



Fraunhofer INT

FRAUNHOFER INSTITUTE FOR TECHNOLOGICAL TREND ANALYSIS INT



1974

1986

FROM 1974 TO 2014:
40TH ANNIVERSARY
FRAUNHOFER INT

1994

2014

1990

ANNUAL REPORT
2014

ANNUAL REPORT 2014

Images Title:

Oscilloscope 1974

Neutron detector 1986

Laboratory robot 1990

Tritium air monitor 1994

Laser laboratory 2014



Dear Reader,

Do you have the same feeling? Time flies by, the days are over in a flash, and before you know it, the year is over?

Psychologists and neuroscientists say that the individual perception of time largely depends on the density of events to which a person exposes himself. If this hypothesis is correct, then time at INT goes by at a particularly high rate. At least, 2014 felt as if it went like lightning, an empirical observation that fully supports the hypothesis just outlined.

Even the very start was marked by a significant event: on 1. January 2014, INT assumed its new structure as a prime result of the strategy process. The two departments Technology Analysis and Foresight (TAV) and Meta-Analyses and Planning Support (AP), were dissolved and fused into one department: Technological Analyses and Strategic Planning (Technologieanalysen und Strategische Planungen – TASP). The new form took on a group structure oriented to INT's client make-up, better able to concentrate on respective business areas than hitherto.

Apart from the classical work areas Defense Technology Foresight (Wehrtechnische Zukunftsanalyse – WZA) and International Research and Technology Management (Internationales Forschungs- und Technologiemanagement – IFT), exciting new business units were set up: Public Research and Technology Management (Öffentliches Forschungs- und Technologiemanagement – ÖFT) for national (but non-military) work, and Corporate Technology Foresight – CTF) for the private market. The work of all business units (also cross-departmental) is rounded off, backed up and supported by a strategic project that shall identify, secure and make readily available the expertise of INT's scientists – something that has sometimes only been accessible to the individual. Technology Trends and Strategies (Technologie- und Planungsmonitoring – TPM) is geared to supporting and promoting the basic synergy within and between the departments.

The department Nuclear and Magnetic Effects (NE) remained unchanged, as far as its structure is concerned. However, its departmental and business unit strategies went through fundamental revision, to be able to answer new challenges adequately.

This expansive change process was accompanied at Institute, departmental and group level by a number of activities which have given impetus to the new structure, already producing positive results. Last but not least, our strategic thinking underwent critical appraisal in preliminary and final audits. At this point, we gratefully acknowledge all the auditors, who helped us with their valuable suggestions and constructive criticism in the development of our strategy.

Another event of significance for our Institute took place at the Fraunhofer Headquarters in Munich in February 2014: on the initiative of INT, the Fraunhofer Space Alliance was launched. This Alliance unites 15 institutes with more than 5000 staff, to jointly develop technologies for the European space sector. From the moment the Alliance HQ was set up at INT, Euskirchen may justly say it is now a major address for German Space Research.

Of course, the major social event in INT's year should not go unmentioned: in September, we celebrated the Institute's 40th birthday. In 1974, the former "Institute for Radiation Protection" was absorbed into the Fraunhofer-Gesellschaft. The task of nuclear and electromagnetic research was extended by the second part of the basic mandate – which still exists today: developing assessment and counseling capabilities in research and technology. Together, this led to the creation of the name "Institute for Technological Trend Analyses" (Institut für Naturwissenschaftlich-Technische Trendanalyse – INT). The event was duly celebrated with an academic ceremony and subsequent birthday party in the Euskirchen Parkhotel.

Not only the 40-year anniversary reminded us of the passage of time, there were also farewells to long-serving colleagues. Acting as representatives here are Dr. Wolfgang Rosenstock

and Dr. Joachim Schulze, respective heads of the departments NE and TASP. With their departure, INT loses two "veterans", who had both been with the Institute for more than 30 years. Within their two departments they had each played major roles in realizing the new strategies and the changes that resulted. At this point, we thank them warmly for their dedicated and successful work for INT. We wish them the very best for their retirement. With the appointments of Dr. Stefan Metzger as Director of NE from 1. September 2014, and Dr. René Bantes as Director of TASP from 1. March 2015, we have succeeded in gaining two people with excellent leadership qualities, who will continue in the same tradition.

This small selection of events clearly illustrates how much effort, dedication and performance there is behind a successful business year; a year that was also accompanied by far-reaching restructuring and realignment – a comparison with open-heart surgery would not be out of place.

I am certain that INT's staff will maintain this momentum, will keep working to consolidate the new course, and will make the coming year another success.

In this sense, I hope you enjoy reading our report, and: carpe diem; seize the day, before it's flown!

Best wishes,

Prof. Dr. Dr. Michael Lauster

ANNUAL REPORT 2014

- 02 Foreword
- 06 Fraunhofer INT in Profile
- 07 Organigram
- 08 Festive event "40 years Fraunhofer INT"
- 10 Fraunhofer INT Facts and Figures
- 12 Advisory Board
- 13 The Fraunhofer-Gesellschaft
- 14 Fraunhofer VVS – Group for Defense and Security

BUSINESS UNITS

16 TECHNOLOGICAL ANALYSES AND STRATEGIC PLANNING

18 DEFENSE TECHNOLOGY FORESIGHT

- 21 Serious Gaming – a Table top Exercise to assess means of conflict
- 22 Cyborg Insects

24 INTERNATIONAL RESEARCH AND TECHNOLOGY MANAGEMENT

- 27 The EVOCS Project – Research into the Development of european Security concepts
- 28 FP7 project ETTIS – european Security threats and trends in Society
- 29 EU-FP7 Projekt driver: Innovative Solutions for better Crisis Management

30 PUBLIC RESEARCH AND TECHNOLOGY MANAGEMENT

- 32 ESFO – an Information System to provide a wider view of the european Security Research Environment

34 CORPORATE TECHNOLOGIE FORESIGHT

- 36 Future Technology Check S/M/L
- 39 Workshop Round up

- 40 Strategic Project: Technology Trends and Strategies

42 NUCLEAR EFFECTS

- 44 Radiation hardness tests for UAV Components within the ANCHORS project

46 NUCLEAR SECURITY POLICY AND DETECTION TECHNIQUES

- 50 Measurement campaign: searching for and identifying radioactive material

54 ELECTROMAGNETIC EFFECTS AND THREATS

- 57 HPM-Vulnerability studies on Smartphones and Tablets

60 NUCLEAR EFFECTS IN ELECTRONICS AND OPTICS

- 63 Construction of a Cryogenic System for Irridiation
- 65 Atmospheric Neutrons, a growing threat

66 SCIENTIFIC-TECHNICAL SUPPORT

68 BUSINESS ADMINISTRATION AND CENTRAL SERVICES

- 70 Construction

72 COOPERATIONS

- 73 Space Alliance launched
- 74 Methods and Training Staff Position

76 APPENDIX

- 76 University Courses
- 77 International Cooperation
- 79 International Reviews
- 80 Collaboration in Committees
- 81 Participation in Norming Processes
- 82 Lectures and Presentations
- 87 Publications
- 95 Other Reports
- 95 Personalia
- 96 Other Events
- 97 Press Releases
- 97 Institute Course
- 100 Business Units and Contacts
- 104 How to reach us
- 105 Publishing Details

FRAUNHOFER INT IN PROFILE

The Fraunhofer Institute for Technological Trend Analysis INT provides scientifically sound assessments and counseling on the entire spectrum of technological developments. On this basis, the Institute conducts Technology Forecasting, making possible a long-term approach to strategic research planning. Fraunhofer INT constantly applies this competence in projects tailor-made for our clients.

Over and above these skills, we run our own experimental and theoretical research on the effects of ionizing and electromagnetic radiation on electronic components, as well as on radiation detection systems. To this end, INT is equipped with the latest measurement technology. Our main laboratory and large-scale appliances are radiation sources, electromagnetic simulation facilities and detector systems that cannot be found in this combination in any other civilian body in Germany.

