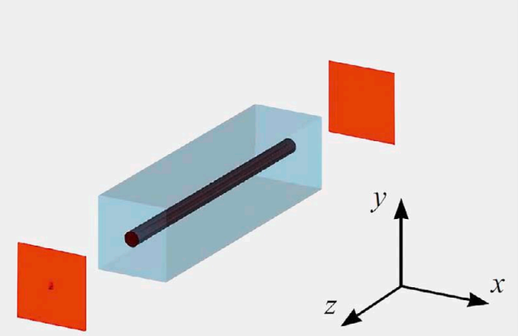
Optical metamaterials can act as wave-polarizers, anti-reflective coatings or lenses. However, due to the large losses at optical wavelengths, the most suitable area of application seems to be absorbers. An example of artificially engineered structure is a low-density array of vertically aligned carbon nanotubes characterized by index of refraction close to unity. Due to the matching of the refractive index at the boundary between nanotube array and air, the metamaterial structure reflects light very weakly. On the other hand, the straight and vertically aligned long carbon nanotubes form a low-density porous nanostructure acting as a light trap. Moreover, the aligned nanotubes do not form continuous surfaces and their surface-normal is not well-defined. The combination of these properties makes a sample of vertically aligned carbon nanotubes an ideal black object acting as an absorber.

A schematic view of the carbon nanotube model is shown in Fig. 1. The vertically aligned nanotube is normal to the z-plane. The anisotropic electromagnetic properties of the nanotube are characterized by a diagonalized dielectric tensor with relative permittivity components related to constitutive graphite properties. The nanotubes are modelled as solid cylinders.

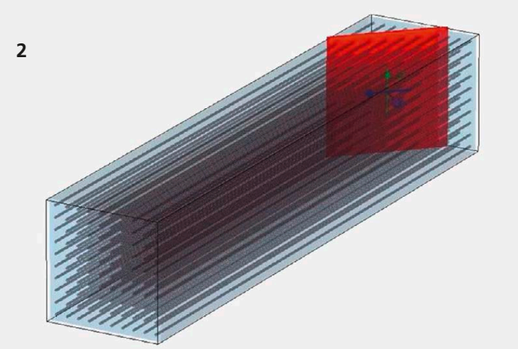
For three-dimensional full-wave simulation of electromagnetic fields distribution in the carbon nanotubes array, the lattice of 10 × 10 unit cells is implemented (Fig. 2).

This was the background for numeric simulations performed at INT. Typical simulation results are shown in Fig. 3 – the gradual field decay in the 25 µm long carbon nanotube array at the optical wavelength of 500 nm can be noticed.

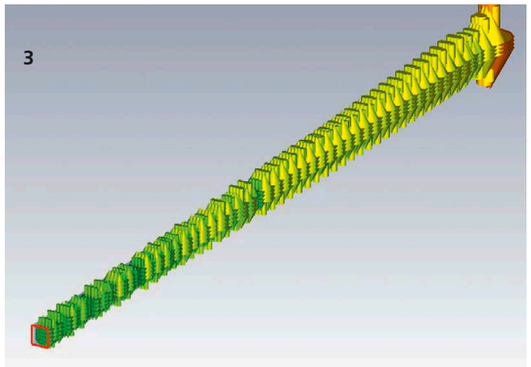
Parametric study of carbon nanotubes absorption illustrated in Fig. 4 indicates, that the geometry of vertically aligned long carbon nanotubes acts as an absorber at optical and infrared wavelengths.



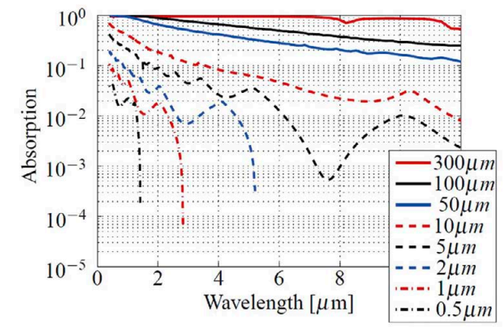
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1 *Unit cell of a carbon nanotube array*

2 *An array of 10 × 10 vertically aligned carbon nanotubes implemented to model the absorber behaviour*

3 *Attenuation of the electromagnetic wave at optical wavelength (500 nm) along the 25 µm long carbon nanotube array*

4 *Simulated absorption of carbon nanotubes for different nanotube lengths*

SCIENTIFIC-TECHNICAL INFRASTRUCTURE



Within the Department Nuclear and Electromagnetic Effects (NE), experimental work in Business Units 3 and 4 is supported by both a precision-engineering and an electronics laboratory. The first produces much of the mechanics used in experimental set up and apparatus, and the second services, repairs and produces specific electronics for use in experimenting. Both NE Business Units are assisted by a very productive secretariat. The following is a selective overview of the tasks performed

Precision-engineering laboratory:

- constructing and adjusting special apparatus for experiments
- special mountings and fastenings for irradiation work (e. g. BiDis)
- constructing special antennas (including a second discone-antenna (broadband omnidirectional antenna))
- preparing INT's structural alterations for irradiation facilities
- preparing platforms for presentations
- hosting 1 scientific assistant and 1 school-age trainee (three weeks)

Electronics laboratory:

- providing extensive support for all fields in preparing and conducting experimental work
- consulting in the planning of INT's new buildings
- developing irradiation and measuring boards
- servicing and operating the neutron generators for irradiation projects
- preparing and supporting tests on media converters
- operating the measuring computer network
- preparing INT's structural alterations for irradiation facilities
- work safety, fire protection and office technology
- electronics for safety systems (radiation protection interlock)
- hosting 3 scientific assistants
- hosting 5 school-age trainees (from 1 to 3 weeks)

Secretariat:

- formatting and producing posters
- providing organizational support for projects
- formatting study reports, radiation protection documentation
- preparing and drafting EU project applications
- preparing and hosting workshops

BUSINESS ADMINISTRATION AND CENTRAL SERVICES

Dr. Harald Wirtz



Business Administration and Central Services is the department responsible for all commercial and administrative tasks in the Institute. As well as providing the central infrastructure, department staff also carries out employer duties such as workplace safety and security.

Tasks:

Finance and Accounting, Purchasing

This area performs the Institute's book-keeping in accordance with German commercial and tax law. Current transactions are simultaneously entered in finance and cost accounts to make costs available for both internal accounting and controlling. The area also handles the purchase of all consumer items and investment goods, in compliance with purchase guidelines and the official German terms for awarding service and construction contracts (VOL/VOB). In cooperation with the Fraunhofer Gesellschaft HQ in Munich, Business Administration invites Europe-wide tenders for major procurements. The department also manages the INT cash office, handling all cash and non-cash payments.

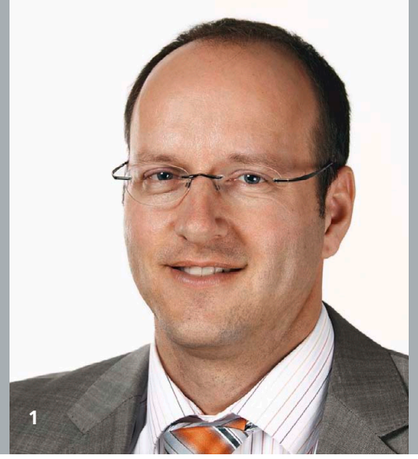
In 2010, procurements arising from the Economic Stimulus Package generated an increased workload for the division. All activities dealing with invitations for tender and accounting were reliably completed by the department.

Controlling and Project Administration, Auditing

This area's task is to control all monetary processes within Fraunhofer INT, which includes the continuous supervision and control of the Institute's entire budget. To this end, the department evaluates cost and performance accounts as well as the finance accounts, and produces monthly control data showing projections on a cost and payment basis. There is also administrative support for project budgets in other departments, involving help in drafting quotations and applications, calculating, concluding contracts and budget supervision. Since sponsors continuously conduct internal and external audits of the Institute, the department also deals with all audit inquiries.

Human Resources

Human Resources supports Institute management in personnel planning, and processes all personnel tasks such as job advertising, hiring, job evaluations and resultant income-group classification, as well as contract extenuation. In addition to general administrative duties such as personnel file and data management, HR supports INT departments in selection procedures, providing references and other services. Staff members are also given advice on all questions of labor and pay law.



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Travel Management

Travel Management assists staff on every aspect of official travel, from planning and preparation, to transport and hotel booking and, finally, travel expense accounting in accordance with Federal Law. In 2010 there was again an increase in business travel, all of which was smoothly arranged by Travel Management.

Facility Management / Internal Services

Tasks for this section include registering and organizing necessary repairs, coordinating user interests in construction work, equipment administration, managing and maintaining the vehicle fleet, procuring and managing furniture and office material, organizing office cleaning and operating the INT printing office. Another important activity was consulting and supporting the heads of both administration and the Institute in advance of the construction work on INT's premises.

1 *Dr. Harald Wirtz*

Marketing and Public Relations

This section does all the necessary communications and marketing work for results produced by INT's various divisions. All activities are closely coordinated with the scientists concerned.

Important, extensive projects in 2010 included organizing and staging INT's presence at the International Airshow (ILA) in Berlin and the conferences "Research and Development" and "CBRN Defense" organized by the German Association for Defence Technology (DWT). Another important task was bringing both layout and content of INT's Internet presence into line with the Fraunhofer Gesellschaft's new corporate design.

Library and Specialized Information Services

Key element of this work is procuring and managing the media required by the Institute, and supporting the scientists in research work and accessing information. The section continues its comprehensive contribution to the Institute's publishing work.

The library also trains specialist media and information services staff in the fields of information and documentation. In 2010, Kathrin Tuppi concluded her training with an excellent result, earning for herself recognition as one of the top 14 trainees within all of the Fraunhofer Gesellschaft.

Central IT Services

This section is responsible for the whole of the Institute's IT infrastructure, providing top level support for the users.

Another important task was the extension work done on the air conditioning system in summer. This called for a several measures, such as converting the server farm to blade systems and the resultant use of virtualization platforms. Currently, 4 hosts (Blades with 2 x 64-Bit-Core-Processors each and a total RAM-Capacity of 240 GB) are set up as a cluster, serving 30 virtual machines as server for the data center as well as machines for direct access by the users.

In 2010, similar concepts were realized throughout the Fraunhofer Gesellschaft for Fraunhofer-wide services. A virtual "VIP" appliance, managed centrally for Fraunhofer, thus went into service at INT. After extension as planned, this will also be used "on location". In consequence, and not least thanks to the energy reduction for power and cooling in the data center (catchword "Green IT"), this will contribute to successful and lasting research work.

TECHNICAL UPGRADE OF DEPARTMENT NE

Successful applications under the Second Economy Stimulus Package provided the Department Nuclear and Electromagnetic Effects (NE, Business Units 3 + 4) with considerable investment funds, allowing for major expansion in experimentation facilities (equipment) and investigation possibilities. The following installations and measuring systems were procured and put into service:

Electromagnetic Effects

Network analyzer:

For high-frequency measurement, INT uses various network analyzers. As a producer withdrew servicing and spare part supply, long-term, reliable operation was no longer possible. In consequence, it was necessary to procure a new, state-of-the-art apparatus: an Anritsu MS4644A vector analyzer, with a frequency range from 10 MHz to 40 GHz.

Pulse amplifier:

To determine the susceptibility of vulnerable systems, Fraunhofer INT operates test units supplied by a generator for high power microwave pulses with a frequency range from 150 to 3400 MHz. To extend testing capacity to frequencies up to 18 GHz, a PT84-5kW pulse amplifier was ordered from ifi/USA. In 2011, the plant is being extended by a 2 kW pulse amplifier with a range of 4 to 8 GHz.
In addition, various waveguide components (directional coupler, adapter, load, waveguides) were acquired in order to connect the amplifier to the unit.

Nuclear Radiation Effects in Electronics and Optoelectronics

1. **Assembly of a further Co-60 gamma irradiation unit (activity 22.2 TBq):**
   This resolves the greatest current bottleneck in the processing of further projects. The "total dose tests" that this new irradiation facility allows are obligatory for every commercial satellite system, and, owing to the increasing use of COTS products (Commercial Off The Shelf) with vitally necessary qualification, future demand for such tests is expected to grow. However, there is also a demonstrably increased demand in other areas (accelerators, nuclear technology). A new irradiation facility with corresponding concrete shielding was constructed for the unit. Temperatures in this chamber are stabilized at +/– 0,1°C, so that it is also possible to measure small radiation-induced changes.

2. **Installation of a 450 kV X-ray Unit:**
   This apparatus opens up a completely new aspect, since there has hitherto been little experience with the effect of X-rays on electronic and optical systems. In the past, questions on the effect of X-rays have constantly been raised, for example in the field of medical technology. Comparative measurement investigation is performed in order to establish X-rays as an alternative to Co-60 qualifications of satellite systems. Since it is possible to vary the X-ray unit's acceleration voltage over large ranges and to harden X-ray radiation by using various exit windows, investigation of the energy dependence of the radiation effect is also possible.

3. **Procurement of a UV Sun Simulator:**
   This allows INT to cover the complete spectrum of ionizing electromagnetic radiation.

4. **Assembly and utilization of a picoseconds-focused laser system to produce single particle effects in electronic systems:**
   This will be the first system of its kind in Germany. It is a fast and economical alternative to radiation on high-energy heavy-ion accelerators, because electron hole pairs can be produced by laser radiation of appropriate wavelength as well as by heavy ions. There are even three advantages for measuring:
   1. the carrier densities produced can be greater by some orders of magnitude
   2. by using a microscope lens, the beam can be injected with µm accuracy, thus determining the spatial dependence of the effects
   3. by triggering the laser beam, a precise time correlation is given.

5. **Assembly of a Spectrometry System:**
   To fully characterize glass fibers under radiation and for a detailed analysis of the fundamental mechanisms, information on the spectral dependence of the attenuation increase is needed. Over and above observation of the effects, this allows for the analysis of the fundamental structural processes.



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FUTURE SECURITY

The 5th Future Security Conference took place in Berlin in 2010. The decision to relocate to the capital – with the facilities of the Representation of the State of Baden-Württemberg being made available in Berlin's Tiergarten – allowed greater proximity to national bodies and government representatives. Future Security 2010 was opened by Prof. Dr. Oliver Ambacher, Director of the Fraunhofer-Institut für Angewandte Festkörperphysik IAF (Fraunhofer Institute for Applied Solid State Physics), which organized the conference. Prof. Dr. Ambacher was supported by Mr. Rainer Krug, Head of Research and Technology at the Federal German Ministry of Defense (BMVg Rü IV 2).