For more than 40 years, INT has been a reliable partner for the Federal German Ministry of Defense, which it advises in close cooperation and for which it carries out research in technology analysis and strategic planning as well as radiation effects. INT also successfully advises and conducts research for domestic and international civilian clients: both public bodies and industry, from SMEs to DAX 30 companies.

THE BUSINESS UNITS IN THIS ANNUAL REPORT:

BUSINESS UNIT

DEFENSE TECHNOLOGY
FORESIGHT

BUSINESS UNIT

INTERNATIONAL RESEARCH AND
TECHNOLOGY MANAGEMENT

BUSINESS UNIT

PUBLIC RESEARCH AND
TECHNOLOGY MANAGEMENT

BUSINESS UNIT

CORPORATE TECHNOLOGY
FORESIGHT

BUSINESS UNIT

NUCLEAR SECURITY POLICY
AND DETECTION TECHNIQUES

BUSINESS UNIT

ELEKTROMAGNETIC EFFECTS
AND THREATS

BUSINESS UNIT

NUCLEAR EFFECTS IN ELECTRONICS
AND OPTICS

ORGANIGRAM

DIRECTOR'S OFFICE

Director

Prof. Dr. Dr. Michael Lauster
Phone +49 2251 18-117/-217
michael.lauster@int.fraunhofer.de

Vice-Director

Dr. Stefan Metzger
Phone +49 2251 18-214
stefan.metzger@int.fraunhofer.de

Assistant to Director

Inge Pastuszka
Phone +49 2251 18-217
inge.pastuszka@int.fraunhofer.de

DEPARTMENT BUSINESS ADMINISTRATION AND CENTRAL SERVICES (BZD)

Head

Prof. Dr. Harald Wirtz
Phone +49 2251 18-237
harald.wirtz@int.fraunhofer.de

Deputies

Sabrina Langemann
Phone +49 2251 18-226
sabrina.langemann@int.fraunhofer.de

Udo Rector

Phone +49 2251 18-270
udo.rector@int.fraunhofer.de

Secretariat

Diana Noé
Phone +49 2251 18-286
diana.noe@int.fraunhofer.de

Marketing and PR

Thomas Loosen
Phone +49 2251 18-308
thomas.loosen@int.fraunhofer.de

Library and Specialized Information Services

Siegrid Hecht-Veenhuis
Phone +49 2251 18-233
siegrid.hecht-veenhuis@int.fraunhofer.de

Central Information Technology and Information Security

Udo Rector
Phone +49 2251 18-270
udo.rector@int.fraunhofer.de

DEPARTMENT TECHNOLOGICAL ANALYSES AND STRATEGIC PLANNING (TASP)

Head

Dr. René Bantes
Phone +49 2251 18-185
rene.bantes@int.fraunhofer.de

Deputy

Hans-Martin Pastuszka
Phone +49 2251 18-298
hans-martin.pastuszka@int.fraunhofer.de

Secretariat

Klara Hardtke
Phone +49 2251 18-223
klara.hardtke@int.fraunhofer.de

DEPARTMENT NUCLEAR AND ELECTROMAGNETIC EFFECTS (NE)

Head

Dr. Stefan Metzger
Phone +49 2251 18-214
stefan.metzger@int.fraunhofer.de

Deputy

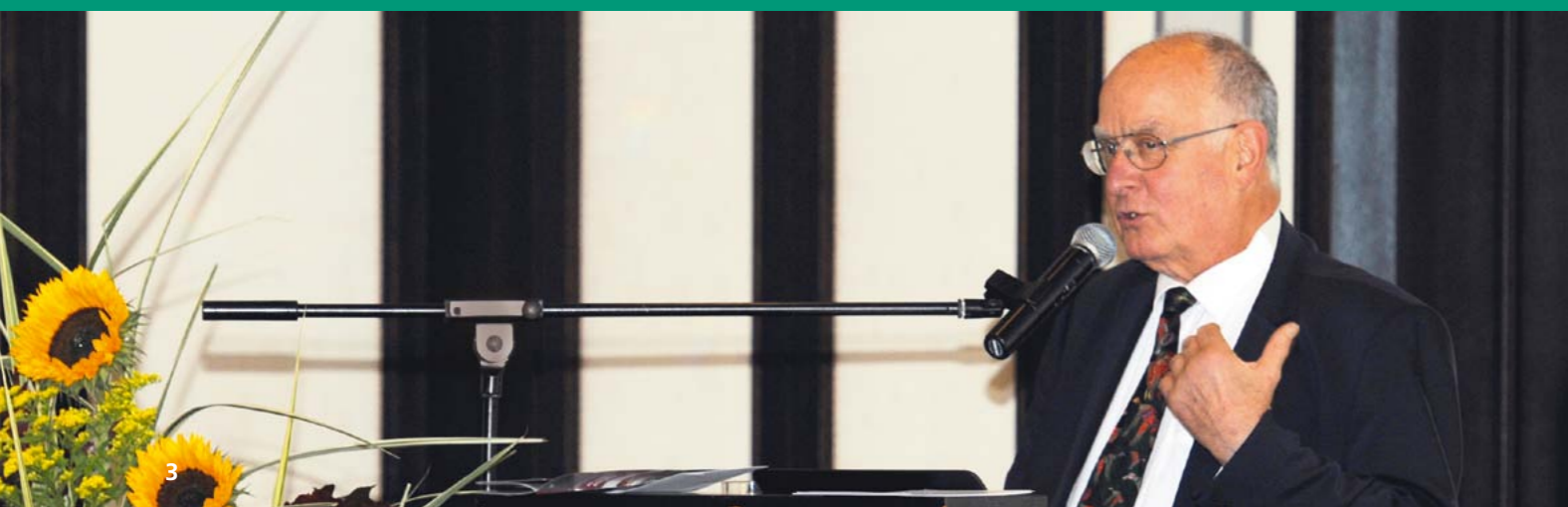
Dr. Michael Suhrke
Phone +49 2251 18-302
michael.suhrke@int.fraunhofer.de

Secretariat

Giesela Fuss
Phone +49 2251 18-218
giesela.fuss@int.fraunhofer.de



FESTIVE EVENT "40 YEARS FRAUNHOFER INT"



On September 25, 2014 the Fraunhofer Institute for Technological Trend Analysis INT celebrated its 40th anniversary as a member of the Fraunhofer-Gesellschaft. To mark the occasion, a ceremony was held at the Ameron Parkhotel, Euskirchen, to which Institute staff, former colleagues, friends and partners were invited.

Fraunhofer INT was founded in the 1960s, arising from the Institute of Pure and Applied Nuclear Physics at the University of Kiel. The Institute's original location was in Stohl, near Kiel. From the beginning, the Institute received administrative assistance from the Fraunhofer-Gesellschaft. This model, common in the early days of the Gesellschaft, supported small research groups in the implementation of their projects.

In 1974, INT was fully absorbed into the larger Fraunhofer family. Since its inception, INT has been closely connected to the Ministry of Defence (MoD). It advised the Ministry, initially exclusively, on questions of the effect of nuclear weapons on Bundeswehr equipment and on the long-term development and defense relevance of new technologies. This relationship led in 1977 to the move from Stohl to Euskirchen, where the closer proximity to MoD in Bonn facilitated better consulting services.

With the end of the Cold War, the original issues lost some of their importance, and the Institute opened itself up to more civilian research work. Since the turn of the millennium, INT has regularly conducted research projects for clients in government and industry, without having any negative effect on its importance for the Ministry. Characteristic for this period is constant and lasting growth for INT, not only regarding staff, but also concerning the Institute's premises. Accordingly, to create more office space, the top floor of the original Institute building was expanded in 2007. In 2012, a new office building was opened, and in 2014, the Institute took possession of its new library and seminar room.

At the Park Hotel ceremony, INT's Director, Prof. Dr. Dr. Michael Lauster, welcomed around 140 guests, including the Mayor of Euskirchen, Dr. Uwe Friedl. The program included a look back at 40 years of INT with Dr. Klaus Leuthäuser and Prof. Dr. Uwe Wiemken, two former Institute Directors, and a lecture by Prof. Dr. Reinhold Popp of the Center for Future Studies, Salzburg. The program, ensuing dinner and formal conclusion were accompanied by the group "2 of As" with a musical retrospective from classical to jazz.

A special highlight was the "technical museum" that had been especially mounted in a side room. On show was old measuring technology as used in the Institute in the '60s, '70s and '80s, including oscilloscopes, various measuring devices and analyzing electronics. Colleagues from the Scientific Technical Infrastructure had prepared the exhibits with great care, even restoring some of them to a functional state, and stimulating many of INT's alumni to share some anecdotes. The devices showed very clearly how daily operations for the Institute's scientists and technicians have changed over the decades.

- 1 2 of As
- 2 Dr. Leuthäuser und Prof. Dr. Dr. Lauster
- 3 Prof. Dr. Wiemken
- 4 Prof. Dr. Popp

FRAUNHOFER INT FACTS AND FIGURES

Staff

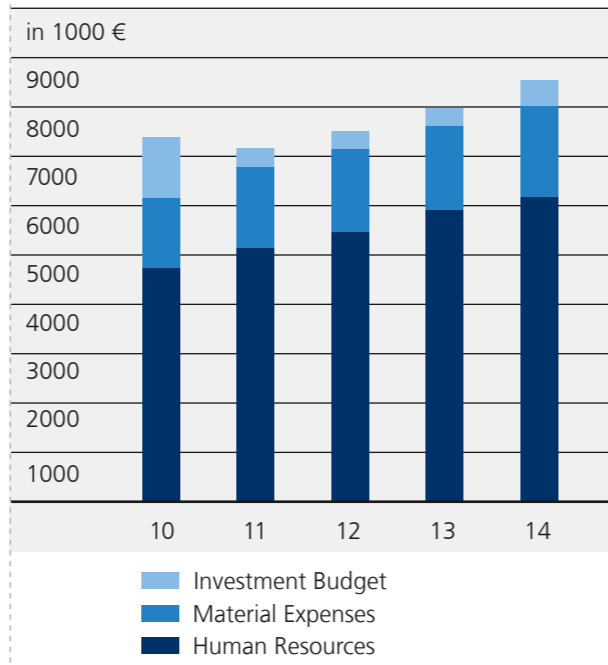
INT staff numbers grew moderately in comparison with previous years. With meanwhile 56 scientists, the Institute staff covers a wide range of natural and engineering sciences, as well as economics, social and human sciences. The researchers are supported by graduate engineers, technologists and administration specialists. INT also has a network of freelance scientists who are regularly involved in the Institute's work.

Budget

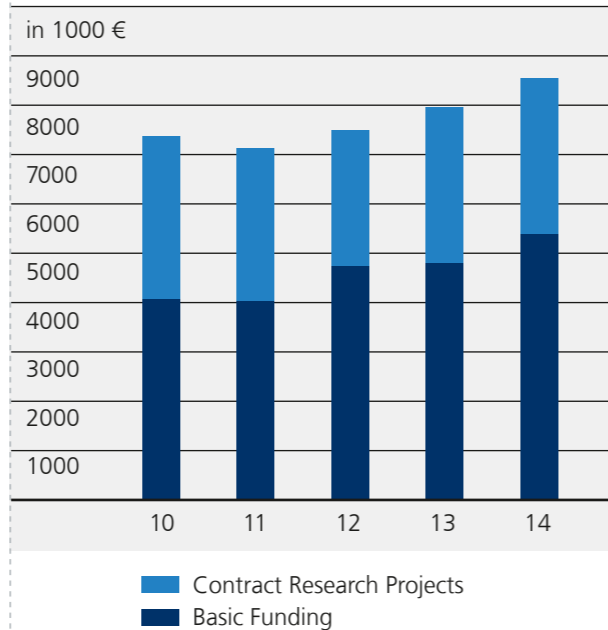
The Fraunhofer Gesellschaft distinguishes between operating and investment budgets. The operating budget covers all staffing and administrative expenditure, the investment budget concerns the procurement of capital goods such as scientific apparatus and technical equipment. The operating budget in 2014 exceeded € 8 million for the first time. Together with the investment budget (including small construction work) of € 514,000, the total budget amounted to more than € 8.5 million. As well as the amounts shown for investment in scientific infrastructure there is also the expenditure for work on the new library and a seminar building. This is funded by Federal Ministry of Defence BMVg and is not shown in the Institute's budget.

Along with basic funding from BMVg, which enables the implementation of a coordinated research program, INT also receives basic funding from Federal and Länder sources. Funding is applied within the Fraunhofer-Gesellschaft in accordance with performance criteria. INT generates the remaining funds necessary for its budget through a large volume of contract research work. As well as the public sector, project clients in various industries range from SMS companies to DAX-30 groups, and also include associations and international organizations.

Budget from 2010 – 2014



Financial Development from 2010 – 2014



Human Resources

	2012		2013		2014	
	Manned Positions	People	Manned Positions	People	Manned Positions	People
Scientists	46.6	50	51.9	55	53.4	56
Graduates	18.5	19	18.5	19	24.5	25
Technicians / Others	17.4	19	16.9	20	11.8	15
Assistants / Trainees	5.5	22	5.4	17	5.5	22
Total	88	110	92.7	111	95.4	118

There were again considerable increases in income, particularly from EU projects. In the public sector, our largest client is the Federal Ministry of Defence, for which we have been an in-depth consultant in research and technology planning for 40 years.

Budget

in 1000 €	2010	2011	2012	2013	2014
Expenses					
Operating Budget	6111.0	6787.0	7146.0	7607.9	8027.6
of which Human Resources	4718.0	5150.0	5461.0	5915.7	6189.4
of which Material Expenses	1393.0	1637.0	1685.0	1692.2	1838.2
Investment Budget	1230.0	362.0	367.0	372.0	514.2
Total	7341.0	7149.0	7513.0	7979.9	8541.8

Funding

Basic Funding	4047.0	4032.0	4772.0	4820.9	5405.8
Contract Research Projects	3295.0	3117.0	2741.0	3159.0	3136.0

ADVISORY BOARD

THE FRAUNHOFER-GESELLSCHAFT



The Institute is advised by an Advisory Board which is composed of people from industry, science, politics and administration.

Chairman:

Prof. Dr. Horst Geschka; Geschka & Partner

Members:

- Herr Dr. Walter Bernard; Diehl BGT Defence GmbH & Co. KG
- Herr Klaus Burmeister; Z_punkt GmbH
- Herr Dr.-Ing. Karsten Deiseroth; IABG GmbH
- Herr Prof. Dr. Horst Geschka; Geschka & Partner Unternehmensberatung Innovarium
- Herr Dr. Wolf Junker; Bundesministerium für Bildung und Forschung (BMBF)

- Herr DirWTD Rainer Krug; Wehrtechnische Dienststelle für Informationstechnologie und Elektronik (WTD 81)
- Herr Dir Prof. Dr. Winfried Schuh; Wehrwissenschaftliches Institut für Schutztechnologien – ABC-Schutz (WIS)
- Herr MinR Norbert Michael Weber; Bundesministerium der Verteidigung (BMVg)
- Herr Dr. Hans-Ulrich Wiese
- Herr Dr. Thomas Weise; Rheinmetall Aktiengesellschaft
- Herr Prof. Dr. Dr. Axel Zweck; VDI Technologiezentrum GmbH
- Herr Dr. Helmut Schmidt; Fraunhofer Gesellschaft

1 *Advisory Board meeting on June 05, 2014.*
Representative of the Executive Board: Dr. Hans-Otto Feldhütter

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 66 institutes and research units. The majority of the nearly 24,000 staff are qualified scientists and engineers, who work with an annual research budget of more than 2 billion euros. Of this sum, around 1.7 billion euros is generated through contract research. More than 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. Almost 30 percent 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.