The conference concentrated on two areas: individual sessions and presentations were held in the conference chamber, while the lobby area housed the poster exhibition to which participants had access in conference pauses, as every year. Owing to lack of space this year, there was no exhibition platform for the Fraunhofer Institutes and industry to present new projects, as has been the case in the past.

The conference was of the highest caliber, as every year. Apart from representatives from Thales, EADS, IBM and other industrial companies, high-ranking Civil Servants from the Federal Government and the European Commission took part, including the European Data Protection Supervisor Peter Hustinx, and Dr. Helge Braun, Parliamentary Secretary of State in the Federal Ministry for Education and Research.

INT participated with several contributions. The Institute's Director, Prof. Dr. Uwe Wiemken, chaired Session 3 "Surveillance and Control – Part II". Dr. Wolfgang Rosenstock, Director of the Unit Nuclear Effects, addressed Session 6 "Detection of Hazardous Material" on the subject "Prevention of Illicit Trafficking of Nuclear and Radioactive Material at Border Stations by Means of Highly Efficient Detection Systems". INT was also present at the poster session, where Guido Huppertz introduced his project "CHorUS: Car Horns Used as Sirens".

This year's conference laid special emphasis on scientific cooperation between Germany and Israel. A joint Israeli-German project was presented In each session, including projects from the Ministry of Health in Jerusalem, from the Weizman Institute in Rehovot and from the University of Tel Aviv.

The 2011 Future Security Conference is already scheduled for 5 – 7 September. Venue is the premises of the Representative of the State of North Rhine-Westphalia in Berlin.

More information is at www.future-security.eu

1 *Participants of the conference „Future Security", Berlin*



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ILA 2010

The International Aerospace Exhibition (ILA – internationale Luftfahrtausstellung) in Berlin is one of the world's most important trade shows for this industry. In 2010, there were 1153 exhibitors from 47 nations. Visitor numbers were given at 235,000, of whom 125,000 were trade visitors. The Air Show was staged from 8 to 13 June, 2010.

The effects of radiation in higher atmospheric levels and space play a major safety role for high-altitude aircraft and space vehicles such as satellites. Fraunhofer INT – in the main represented by the Unit Nuclear Effects and Threats – was present at a joint booth mounted by the Federal State of North Rhine-Westphalia, to improve communications with aerospace users and intensify contact with existing clients.

Promoted by the North Rhine-Westphalia Ministry of the Interior, joint booth offered excellent conditions. Its location where German industry was housed, right at the exhibition entrance in Hall 8a, guaranteed a constant stream of visitors. The other exhibitors at the booth, mostly high tech companies and research bodies from throughout North Rhine-Westphalia, helped to create a lively impression with fitting contributions to the booth theme "We love the new."

INT presented two test setups to demonstrate research work being conducted at the Institute. Exhibits by the working group Nuclear Effects in Electronics and Optics included an irradiation structure from which the radioactive Cobalt 60 capsule had been removed, but which otherwise exactly conformed to the apparatus used in the Institute. The harmless substitute capsule was shown being withdrawn from its protective container with the help of an electric motor. Simultaneously, a monitor showed what results can be expected from actual irradiation.

In the laboratory, this work looks into what radiation levels make electronic or optoelectronic components unusable, thus making it possible to draw valuable conclusions on the expected working life of electronic components, even before a satellite is launched.

Parallel to this, the unit Nuclear Security and Detection Techniques demonstrated a portal monitor, with which radioactive and nuclear material can be detected. Detection is both reliable and concealed, making it suitable for monitoring people, at airports for example. Scientists from this field are also consulting Ukrainian border security authorities on equipment for use at crossing points along the border with the European Union.

NEW CONSTRUCTION OFFICE BUILDING

In front of a full staff turn-out, Institute Director Uwe Wiemken turned the sod for INT's new office building on November 11, 2010. A symbolic act, crowning the planning and administration work that had been going on for considerably more than a year before. The building is the first phase of a three-stage master plan, the remaining two phases being a new seminar room and a new library. These extensions to the Institute take account of how INT has grown constantly in recent years.

The building will house 16 offices, with a generous communication area, including a kitchenette and bar tables, to encourage greater exchange between staff members. The use of glass elements, indoors as well as out, will emphasize the open nature of the building. Its completion will reduce the need for room-sharing in the old complex. Experience has shown that for concentrated, scientific work, single offices are better suited than multiple.

Space in the new library will be much more generous than in the rooms used hitherto. Not only will there be more space for books and magazines, but there will also be a special reading area, conceived as an encouragement for studying on location.

The new seminar room will extend the possibilities for workshops and other specialist events. Capacity will be for up to 120 people, and it will be possible to divide the room to make its use more flexible. The old seminar room will be available for other purposes; the canteen will be re-sited there, including a serving area for the kitchen. In turn, the electronics laboratory will relocate to the old canteen, forming a single unit with short distances for the chemistry and electronics laboratories and the rooms belonging to them.

A glass corridor will connect all three buildings to each other and to the main building. This will mean changes for the inner courts, which can then be better used for recreation during breaks. On the whole, the building program should give the premises at Appelsgarten more of a campus character, generating an active inner spirit and lively exchange between the Institute sections.

The new office structure should be completed in August 2011. Shortly before, in early summer, work will begin on the library and seminar room, with completion being scheduled for the middle of 2012. The budget for the whole program amounts to around 3 million Euros.

1 *Head of the institute Prof. Dr. Uwe Wiemken by cut of the spade*

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SHORT NOTES

6th Düsseldorf Entrepreneur Award

The presentation of the 6th Düsseldorf Entrepreneur Award took place in the forum of the Stadtsparkasse in Düsseldorf on May 6, 2010. Motto for the event was the word "Future". In an accompanying exhibition, INT and other Fraunhofer institutes from the region staged presentations on future themes that are currently undergoing research. The program included a podium of experts on the subject "Chances and Prospects for SMEs", where Prof. Uwe Wiemken, INT Director, put forward the Institute's future research position. The evening was hosted by German TV's news anchorman Tom Buhrow.

1st International Symposium on Development of CBRN Defence Capabilities

From 30 November to 1 December 2010, Fraunhofer INT took part in the CBRN Symposium of the German Association for Defense Technology (Deutsche Gesellschaft für Wehrtechnik, DWT) in Berlin. At the accompanying exhibition, a model at INT's booth demonstrated the concealed detection of radiological material. In addition, Dr. Wolfgang Rosenstock contributed to Panel 9's theme "Detection of Radiological and Nuclear Threats", with a talk entitled "Preventing Terrorist Acts by Early Detection of Illicit RN Material on Site".

Workshop on Long-Term Technology Trends

On October 26, 2010, Fraunhofer INT and the management consultancy firm Geschka & Partner co-hosted the workshop "Long-Term Technology Trends". Experts from both parties presented the medium and long-term progress that can be expected from a widely-varying range of technologies with marketing potential in very different branches. Almost all participants were representatives from technology-oriented industry.