International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the 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.

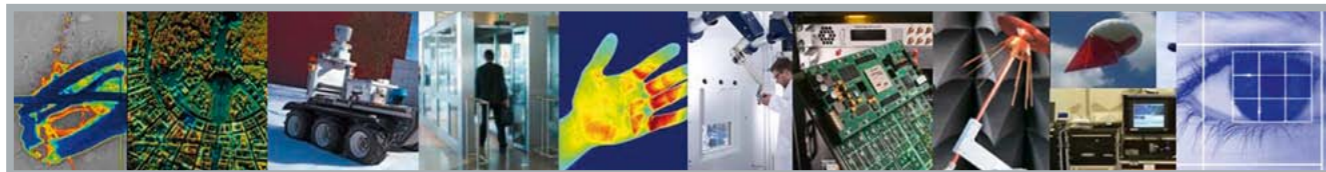
FRAUNHOFER VVS – GROUP FOR DEFENSE AND SECURITY



After a 12-year term of office, Prof. Dr. Klaus Thoma handed over the chairmanship of the Group to Prof. Dr.-Ing. Jürgen Beyerer, director of the Fraunhofer Institute for Optronics, System Technology and Image Exploitation IOSB.

In times of social and political turbulence, security is a future market with enormous growth potential. Modern technologies, products and services are in demand like never before. The prosperity and growth of our industrial societies are dependant upon critical infrastructures that are globally networked. Their breakdown or destruction could result in unpredictable economic and social damage as a consequence.

Dissipating borders between interior and exterior security, as well as between public and private security are making state institutes that are responsible for public safety face challenges that, up until now, were unknown. Examples of this include terrorism at an international level, transnational organized crime, as well as the effects of local natural disasters and major accidents which are, in part, felt at a global level. In order to recognize a variety of risks early, be able to avoid these to the greatest extent possible, and in order to minimize subsequent damage after their occurrence, comprehensive technological security solutions and accompanying methodical, procedural and tactical concepts are being developed by 2500 scientists working in the ten member institutes. In addition to contract research for companies in the defense and security sector, the Group also serves as a reliable advisor for the Federal Ministry of Defense and the Federal Ministry of Education and Research. The service range of the Group also covers the majority of the institutional research for the ministries.



Prof. Dr. Klaus Thoma is handing over chairmanship of the VVS Group to Prof. Dr.-Ing. Jürgen Beyerer

The chairman of the Group up until this point, Prof. Dr. Klaus Thoma of the Fraunhofer Ernst-Mach-Institut, EMI, retired at the end of last year. He had successfully managed the Group since its founding in 2002. After a 12-year term of office, Mr. Thoma handed over the chairmanship of the Group to Prof. Dr.-Ing. Jürgen Beyerer as of 1 January 2015.

Since 2004, Mr. Beyerer has been the director of the Fraunhofer Institute for Optronics, System Technology and Image Exploitation IOSB and owner of the chair Vision and Fusion Laboratory IES at the Department of Informatics at the Karlsruhe Institute of Technology KIT.

The home institute of the new chairman provides itself a broad and well-linked spectrum of technologies for defense and security at the locations Karlsruhe and Ettlingen: Competencies range from optronic image recording through real-time evaluation to reconnaissance and surveillance systems.

Prof. Dr. Peter Martini is deputy speaker of the Group, who is, for his own part, director of the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE. The new managing director of the Group is Caroline Schweitzer.

Member institutes are the Fraunhofer institutes for

- High-Speed Dynamics, Ernst-Mach-Institut, EMI
- Applied Solid State Physics IAF
- Chemical Technology ICT
- Technological Trend Analysis INT
- High Frequency Physics and Radar Techniques FHR
- Communication, Information Processing and Ergonomics FKIE
- Optronics, System Technologies and Image Exploitation IOSB
- Systems and Innovation Research ISI (guest institute)
- Integrated Circuits IIS (guest institute)
- Telecommunications, Heinrich-Hertz-Institut, HHI (guest institute)

Chairman of the Group

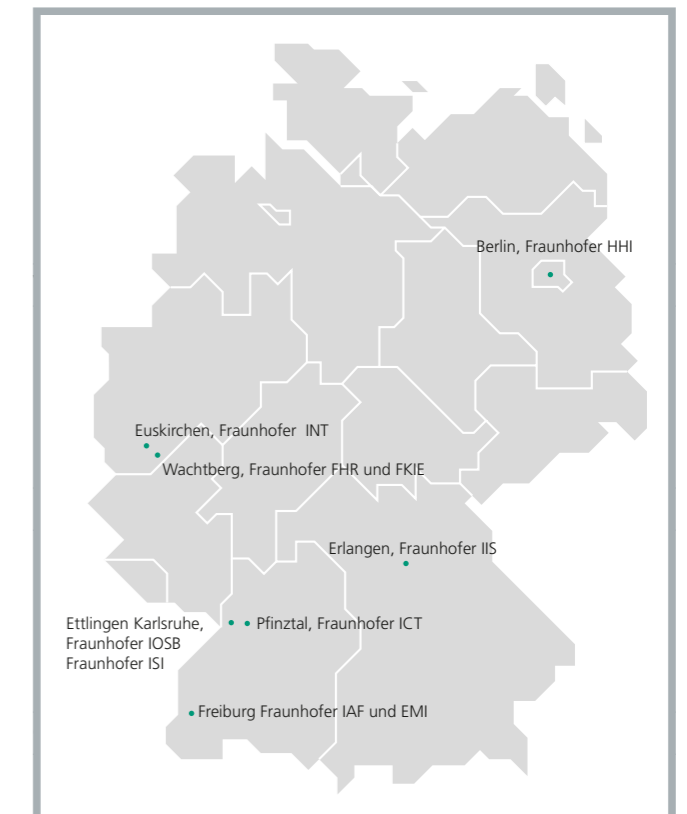
Prof. Dr.-Ing. Jürgen Beyerer
Fraunhofer IOSB

Deputy Chairman of the Group

Prof. Dr. Peter Martini
Fraunhofer FKIE

Central Office

Dipl.-Ing. Caroline Schweitzer
Fraunhofer IOSB
Gutleuthausstraße 1
76275 Ettlingen
Phone +49 7243 992-361
caroline.schweitzer@iosb.fraunhofer.de



¹ Chairman of the Group
Prof. Dr.-Ing. Jürgen Beyerer,
Fraunhofer IOSB

TECHNOLOGICAL ANALYSES AND STRATEGIC PLANNING

Dr. René Bantes

At the beginning of 2014, the Institute was restructured according to its Strategy Process. This involved merging the two departments Technology Analysis and Foresight and Meta-Analyses and Planning Support, to create the new Department "Technology Analyses and Strategic Planning" – TASP.

Staffed with 40 scientists, mainly from scientific-technical disciplines, TASP's primary task is to deliver continual analysis, evaluation and forecasting of technological developments worldwide, and thus identify potential research and technology planning implications for our clients.

This expertise is based on Fraunhofer INT's systematic and continuous technology foresight process, which is centrally coordinated and developed by the TASP group "Technology Trends and Strategies". Findings from this process lead to a client-specific technology assessment. Key points of interest are the overall future potential and possible risks and benefits of a technology's application potential. We also assess the relevance of corresponding players, national and international, as well as plans and programs in research and technology. From this we derive specific recommendations for action to be used as valuable input into the clients' strategic decision making.

Although the methods are essentially generic, the conclusions and recommendations derived vary, depending on client requirement. To support the adaptation to different client specifications, TASP is structured in four Business Units, each of which addresses different types of clients and their varying analysis requirements:

- Defense Technology Foresight
- Public Research and Technology Management
- International Research and Technology Management
- Corporate Technology Foresight

These Business Units and their activities in 2014 are described in detail on the following pages.