20th Conference on Practical IT Security

Held on 31 August and 1 September, 2010, the 20th Conference on Practical IT Security (formerly "Rheinlandtreffen") provided a platform for 55 IT experts to discuss and swap experience on current problems and solutions in IT security. The conference concentrated on issues of software quality and testing it is proof, and on exposing weaknesses by using penetration tests and deliberately entering false data. Also considered were the falsification of data and programs through physical influence, the possibility of insulating highly sensitive areas, and the development of encryption solutions for SAN storage. The Conference, held this year at the University of Applied Sciences Bonn-Rhein-Sieg in St Augustin, presented the state of IT security from a practical viewpoint and offered a forum for lively discussion on trends and risks that will greatly impact on the use of IT in the near future. The next Conference is scheduled for 14 – 15 September, 2011, in Karlsruhe. Further information is available at www.praktische-it-sicherheit.de

4th Annual Meeting Netzwerk Zukunftsforschung e.V. 1

On 16 and 17 September, 2010, about 20 futurists from German-speaking countries met at Fraunhofer INT for the 4th annual meeting of „Netzwerk Zukunftsforschung e.V." (futures research network). In workshops and open discussions they exchanged their views on the future perspectives and current topics of scientific futures research. Shortly before, the network's working group on methodology had met at Fraunhofer INT on 8 and 9 June. At this working session bibliometrics and text mining had been analysed for their potential for researching future technological developments. In addition, the network's objective of developing quality criteria and standards for scientific futures research had been brought forward.
For further information on the network, visit www.netzwerk-zukunftsforschung.eu

Workshop on Data & Information Fusion – Representation – Perception

Conceived as an information exchange on technological progress, a workshop was held under the title "Data & Information Fusion – Representation – Perception: Contributions to Situational Awareness, Decision Making and Training". Taking place on 25 and 26 May, 2010, participants came from Germany, France, the Netherlands and Sweden.

Working Group Meeting of the Commission on Civil Protection of the Federal Ministry of the Interior

On 9 February and 23 November, 2010, the ad hoc Working Group of the Commission on Civil Protection met to discuss the development of a weighted-bit assessment table for biological agents. A network of experts, one purpose of the Working Group is to advise on a feasibility study on developing an evaluation system that will enable a scenario-specific assessment of the danger potential of biological agents. Apart from Fraunhofer INT, participants include experts from the Robert Koch Institute, the Bundeswehr research institutes, various universities and the Federal Office of Civil Protection and Disaster Assistance.

Round Table on Security and Defense Research 2

On 17 and 18 November, 2010, a workshop was held in Euskirchen for the DLR, the ISL and all institute members of the Group for Defense and Security (VVS). The purpose was to identify new defense trends and priorities for the Federal Ministry of Defense. Experts from the individual institutes presented various technologies, of which the immediate and future relevance was discussed in plenary. The results from the round table will be integrated into the presentation that Prof. Uwe Wiemken gives each year to the Federal Ministry of Defense (BMVg) in his capacity as Director of Fraunhofer INT.

Fission Meter Workshop

On 14 and 15 September, 2010, Fraunhofer-INT conducted Europe's first international Fission Meter Workshop. The fission meter is a neutron measuring system that is marketed by the company Ametek/ORTEC. Organizations and bodies in Germany and the USA were represented. The workshop's purpose was to provide a platform for fission meter users to exchange experience, and to clarify questions with the developer of the instrument, who was also present. Results give an indication of whether a measured object is nuclear material or not. Applications for the meter are in nuclear security, which had a clear effect on workshop classification and implementation, and on participant selection.

Second Workshop „Herausforderung Weltraum" 3 at Fraunhofer INT

On 20 and 21 January, 2010, the second workshop "Herausforderung Weltraum" took place at Fraunhofer INT. Introductory and advanced presentations about radiation effects in space were held by INT staff and invited speakers. The topics discussed included space weather, single event effects and total dose effects. The workshop was attended by a cross section of the German space community, including the DLR, EADS Astrium, OHB-System GmbH, Tesat-Spacecom und Rockwell Collins Deutschland.

DWT Forum Research and Technology 2010

From 13 to 14 April 2010, Fraunhofer INT participated in the Forum Research and Technology, held by the German Association for Defense Technology (Deutsche Gesellschaft für Wehrtechnik, DWT), in Bonn. At a joint booth mounted by the Fraunhofer Group for Defense and Security Research (Fraunhofer Verbund Verteidigungs- und Sicherheitsforschung), INT presented current research results. In addition, a presentation by Dr. Sabine Müller and Dr. Sonja Grigoleit introduced their technology roadmap on self-healing materials.

APPENDIX

University Courses

Burbiel, J.: Pharmazeutische Chemie II, winter semester 2010/11, Rheinische Friedrich-Wilhelms-Universität Bonn, Bonn

Chmel, S.: Internship „Physikalische Grundlagen" for the Bachelor's programme „Chemie und Materialeigenschaften", Hochschule Bonn-Rhein-Sieg, Sankt Augustin

Chmel, S.: Praktikum „Measuring Techniques", „Naturwissenschaftliche Forensik", Hochschule Bonn-Rhein-Sieg, St. Augustin

John, M.: Das Cochlea Implantat, IB-Medizinische Akademie, Schule für Logopädie, Berlin

Jovanovic, M.: Projektmanagement im Studium, winter semester 2009/10, Heinrich-Heine-Universität Düsseldorf, Düsseldorf

Jovanovic, M.: Bibliometrical analyses, summer term 2010, Heinrich-Heine-Universität Düsseldorf, Düsseldorf

Jovanovic, M.: Bibliometrie – Die Wissenschaft der Wissenschaft – Beispiel Energy Harvesting, meeting on 18.06.2010, Hochschule Bonn-Rhein-Sieg, Sankt Augustin

Wiemken, U.: Einführung in die Technik, Fachhochschule Köln, Fakultät für Informations- u. Kommunikationswissenschaft, Köln

Wiemken, U. in cooperation with Burbiel, J.; Chmel, S.; Huppertz, G.; John, M.; Neupert, U.: Aktuelle Entwicklungen in der Technik, Hochschule Bonn-Rhein-Sieg, Fachbereich Elektrotechnik, Maschinenbau und Technikjournalismus, Sankt Augustin, SS 2010

Wirtz, H.: Finanzierung, Hochschule Fresenius, Köln, Bachelors' programme, WS 2009/10, SS 2010, WS 2010/11

Wirtz, H.: Investition, Finanzierung, Steuern, Hochschule Fresenius, Köln, diploma course for working professionals, WS 2009/10, SS 2010, WS 2010/11

International Cooperation

Berky, W., Friedrich, H., Köble, T., Risse, M., Rosenstock, W.: JRC, Institute for the Protection and Security of the Citizen (IPSC), Nuclear Security Unit, G08, European Commission – Joint Research Centre, 21027 Ispra, Italy, Cooperation on "Active neutron interrogation techniques and in situ methods of identification of fission material"

Euting, T.; Huppertz, G.; Müller, M.; Ruhlig, K.: Trilateral Information Exchange Workshop: Data & Information Fusion – Representation – Perception: Contribution to "Situational Awareness, Decision Making and Training", Fraunhofer INT, Euskirchen

Kernchen, R.: NATO Research and Technology Organisation (RTO), Collaboration in Panel Applied Vehicle Technology (AVT): AVT-177 Munition and Propellant Disposal and its Impact on the Environment (2010-2011), AVT-179 Design for Disposal of Present and Future Munitions and Application of Greener Munition Technology (2010-2012)