Among TASP's main activities in 2014 was intensive participation in Future Security 2014 in Berlin, with INT scientists taking the chair for the Session "Detection Technologies 2", and participating in other sessions as speakers and/or panelists.

BUSINESS UNIT “DEFENSE TECHNOLOGY FORESIGHT”

Hans-Martin Pastuszka



Defense Technology Foresight (WZA) is the Business Unit that covers all services of the Institute's Department for Technology Analyses and Strategic Planning (TASP) provided for the Federal Ministry of Defense (MoD) and its downstream offices (in particular BAAINBw, the Federal Office for Bundeswehr Equipment, Information Technology and In-Service Support and its subordinates, as well as the Bundeswehr Planning Office, PlgABw).

The technology-oriented futures research of this Business Unit serves to provide its clients with reliable orientational knowledge and decision guidance on likely future developments in science and technology, including the defense-technological and military implications of such developments. The main spotlights are on the early detection of Emerging technologies, the identification of related opportunities and risks, and a client-specific technology assessment. As well as focusing on technological issues, relevant international research planning processes and strategies are observed and analyzed, resulting in recommendations for the client's research and technology planning. WZA is thus making its contribution in gaining insights into future global technological developments, ensuring a broad analysis and assessment capability for clients in the field of defense research and technology (R&T). These services, with the "Defense Technology Forecast" (WTV, restricted) as the Business Unit's core product, are provided by an interdisciplinary team of scientists and engineers within TASP. In sum, this team provides an area-wide expertise in all relevant science and technology fields, complemented by comprehensive competence in methodology and processes.

2014 was marked by the adoption and implementation of the new departmental structure, which coincided with increasing contracts for WZA from MoD and its downstream offices.

For the Institute, there were thus more requests for science-based advice and decision support for the authorities, for example in the form of individual contributions on long-term technological trends in connection with preparations for the Federal Government's new White Paper 2016, and in various

statements on technological and planning issues, especially on international R&T cooperation (such as the Preparatory Action on CSDP-related Research).

An essential task in contract research for WZA was ensuring quantity and quality for the Defense Technology Forecast mentioned above. Appearing quarterly, the Forecast is made available by the client to a broad readership in MoD, its subordinate offices and the Bundeswehr.

Going beyond this established practice, a WZA workshop was mounted in 2014 for the first time, jointly conceived and organized by the client and WZA. The workshop, which will take place regularly in the future, aims at promoting information exchange and discussion between the Forecast's authors and the various users, as well as supporting the possibility of taking up and implementing recommendations for action.

Over and above this main WZA task, last year also saw in-depth technology analyses on selected individual issues. These analyses addressed the military potential of novel quantum technologies, "Cyborg Insects" (see the separate contribution in this Annual Report) and the potential threat of resource scarcity for the Bundeswehr. Cooperation with FMV, the Swedish Defence Materiel Administration, was successfully continued, with a number of technology analyses being carried out.

A final highlight of 2014 was the participation in and contribution of a TASP team involving WZA to the Bundeswehr Planning Office's "Future Study 2014" on effectors in the future. This activity focused on preparing, implementing and evaluating a three-day workshop for the Planning Office's Future Analysis Unit, using the assessment game method for analyzing effectors. Again, the next article in this Annual Report looks at this in greater detail.

WZA's prospects for 2015 are encouraging: as well as continued contractual work for the client – particularly in-depth technology analyses in the context of WTV, new tasks are emerging.



SERIOUS GAMING – A TABLE TOP EXERCISE TO ASSESS MEANS OF CONFLICT

Dr. Silke Römer

These relate primarily to the European Defence Agency (EDA), where as a member of an international consortium led by the consultancy Ernst & Young France, a framework agreement on consultancy services was concluded. Also for EDA, there is a pilot study on the development of a Technology Watch Tool commissioned.

The aim of the study “Wirkmittelanalyse mit der Methode Assessment Game” for the Unit for Future Analysis of the Bundeswehr Planning Office was to assess a range of widely varying means – within the framework of the expanded security notion – on the background of different scenarios. The basis for this was the unit’s internal paper “Future Study 2014” (FS2014), entitled “Rolle der Wirkmittel in der Zukunft – Charakter, Nutzung und Implikationen”, which identifies a set of means (political, economic, information & communication and technological means) with potential relevance for the Bundeswehr.

In this study, the following aspects were to be given special consideration:

- Influence of the different means within the scenarios considered,
- Opportunities (improvement of capabilities) resulting from the existence and/or usage of the means considered,
- Capability gaps that cannot be closed even when using the means considered.

As far as possible within the given framework conditions, additional insight should be gathered with respect to the following questions:

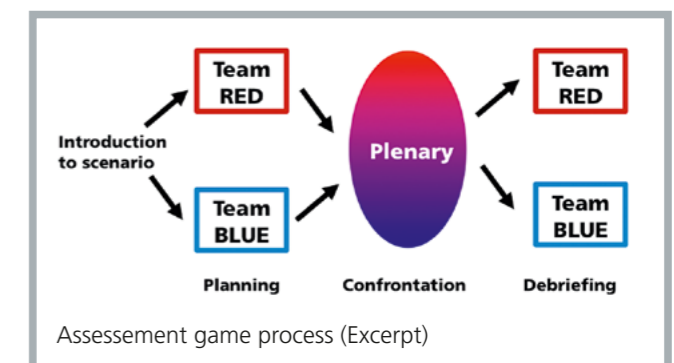
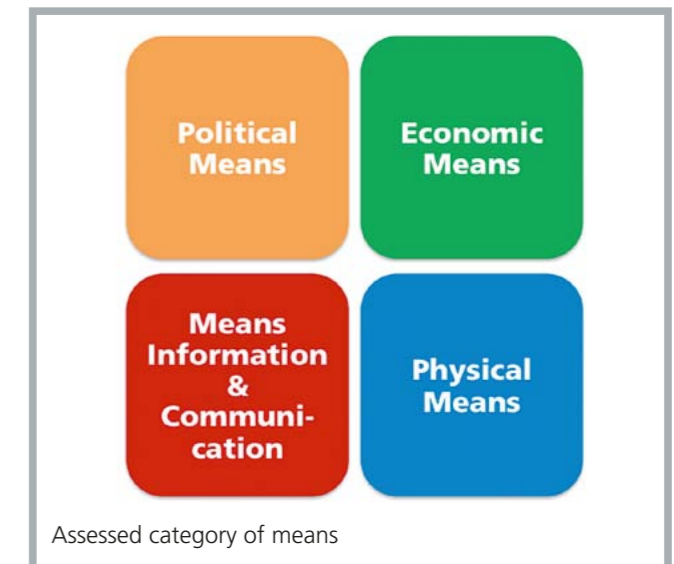
- Will the action hot spots shift or change due to the application of the considered means?
- What is the probability of the considered means being used?
- Who are the likely users of these means (state or non-state actors)?

For this purpose, known methods were tested for their applicability to the issues in question, in particular the concept of disruptive technology assessment gaming developed in the context of two NATO RTO SAS working groups.

A customized gaming method was developed and used in a workshop involving the client and both internal and external experts. Finally, the input from the workshop was used to assess the different means of conflict within the given scenarios. The applicability of the adapted methodology for this complex

task of assessing means of very different character was discussed.

The interdisciplinary and inter-agency approach was recognized by all participants as interesting and productive. For future analyses, it was suggested that questions should be narrowed down and deepened in order to achieve well-adapted methods for conducting detailed system analyses of relevant factors and relationships (causal relationships, cause and effect, probability of occurrence). Additionally, it was proposed to further develop the assessment game method by using additional virtualization, also for training purposes.



CYBORG INSECTS

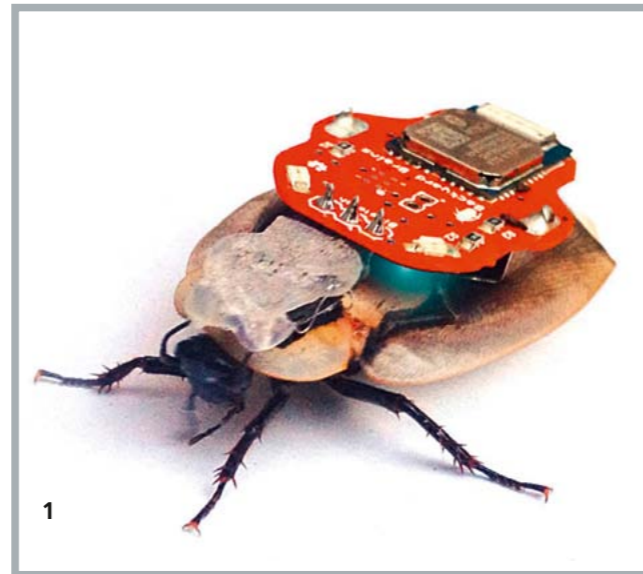
Dr. Carsten M. Heuer

With RoboRoach, the “first commercially available cyborg in the world”, a US-based company sparked heated ethical debates towards the end of 2013. After all, the do-it-yourself kit facilitates the transformation of a living cockroach into a remote-controlled organic-technical hybrid creature through the implantation of electronic components (see Figure). Similar to reins and spurs in horseback riding, wire electrodes convey commands such as “left/right” or “forwards” through electric stimulation. The system is completed by a backpack-like microcontroller and a signal receiver, such that it can be operated by a smartphone or other remote devices.

Contrary to the view of many critics, the RoboRoach is not a perfidious toy. In fact, the cyborg insect serves pedagogical purposes and primarily addresses students and teachers, but also interested laypersons who want to understand how nervous systems work and who want to explore the underlying principles of neural interfaces. After all, comparable neuro-technical systems are already being used in rehabilitative medicine, e. g. in the form of cochlear implants that transform acoustic signals into electric stimuli and transmit them to the auditory nerve.

Performing surgery on the animals is not trivial: accurately implanting the hair-thin wire electrodes requires meticulous preparation, utmost care and patience. Even if implantation is successful, an effective manipulation of the cockroach is not guaranteed. Although the insects generally recover quickly – they feel no pain and are extremely resistant – even the smallest mechanical influences can damage the fragile electrodes and render specific stimulation impossible. Moreover, success is usually short-lived. Because of their natural adaptability, the insects quickly get used to the external stimulation and their responsiveness to the control impulses falters.

In principle, cyborg technologies could also find applications in civil protection and military reconnaissance. As remotely controllable sensor-platforms, cyborg insects like RoboRoach could unlock capabilities similar to those facilitated by purely technical reconnaissance robots (e. g. micro-drones). However,



regarding the above-mentioned difficulties in creating and controlling cyborg insects, such application scenarios appear unlikely. Moreover, although insect movement control and even flight manipulation have already been demonstrated under laboratory conditions, the control options are very limited and not fully reliable. In addition, insect cyborg systems are subject to strict size and weight limitations, which adversely affect their service life and efficiency. Although the development of cyborg insects could benefit from general technological advances (e. g. the miniaturization of electronic components), application-oriented research and development is currently heavily focused on purely technical miniature systems. The fear of “six-legged soldiers”, as instilled by various critics, therefore appears largely unfounded. Rather, research into cyborg insects provides us with valuable insights into the basics of biological-technical interfaces, and may thus open up new avenues in rehabilitation medicine.

1 *Cyborg Cockroach*
“RoboRoach”.
© backyardbrains.com

BUSINESS UNIT “INTERNATIONAL RESEARCH AND TECHNOLOGY MANAGEMENT”

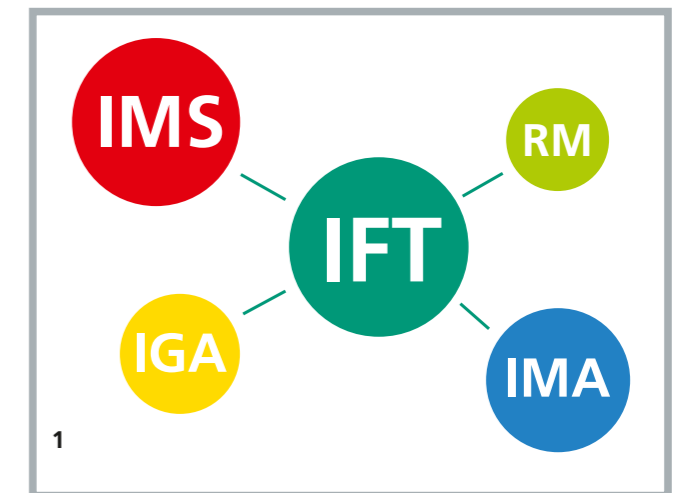
Dr. Merle Missoweit



The Business Unit IFT (International Research and Technology Management) clusters the international activities of Department TASP. Our clients are the European Commission, mainly the European Research Framework Programmes (FP7 and Horizon 2020 *Secure Societies*), the European Defence Agency EDA, the European Parliament and international organizations and stakeholders in the areas of security and defense.

IFT focuses its research on evidence-based decision support for research and innovation management in security and defense. This mainly means foresight and scenario activity, technology assessment, roadmapping and contributions to capability development, bibliometric and statistical analyses, and developing concepts for innovation management. In this context, *Innovation Management for Public Security Provisions* pursues the development and testing of innovation management concepts to support policy makers. In 2014, a key activity in the area was the first phase of the FP7 demonstration project DRIVER (Driving Innovation in Crisis Management for European Resilience, 2014–2018), in which IFT is overall scientific manager and also directs a sub-project. In contrast, the area *Innovation Management for Security Players* addresses the individual authorities and organizations in security, supporting them in the implementation of research findings. Extending this Business Unit's portfolio, the “Resilience Management” area is currently being set up. This activity has its sights on using innovation management methods to increase the resilience of critical infrastructures in cases of crisis and catastrophe.

For some time, a task cross-linked to these three main activities has been broadening the connection with societal issues on the acceptance of security technologies and concepts (including the FP7 Project EvoCS, *The Evolving Concept of Security*, which IFT is coordinating, but also within the DRIVER project). Within this key area, the European Network of Excellence SOURCE – Virtual Centre of Excellence for Research Support and Coordination on Societal Security (2014-2019) was launched in January 2014, with TASP participating.



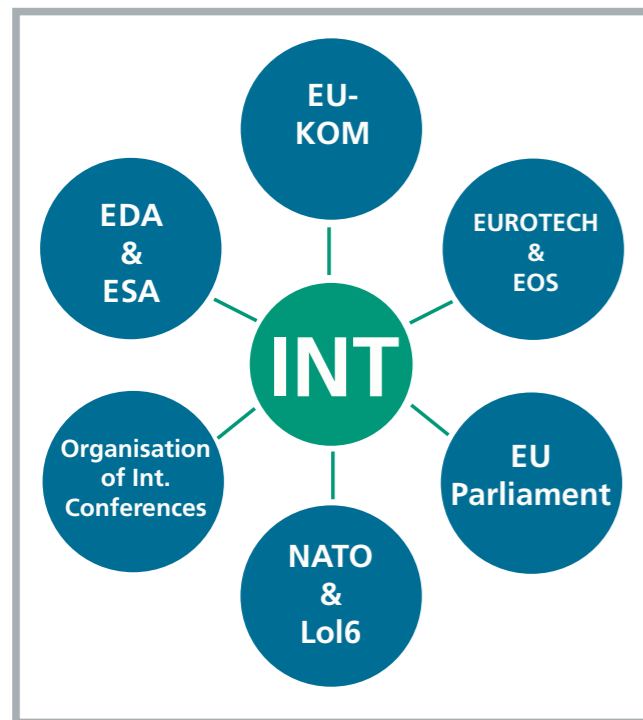
Another highlight of 2014 was the conclusion of a framework agreement for scientific and technical support of the European Parliament (Science and Technology Options Assessment – STOA).