Köble, T., Rosenstock, W.: Discussion with Prof. Vadim L. Romodanov, Experimental Reactor Physics Institute, MEPhI, 115409, Moscow, Kashirskoe Shosse 31, Russian Federation, and his team on detection methods for fissile material and explosives in suitcases within the Canadian-European project ISTC 2978 „Digital technology for the control of fissile materials in devices with pulsed sources". Further cooperation partners are Universita Degli Studi di Bari / Dipartimento Interateneo di Fisica (Italien) and Bubble Technology Industries Inc. (Canada)

Missoweit, M.: Participation in Strategic Mutual Assistance in R&T (SMART) initiative of the Dutch ministry of defence

Neupert, U., Römer, S.: NATO Research and Technology Organisation (RTO), Collaboration in Studies, Analyses and Simulation (SAS) Panel, Task Group 082 "Disruptive Technology Assessment Game, Extension and Applications"

Pastuszka, H.-M.: Collaboration in FP7 Security Research Project CRESCENDO (Coordination Action on Risks, Evolution of Threats and Context Assessment by an enlarged Network for an R&D Roadmap, vgl. www.crescendo-project.org); 22 project partners, July 2009 – June 2011

Pastuszka, H.-M.: Participation in German-American F&T-Workshop in Reston, VA, USA, 08./09.06.2010, and Deutsch-Amerikanischer Army Roundtable Meeting at US Army Research Laboratory (ARL), Aldephi, VA, USA, 10.06.2010

Pastuszka, H.-M.: Rapporteur EC-Workshop Societal Security in R&D, Expert Session Security Research in Support of Societal Resilience and Trust, Brüssel, 01.07.2010

Schulze, J.: Contribution to FP7 Security Research Project DEMASST

Suhrke, M.: Contribution to the NATO RTO SCI-198 Task Group Protection of Military Networks against High Power Micro-wave Attacks, meeting: Munster, Germany, 16.-18.03.2010; Vilnius, Lithuania, 21.-23.6.2010; Den Haag, the Netherlands, 03.-05.11.2010

Suhrke, M.: NATO RTO SCI-227-ST on Directed Energy Weapons (DEW) Related Capabilities: Near, Mid, Long Term Prospects, Brussels, 13.-14.01.2010

Suhrke, M.: Contribution to HPM Threat Scenarios, US/German Research and Technology Workshop, 08.-10.06.2010, Reston, Virginia, USA

International Reviews

Burbiel, J.: Bioorganic & Medicinal Chemistry

Burbiel, J.: International Journal of Hospitality Management

Burbiel, J.: Tetrahedron Letters

Höffgen, S., Kuhnhenn, J., Metzger, S.: IEEE Transactions on Nuclear Science"

Suhrke, M.: IEEE Transactions on Electromagnetic Compatibility

Suhrke, M.: Member of the programme commitee for NATO SCI-232 Symposium on High Power Microwaves and Directed Energy Weapons, Norfolk, Virginia, USA, 09.-11.05.2010

Thorleuchter, D.: Decision Support Systems

Thorleuchter, D.: Technological Forecasting and Social Change

Collaboration in Committees

Köble, T., Rosenstock, W.: Nationale Arbeitsgruppe Radiologische Bombe (NAG RB), organized by BMVg, Rü IV

Köble, T.: UAG 2: Physikalische Wirkung, 2 Sessions

Missoweit, M.: R&T national Points of Contact Group of the European Defence Agency

Missoweit, M.: Points of Contact/Group of Research Directors of the Letter of Intent 6 Framework Agreement/European Defence Industry Restructuring

Missoweit, M.: Workgroup „Strategische Aspekte" des EU-Netzwerks der Fraunhofer Gesellschaft, Koordination

Missoweit, M.; Pinzger, B.; Römer, S.; Schietke, R.; Schulze, J. (Leiter): Ad-hoc-working group of the Commission on Civil Protection of the Federal Ministry of the Interior „Entwicklung eines Punktesystems zur Einschätzung der Gefahrenpotentiale biologischer Agenzien", moderation and cooperation

Pastuszka, H.-M.: FP7 Security Advisory Group der EU-Kommission, DG Enterprise

Pastuszka, H.-M.: Post-ESRIF-workshop of the german ESRIF-members (ESRIF: European Security Research and Innovation Forum)

Pastuszka, H.-M.: Coordination meetings BMVg-Ressortforschung

Römer, S.: Letter of Intent 6 Framework Agreement, Disruptive Technology Group

Rosenstock, W. (Task Leader): National workgroup Radiological Bomb (NAG RB, UAG1): Bedrohungsanalyse

Schulze, J.: Commission on Civil Protection of the Federal Ministry of the Interior

Schulze, J.; Schietke, R.: Fraunhofer-Gesellschaft Representative at EUROTECH Security Research Group der EARTO (European Association of Research and Technology Organisations)

Schulze, J., Schietke, R.: Participation in SMI²G (Board of ASD and EUROTECH to form consortia for EU Calls for Proposals on Security)

Schulze J.: Member of European Security Round Table (ESRT)

Schulze, J.: Workgroup „Proliferation" der Stiftung Wissenschaft und Politik

Schulze, J.: National Expert Panel CTBT (Comprehensive Test-Ban Treaty) at Auswärtigen Amt

Schulze, J.: Programme Committee International Science & Technology Conference 2011, Vienna

Schulze, J.: Deutsche Physikalische Gesellschaft, Nuclear Test Ban Commission

Schulze, J.: Programme Committee Fraunhofer Future Security Conference 2011, Berlin

Schulze, J.: European Organization for Security, Mitglied im Board of Directors

Schulze, J.: German European Security Association e.V.

Schulze, J.: Runder Tisch Sicherheitsforschung MIWFT NRW

Schulze, J.: Regio-Cluster NRW Sicherheitsforschung Raum Bonn

Thorleuchter, D.: Spokesperson of Fachgruppe BIK „Betrieb von Informations- und Kommunikationssystemen" at Gesellschaft für Informatik (GI)

Participation in Norming Processes

Adami, Ch.: NA 140-00-19 AA
Creation of VG-Normen VG96900-96907, NEMP- und Blitzschutz

Adami, Ch.: NA 140-00-20-02UA
Creation of VG-Normen VG95370 ff., Elektromagnetische Verträglichkeit, Creation of VG-Normenteile Grenzwerte für Geräte

Kuhnhenn, J.: Lead-managed by Überarbeitung von IEC 6073-1-54

Suhrke, M.: GAK 767.3/4.4
„TEM-Wellenleiter und Reverb-Chamber", DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Lectures and Presentations

Thorleuchter, D.:
Extracting Consumers Needs for New Products – a Web Mining Approach, Third International Conference on Knowledge Discovery and Data Mining, Thailand, 07.01.2010

John, M.:
Das Cochlea Implantat: Funktionsweise, Entwicklung, Chancen, Risiken und Erfahrungen im Hinblick auf die logopädische Praxis, Schule für Logopädie, Berlin, 18.01.2010

Suhrke, M.:
Presentation „Electromagnetic Effects and Threats" Workshop Herausforderung Weltraum, Fraunhofer INT, Euskirchen, 20.-21.01.2010

Rosenstock, W.:
Current status and outlook sub-working group 1 „Bedrohungsanalyse" and NAG Radiologische Bombe. Meeting on „Flughafensicherungssystem", Fraunhofer FKIE, Bonn-Wachtberg, 21.01.2010