IFT's wide expertise not only becomes evident through the Business Unit's appointment to the H2020 Advisory Group Secure Societies, but also through its appointment to the cross-discipline H2020 Advisory Groups on *Gender and International Cooperation*. IFT also represents the Fraunhofer Group for Defense and Security Research (Fraunhofer-Verbund für Verteidigungs- und Sicherheitsforschung – VVS) in the *Eurotech Security Working Group* at the European Association of RTOs (EARTO), and in the *European Organisation for Security* (EOS).

¹ Thematic areas IFT:
IMS: Innovation Management for Public Security Provisions
IMA: Innovation Management for Security Players
IGA: Innovation & social acceptance
RM: Resilience Management

THE EVOCS PROJECT – RESEARCH INTO THE DEVELOPMENT OF EUROPEAN SECURITY CONCEPTS

Dr. Miloš Jovanović, Dr. Joachim Burbiel



2 International networks and committees

What are the national security concepts of France, Poland or Serbia? And how do these security concepts relate on a regional and European level? The FP7 project “The Evolving Concept of Security (EvoCS) – A critical evaluation across four dimensions” is looking for answers to questions like these. In the project, the term “Security Concept” means the interaction between five research dimensions within a nation, such as the relevance of certain basic values (examples being social security and physical integrity), or the prominent actors in security (e.g. the government, the media, the private sector). The other three dimensions are political levels, ethics and threats. Fraunhofer INT is both Project Coordinator and the leader of two scientific work packages.

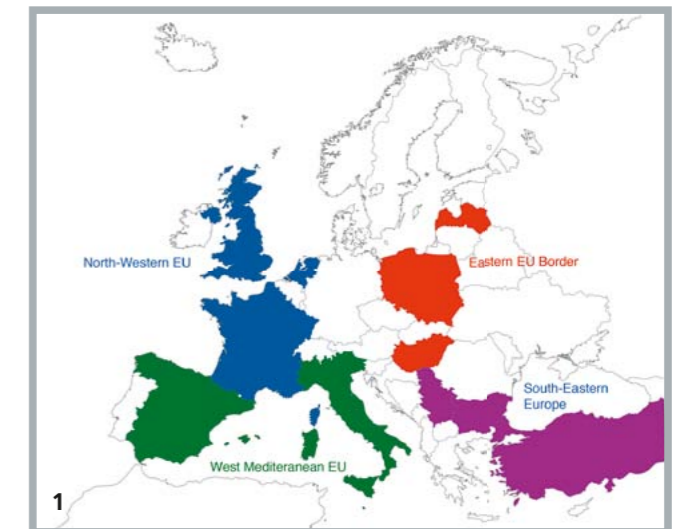
The EvoCS consortium took up work in June 2014 and the initial results generated by year-end were passed on to the European Commission, the funding agency in the 7th Research Framework Programme. As part of the work in 2014, an analytical framework was designed as the basis for analyses of national and regional security concepts, which are now being conducted. To this end, Europe was divided into four model regions, within each of which three countries (in parentheses) were the subject of analysis (see figure):

- Western Mediterranean EU (Italy, Malta, Spain)
- Eastern EU border (Poland, Hungary, Latvia)
- North Western EU (UK, Netherlands, France)
- Southeastern Europe (Serbia, Bulgaria, Turkey)

The analytical framework consists of two stages. First, a snapshot of current national security concepts (ca. 2009–2014) is being created on the basis of various public sources. These sources include government documents, transcripts of parliamentary debates, newspaper articles, scientific papers, etc. The sources are recorded and evaluated in accordance with the dimensions outlined above, and the first results were presented in January 2015 at regional workshops. These workshops also served to include the views of relevant stakeholders (e.g. decision-makers in the security sector). This feedback is already part of the second stage, in which the EvoCS consortium is analyzing

how current national security concepts evolved in the past, what similarities and differences there are and what regional or pan-European conclusions can be drawn from them.

The EvoCS project runs until November 2015. The results will be made available to European policy makers and security users, in order to support work in fields such as future European security strategies, for example by comparing similarities and differences between various national and regional security concepts. In addition, the knowledge generated through the EvoCS project is intended for incorporation into new projects under Horizon 2020.



1 The four EvoCS regions. The countries analyzed are in color

FP7 PROJECT ETTIS – EUROPEAN SECURITY TRENDS AND TRENDS IN SOCIETY

Dr. Sonja Grigoleit

Since the beginning of 2012 Fraunhofer INT has been working in the area of societal security as a consortium partner in the EU FP7 project ETTIS (European Security Trends and Threats In Society, <http://ettis-project.eu>). Societal security is regarded as the ability of a society to survive and persist in its essential character under changing conditions and actual threats. It includes not only the material aspects of life (e. g. infrastructure, property, etc.), but also complex ethical and societal aspects such as confidence and trust.

In recent years, there has been a growing understanding that the basis for security is deeply rooted in society itself and is not only a combination of external threats and appropriate responses to them. Instead, a broad range of stakeholders, including the EU citizens themselves, plays an important role in prevention, in the response to a potential threat and in the resilience of society. As well as purely physical security (e. g., border security), ETTIS thus regards politics, socio-economics, culture, environment, resources, and health to be key aspects of social security. This shift in the understanding of security underpins the work of the ETTIS project. It is also reflected in the methodological contributions to research and innovation planning with which ETTIS aims to support a comprehensive societal security.

The diversity of factors relevant for societal security continues to grow. As well as external threats and natural disasters, the novel security challenges include cyber threats, globalization and social change. In response to this complex range of challenges, ETTIS has developed a meta-model consisting of four archetypes of innovation, representing a taxonomy for the full range of security research and innovation systems.

The model takes into account both social and technical aspects, as well as different time frames (such as coping with climate change compared to internet security):

- modified industrial innovation (e. g. aviation security)
- fast and open innovation (e. g. cyber defence system),
- social innovation (e. g. cyber civic resilience)
- commons-oriented innovation (e. g. climate change induced migration).

The ETTIS consortium consists of 10 partners from 8 EU countries, plus Norway and Israel. With a budget of 2.8 million Euros, numerous research reports, policy briefs, newsletters and videos were produced in the three years up to the end of the project in December 2014, with the aim to advise policy makers on societal security, especially on research and innovation policy and programming.

Apart from the actual research work, Fraunhofer INT was also responsible for staging the final high level event in Brussels in November 2014, where the consortium discussed its findings with other scientists, policy makers, industry representatives and societal actors.



EU-FP7 PROJECT DRIVER: INNOVATIVE SOLUTIONS FOR BETTER CRISIS MANAGEMENT

Maike Vollmer

Crisis Management is an ever evolving challenge. Hazards change, both for natural and man-made reasons – climate change being a well-known example of the latter. Vulnerabilities change, for reasons ranging from the establishment of settlements in new areas to societal evolution affecting people's ability to cope with crises. Interconnectedness changes because of increased connectivity in the technical domain, for example the power transmission system, and in the socio-cultural domain as cross-border communities become increasingly important.

All these societal, technical and environmental changes interact to create new challenges for Crisis Management.

In recent years, INT has been successfully working with an innovation approach to crisis management research at EU-level (the ACRIMAS Project), which is being further developed and implemented under DRIVER (Driving Innovation in Crisis Management for European Resilience). DRIVER, a "Demonstration Project" of the European Union, was successfully launched in May 2014. In addition to the results from ACRIMAS, it builds on other research projects and brings together the expertise of 37 organizations from 15 countries.

The European Commission has funded DRIVER with 33.4 million Euros from the 7th Research Framework Programme, making it – for the foreseeable future – the largest research and innovation project on crisis management in Europe, if not the world. For four and a half years, the consortium is promoting the development of a distributed pan-European test-bed of virtually networked operational facilities and crisis laboratories, in which users, suppliers, researchers, policy makers and citizens may work step-by-step together on new approaches to current and emerging crisis management questions and their solutions.