Wiemken, U.:
Langfristige Aspekte der wehrtechnischen Forschung, Meeting of Strategiegruppe F&T, Bonn, 27.01.2010

Euting, T.:
Evonik-Project: Presentation of results in the IT-sector, Euskirchen, 25.02.2010

Adami, Ch.; Braun, Ch.; Clemens, P.; Schmidt, H. U., Taenzer, A.; Suhrke, M.:
Betrieb von Modenverwirbelungskammern mit gepulsten Mikrowellensignalen, Elektromagnetische Verträglichkeit EMV 2010 (2010), Internationale Fachmesse und Kongress für Elektromagnetische Verträglichkeit 2010, Düsseldorf, 09.-11.03.2010

Grigoleit, S.:
Gefahrenpotenziale von chemischen Kampfstoffen und toxischen Industriechemikalien – das Punktesystem, symposium ABC-Schutz, Munster, 10.03.2010

Euting, T.:
Zukunft des Internets: Unser Leben 3.0, Fraunhofer Technologiezirkel, Fraunhofer Academy, Stuttgart, 10.-11.03.2010

Grüne, M.:
Technologisch in die Zukunft: Was können wir wissen? Was werden wir können?, Fraunhofer Technologiezirkel, Fraunhofer Academy, Stuttgart, 10.-11.03.2010

Neupert, U.:
Energy Harvesting, Fraunhofer Technologiezirkel, Fraunhofer Academy, Stuttgart, 10.-11.03.2010

Berky, W.; Chmel, S.; Friedrich, H.; Köble, T.; Risse, M.; Rosenstock, W.:
Möglichkeiten der Detektion von Spaltmaterial vor Ort zur Verhinderung missbräuchlicher Verwendung bzw. Proliferation, 74. spring summit of the German Physical Society (DPG), Bonn, 17.-19.03.2010

Kernchen, R.:
Biological approaches to degeneration of explosives and propellants, NATO AVT-177 Meeting, Antalya, Türkey 12.-16.04.2010

Pastuszka, H.-M.:
ESRIF (European Security Research and Innovation Forum) – Conclusions on Crisis Management, FP7 CRESCENDO Workshop on Crisis Management, Brussels, 14.04.2010

Kohlhoff, J.:
Technologische Megatrends und ihre Wechselwirkungen mit der Wehrtechnik, seminar „Seestrategische Konzepte", Lehrgang „Generalstabsdienst/Admiralstabsdienst National" at Führungsakademie der Bundeswehr, Hamburg, 15.04.2010

Wiemken, U.:
Langfristige Technologieentwicklungen – Prognosen und Planung, Mitgliederversammlung Carl-Cranz-Gesellschaft, Oberpfaffenhofen, 30.04.2010

Rosenstock, W.:
Expanding "Radiological Survey" to "Detection and Identification of Nuclear Material on-site", VTM – Verification meeting, 32th ESARDA Annual Meeting, Luxembourg, 04.-06.05.2010

Huppertz, G.:
Nano Air Vehicles – Auf dem Weg zur künstlichen Fliege, Visit by Rotary-Clubs Euskirchen-Burgfey, INT, Euskirchen 12.05.2010

Suhrke, M.:
Presentation „Electromagnetic Effects and Threats", European Reference Network Critical Infrastructure Protection (ERN-CIP) Workshop on Electromagnetic Interference, Ispra, Italy, 27.-28.05.2010

Thorleuchter, D.:
Textmining for improved decision making, Faculty of Economics and Business Administration, Gent University, Belgium, 28.05.2010

Burbiel, J.:
Psychopharmaka – Chemie für die Seele, lecture „Technik und gesellschaftlicher Wandel", Hochschule Bonn-Rhein-Sieg, Sankt Augustin, 28.05.2010

Pastuszka, H.-M.:
Workshopleitung und Vortrag Research Needs in Crisis Management – a European Perspective, International Disaster and Risk Conference (IDRC) 2010 Davos, Switzerland, 02.06.2010

Burbiel, J.:
The Weighted-Bit Assessment Table of Hazardous Chemicals, 10th International Symposium on Protection against Chemical and Biological Warfare Agents, Stockholm, Sweden, 08.06.2010

Römer, S.:
Scenario-Oriented Assessment of Hazardous Biological Agents, 10th International Symposium on Protection against Chemical and Biological Warfare Agents, Stockholm, Sweden, 08.06.2010

Suhrke, M.:
Elektromagnetische Einkopplungsmessungen am Fraunhofer INT Euskirchen, Hochschule Bonn-Rhein-Sieg, Sankt Augustin, 08.06.2010

Wiemken, U.:
Technik und gesellschaftlicher Wandel – von Avataren, Robotern, künstlichen Fliegen und Laufmaschinen, Kiel, 10.06.2010

Huppertz, G.:
Nano Air Vehicles, Vorlesung „Technik und gesellschaftlicher Wandel – Rückblick und Ausblick", U. Wiemken et al., Hochschule Bonn-Rhein-Sieg, Sankt Augustin, 11.06.2010

Thorleuchter, D.:
Textmining und Wissensmanagement, visit by Fraunhofer Abteilung P4 Wissensmanagement, Euskirchen, 14.06.2010

APPENDIX

Jovanovic, M.:
Footprint Analyses – The example of Metamaterials, visit by Delegation of China Defense Science and Technology Information Centre (CDSTIC), Euskirchen, 16.06.2010

Thorleuchter, D.:
Text mining methodology for identifying future technological innovation fields, visit by Delegation of China Defense Science and Technology Information Centre (CDSTIC), Euskirchen, 16.06.2010

Huppertz, G.:
Nano Air Vehicles – Auf dem Weg zur künstlichen Fliege, visit by Delegation of China Defense Science and Technology Information Centre (CDSTIC), Euskirchen, 16.06.2010

Pastuszka, H.-M.:
FP7 Security Advisory Group, Arbeitstreffen deutsche ESRIF-Mitglieder, BBK Bonn, 22.06.2010

Adami, Ch.; Braun, Ch.; Clemens, P.; Schmidt, H. U.; Taenzer, A.; Suhrke, M.:
Operation of a Reverberation Chamber with Pulsed Microwave Signals, AMEREM 2010, Ottawa, Canada, 06.-08.07.2010

Pastuszka, H.-M.:
Societal Security in R&D, Report to the FP7 Security Advisory Group, Brussels, 07.07.2010

Thorleuchter, D.:
Textmining für die Technologiefrüherkennung oder für zukunftsorientierte Forschung im technischen Bereich, 5. meeting "AG Methoden des Netzwerks Zukunftsforschung", Euskirchen, 08.07.2010.

John, M.:
Szientometrische Methoden für die Technologiefrühaufklärung, 5. meeting "AG Methoden des Netzwerks Zukunftsforschung", Euskirchen, 08.07.2010.

Risse, M.; Berky, W.; Friedrich, H.; Köble, T.; Rosenstock, W.; Rennhofer, H.; Pedersen, B.:
Identification of nuclear material with hand-held and portable gamma and neutron measuring devices; 51st annual meeting of the Institute of Nuclear Materials Management (INMM); Baltimore, Maryland, USA; 11.07.-15.07.2010

Suhrke, M.:
Präsentation des Geschäftsfelds Elektromagnetische Effekte und Bedrohungen, visit by ISL, Fraunhofer INT, Euskirchen, 20.07.2010

Burbiel, J.:
Sicherheitsforschung aus der Sicht des Fraunhofer INT, seminar „Polizeitechnik im Wandel" der Deutschen Hochschule der Polizei, Brühl, 26.08.2010

Gericke W., Thorleuchter, D.:
Aktuelle Entwicklungen der praktischen IT-Sicherheit, Konferenz zur praktischen IT-Sicherheit 2010, Hochschule Bonn-Rhein-Sieg, Sankt Augustin, 31.08.2010.

Metzger, S.:
Wirkung kosmischer Strahlung auf elektronische Systeme, Konferenz zur praktischen IT-Sicherheit 2010, Hochschule Bonn-Rhein-Sieg, Sankt Augustin, 31.08.2010

Thorleuchter, D.:
Strategien der neuen GI-Fachgruppenleitung BIK ,,Betrieb von Informations- und Kommunikationssystemen", Konferenz zur praktischen IT-Sicherheit 2010, Hochschule Bonn-Rhein-Sieg, Sankt Augustin, 31.08.2010

Rosenstock, W.:
Prevention of illicit trafficking of nuclear and radioactive material at border stations by means of highly efficient detection systems, Future Security – 5th Security Research Conference, Berlin, 07.-09.09.2010

Pastuszka, H.-M.:
Fachforum IV European Security Research, 6. Europäischer Bevölkerungs- und Katastrophenschutzkongress, Bonn – Bad Godesberg, 08.09.2010

Höffgen, S.:
Laser system for the simulation of single-event-effects (see). Radecs 2010, 11. Europäische Konferenz über Strahlungseffekte in Komponenten und Systeme, Thematic Workshops on International Irradiation Facilities, Längenfeld, Austria, 20.-24.09.2010

Kuhnhenn, J.:
Radiation effects testing at Fraunhofer INT. Radecs 2010, 11. Europäische Konferenz über Strahlungseffekte in Komponenten und Systeme, Thematic Workshops on International Irradiation Facilities, Längenfeld, Austria, 20.-24.09.2010

Metzger, S.:
Single-Event Effects Testing with Relativistic Heavy Ions at GSI: Radecs 2010, 11. Europäische Konferenz über Strahlungseffekte in Komponenten und Systeme Thematic Workshops on International Irradiation Facilities, Längenfeld, Austria, 20.-24.09.2010

Metzger, S.:
Session-Chair Basic Mechanisms. Radecs 2010, 11. Europäische Konferenz über Strahlungseffekte in Komponenten und Systeme, Längenfeld, Austria, 20.-24.09.2010

Höffgen, S.:
Comparison of the Radiation Sensitivity of Fiber Bragg Gratings made by Four Different Manufacturers, Radecs 2010, 11. Europäische Konferenz über Strahlungseffekte in Komponenten und Systeme, Session on Photonics, Längenfeld, Austria, 20.-24.09.2010

Pastuszka, H.-M.:
Requirements and Future R&T Projects, European Defence Acquisition Manager Intercultural Course (EDAMIC) 2010, Berlin, 04.10.2010

Rosenstock, W.:
Identification of unknown CBRNE materials (Dirty bomb) – reliability of the test devices, uncertainty of the measurements; standards and test procedures. 2nd CREATIF Workshop European Certification System for CBRNE Sensor Systems and Devices, Berlin, 05.-06.10.2010

Wiemken, U.:
Langfristige Aspekte der Verteidigungs- und Sicherheitsforschung, meeting of Ressortforschungskreises, Kiel, 06.10.2010

Reschke, S.:
Strategische Frühaufklärung – Entdecke deine Möglichkeiten, 3rd annual meeting Strategisches Technologie- und Innovationsmanagement in produzierenden Unternehmen 2010, MarcusEvans, Düsseldorf, 12.-13.10.2010

Pastuszka, H.-M.:
ESRIF WG4 Crisis Management – Wrap-up and Look-ahead, Akademie für Krisenmanagement und Zivilschutz (AKNZ), Ahrweiler, 14.10.2010

Missoweit, M.:
The European Framework Cooperation, ESRIF working group "crisis management" wrap-up meeting, Akademie für Krisenmanagement und Zivilschutz (AKNZ), Ahrweiler, 15.10.2010

Jovanovic, M.:
Workshop „Bibliometrie – ‚Sortierung' von Fraunhofer-Instituten – nur wie?", conference Fraunhofer Bibliotheken 2010, 18.10.2010

Thorleuchter, D.:
Vernetzte Operationsführung, seminar Carl-Cranz-Gesellschaft, Wachtberg, 26.10.2010

Grüne, M.:
Technologisch in die Zukunft – Was können wir wissen? Was werden wir können? Conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT und Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Offenberg, D.:
Plasmonik: Elektronik und Photonik vereint in der Nanowelt, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Huppertz, G.:
Miniatur-Roboter – Natura ex machina, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Müller, M.:
Bioinspirierte Robotik, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Reschke, S.:
Upgrading – Auf dem Weg zu Mensch 2.0, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Neupert, U.:
Energy Harvesting – Energie ist überall, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Ruhlig, K.:
Augmented Reality – Die virtuelle Erweiterung der realen Welt, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

John, M.:
Nanobasierte Sensoren – Auf dem Weg zum kontinuierlichen Monitoring, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Reschke, S.:
Materialised Surprise – Neue Werkstoffe und Anwendungen, conference „Langfristige Technologietrends – Orientierungen für die F&E-Strategie“, Fraunhofer INT and Geschka & Partner Unternehmensberatung, Euskirchen, 26.10.2010

Suhrke, M.:
Gegenwärtige Bedrohung Deutschlands durch Hochleistungsmikrowellen-Anwendungen (HPM), work session AG Luftverkehr in der Innovationsplattform „Schutz von Verkehrsinfrastrukturen“, programme „Forschung für die zivile Sicherheit“ of BMBF, Frankfurt, 28.10.2010

Rosenstock, W.; Berky, W.; Chmel, S.; Friedrich, H.; Köble, T.; Risse, M.; Schumann, O.-J.:
Hand-Held Devices for the Detection of Clandestine Nuclear Material On-site: Poster. In: International Atomic Energy Agency -IAEA- Symposium on International Safeguards 2010 – Preparing for Future Verification Challenges, IAEA, Vienna, Austria, 01.-05.11.2010

Rosenstock, W.:
Current status and outlook sub-work group 1 (UA 1) “Bedrohungsanalyse“, 6th meeting of national workgroup (NAG) “Radiologische Bombe“, WIS-Munster, 10.-11.11.2010

Rosenstock, W.:
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Personalia

January 2010:
Promotion Olaf Jochen Schumann at Cologne University on „Structural Investigations on layered Manganites and Ruthenates“

February 2010:
Promotion Guido Huppertz at Aachen University on „Experimental Investigation of Engine Jet/Vortex Interaction“

31st August 2010:
Dirk Thorleuchter elected spokesman for working group BIK of the Gesellschaft für Informatik

Other Events

10. – 11. 03. 2010:
INT contributes presentations to the Technology-Circle „Technologietrends“ of the Fraunhofer Academy, Stuttgart. The event was developed and moderated by the Fraunhofer Headquarters in cooperation with INT and adressed to the industrial sector.

22. 09. 2010:
INT-Booth at „Tag der Luft und Raumfahrt“, Bonn.

29. 09. 2010:
A chemistry class of the Gymnasium Gerostein visits the INT.

12. – 13. 10. 2010:
INT provides a Session Chair and an invited presentation at the 3rd annual meeting „Strategisches Technologie- und Innovationsmanagement in produzierenden Unternehmen“ by marcus evans.

Institute Course

Karden, W. (Innenministerium NRW):
Spionage – ein Thema für die Wissenschaft, Euskirchen, 24.02.2010

Dr.-Ing. Lubkowski, G. (Fraunhofer INT Euskirchen):
Simulation elektromagnetischer Felder in doppeltnegativen Metamaterialien, Euskirchen, 03.03.2010

Prof. Pretzler, G. (Universität Düsseldorf):
Elekronen- und Protonenbeschleunigung mit ultrakurzen relativistischen Laserpulsen, Euskirchen, 10.03.2010

Dr.-Ing. Huppertz, G. (Fraunhofer INT Euskirchen):
Auf dem Weg zur künstlichen Fliege – Miniaturisierung unbemannter Flugsysteme, Euskirchen, 17.03.2010

Oberst i.G. Borst, H. (Weltraumlagezentrum der Bundeswehr Uedem):
Weltraumlagezentrum – Sachstand und Perspektive, Euskirchen, 24.03.2010

Prof. Kugeler, K. (Institut für Energieforschung IEK-6 Forschungszentrum Jülich):
Analysen zu Schwerwasserreaktorprogrammen unter Nonproliferationsgesichtspunkten, Euskirchen, 14.04.2010

Dr. Richter, B. (Institut für Energieforschung IEK-6 Forschungszentrum Jülich):
Das gemeinsame Entwicklungsprogramm von Bundesregierung und internationaler Atomenergie-Organisation – Ergebnisse und Perspektiven, Euskirchen, 21.04.2010

Wilbert, S. (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe BBK Bonn):
Radiologisches Szenario innerhalb der Lükex09/10, Euskirchen, 28.04.2010

Dr. Hübers, H.-W. (DLR Instiut für Planetenforschung Berlin):
Terahertztechnik für Sicherheitsanwendungen, Euskirchen, 02.06.2010

Prof. Fiedrich, F. (Fachbereich Sicherheitstechnik Uni Wuppertal):
Modellbasierte Szenarienentwicklung für katastrophenhafte Erdbeben, Euskirchen, 19.05.2010

Dr. Eickenbusch, H. (VDI Technologiezentrum GmbH Düsseldorf):
Trends in der Werkstofftechnik, Euskirchen, 26.05.2010

Dr. Missoweit, M. (Fraunhofer INT Euskirchen):
Fünf Jahre Europäische Verteidigungs-Entwicklung und Probleme der europäischen Kooperation in wehrtechnischer F&T, Euskirchen, 09.06.2010

Dr. Lieder, E. (Fraunhofer INT Euskirchen):
Untersuchung von schnell rotierenden hoch-angeregten Kernen, Euskirchen 23.06.2010

Dr. Mathes, M. (Fraunhofer INT Euskirchen):
Strahlungstolerante Halbleitersensoren für die Hochenergiephysik, Euskirchen, 30.06.2010

Dr. Schäfer, F. (Fraunhofer EMI Freiburg):
Verwundbarkeitsanalysen von Satelliten durch Einschläge, Euskirchen, 07.07.2010

Dr. Burbiel, J. (Fraunhofer INT Euskirchen):
Sicherheitsforschung in Deutschland, der EU und dem Vereinigten Königreich, Euskirchen, 22.09.2010

Dr. Reifer, E. (WIS Munster):
Operation Atemluft, Euskirchen, 29.09.2010

Plescher, E. (FH Aachen):
COMPASS-1, ein studentischer Picosatellit und sein Potential für zukünftige Missionen, Euskirchen, 06.10.2010

Schmitz, W. (Crealab GmbH Feldkirchen):
Scenario-based Risk Assessment of Terrorist Attacks, Euskirchen, 27.10.2010

Damm, H. (Polizeitechnisches Institut Münster):
Koordinierung der Sicherheitsforschung durch die deutsche Hochschule der Polizei, Euskirchen, 03.11.2010

Dr. Offenberg, D. (Fraunhofer INT Euskirchen):
Moleküle in Slow-Motion – Indirekte Laserkühlung in einer Ionenfalle, Euskirchen 10.11.2010

Schumann, O.-J. (Fraunhofer INT Euskirchen):
Einkristallpräparation und Strukturuntersuchungen von Schichtmanganaten, Euskirchen, 24.11.2010

Dr. Pinzger, B. (Fraunhofer INT Euskirchen):
Untersuchungen der Effekte von Pestiziden auf den Erreger der Kartoffelfäule, Euskirchen, 01.12.2010

Dr. Osterloh, K. (BAM Berlin):
Bildgebung jenseits von Linsen „Optik“ für hochenergetische Strahlung, Euskirchen, 08.12.2010

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Autobahn A61: leave at exit 26 “Swisttal-Heimerzheim”

By air

Nearest airports:

- Cologne/Bonn (60 km)
- Düsseldorf (100 km)

By rail

Nearest Inter-City Main Stations:
Bonn Hauptbahnhof and Cologne Hauptbahnhof.

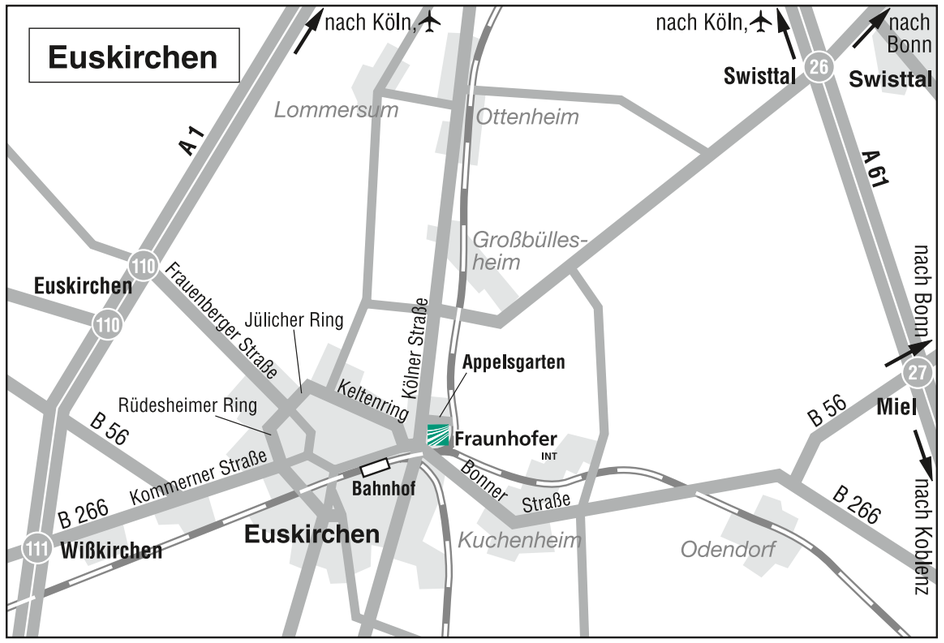
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