The test-bed will provide methodology & infrastructure for evidence-based innovation management. Using the test-bed methods and infrastructure, DRIVER will also develop a first portfolio of emerging crisis management solutions for individual Member States and EU level crisis management.

The two key results of DRIVER – the test-bed and the portfolio of emerging crisis management solutions – are being complemented by a third element: the discussion on how common crisis management in Europe and innovation in the field is to be understood in the future. Crisis managers, policy makers, technology providers and the public are being invited to participate in the "DRIVER Community" 1. This constantly evolving community enables an intensive exchange between the various actors involved in crisis management, with the aim of developing and implementing societal and technological solutions in crisis management.

Registration for the DRIVER Community under:
<http://www.eurtd.com/driver/community/registration.php>

Test-bed infrastructure and methodology are being sustainably designed, so that their use will help to strategically improve resilience and crisis management capability development in Europe over and beyond the term of the project.

The project is being coordinated by the leading European IT provider ATOS, with technical support from the Swedish Defence Research Agency FOI, and scientific support from INT (TASP Business Unit IFT).



BUSINESS UNIT “PUBLIC RESEARCH AND TECHNOLOGY MANAGEMENT”

Dr. Joachim Burbiel, Dr. Silke Römer

The Business Unit “Public Research and Technology Management” (ÖFT) is specifically dedicated to public, non-military clients in Germany. It deals with research management (e. g. “How can research funds be spent wisely?”), and technology management questions (e. g. “What technologies will need more attention in the future?”). It applies both traditional planning support instruments, such as roadmapping, and participatory methods, such as scenario workshops or World Café.

In addition, the division has specialists who address questions about how knowledge can be organized and presented, or who deal with the technical analysis of large amounts of information, e.g. in scientometrics. These in-house skills take the service portfolio beyond purely scientific dimensions.

Setting up this new Business Unit left its mark on 2014. This included attending conferences to build up and expand an acquisition network. One example was the presentation given by the Unit Manager, Dr. Joachim Burbiel, at the 17th European Police Congress in Berlin. In addition, Unit staff wrote a bid for the Federal Environment Agency tender “Analysis and Assessment of the Effects of Social and Environmental Issues on Environmental Policy, using the Trend Analysis Method”.

Furthermore, a project outline was jointly produced with eight external partners, in response to the call for “Enhancing Resilience in Crisis and Catastrophe Cases” – part of the security research program of the Federal Ministry for Education and Research BMBF. In the context of other projects, experience with variants of “serious gaming” was expanded, regarding both further method development and method application. One advantage of serious gaming is that under appropriate conditions, it can improve the dialogue between technology experts and other fields, so that research and technology management questions can find positive answers on the basis of newfound common understanding.



Last but not least, a project on the topic “Identification Technologies for the Protection of Property” was conducted for the Bremen Police.



ESFO – AN INFORMATION SYSTEM TO PROVIDE A WIDER VIEW OF THE EUROPEAN SECURITY RESEARCH ENVIRONMENT

Dr. Joachim Burbiel, Beate Becker



European security research is a complex and dynamic field. It is characterized by national and international players who identify risks and threats and respond to them through research and development. Since 2005, Fraunhofer INT has been analyzing the European security research environment, considering both civilian and military sectors. The information system esfo (Europäische Sicherheitsforschung) summarizes the information gathered on players, structures and programs in European security research, puts bits of information in relation to each other and makes the results available to the public via the Internet.

As part of the North Rhine-Westphalian project "Transfer of defense science and technology to civilian applications", facts and figures on players, structures and programs in security research are collected and condensed in a web-based information system. Esfo links the information packages on the basis

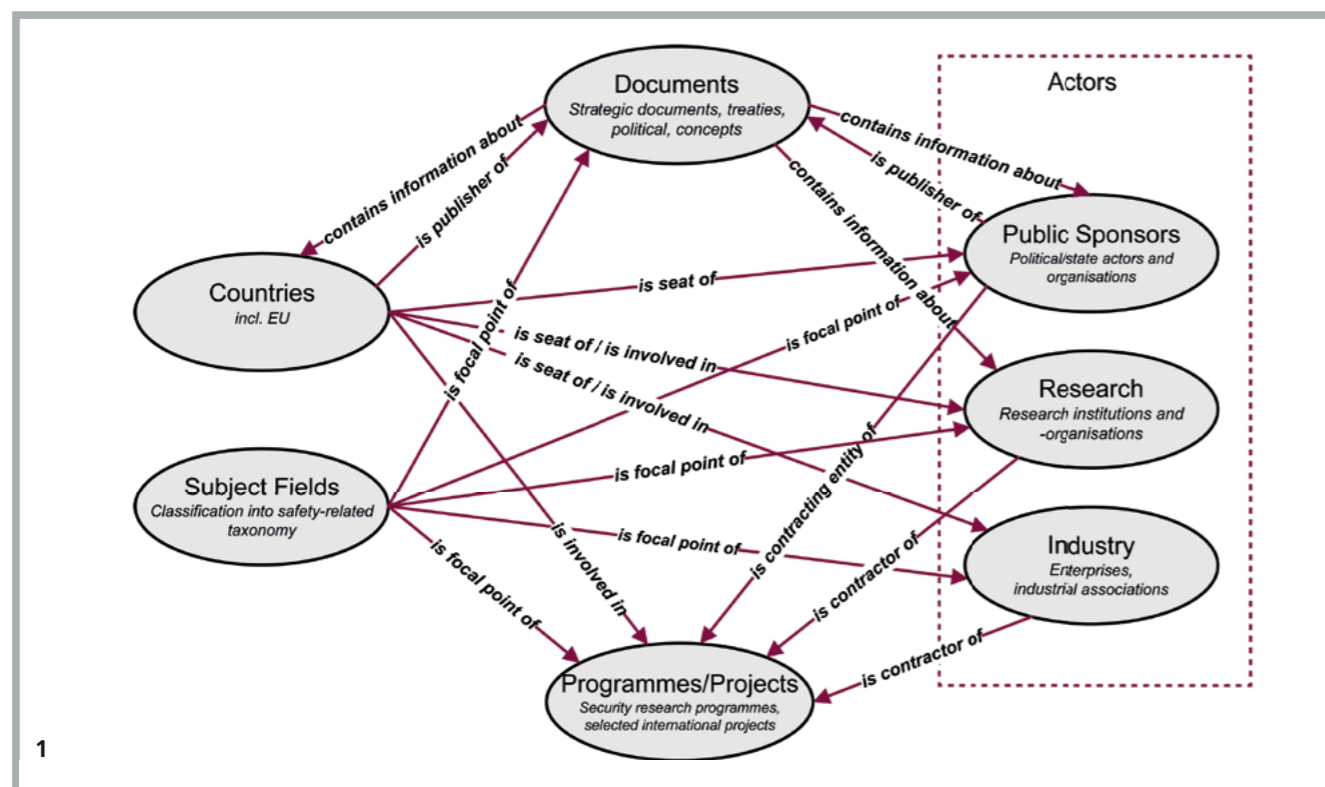
of their ontological relations with each other (e. g. "Country X participates in Project Y" or "Document X contains information about Organization Y"). Through these links, correlations that are difficult to identify become more easily and clearly visible.

With its content maintained by scientists with years of experience in European security research, esfo is coordinated by the Business Unit PRTM (Public Research and Technology Management – ÖFT). Experts from the entire TASP Department are also involved. Esfo data is checked twice a year and updated or amended where necessary.

Esfo information currently encompasses eight states and the European Union in its function as political and economic player. In addition to these "core states", information on other states is occasionally supplemented. As an example, specific Austrian security research documents were evaluated and fed into the

system in 2014. Austria has a special role in this context, as it was a pioneer in Europe with its security research program KIRAS in 2005. In addition to the overviews of state security research, esfo covers about 80 strategy papers, 90 research organizations, 100 state institutions and public funders, 80 companies and industry associations, and 70 research programs.

Access is intuitive and requires no previous knowledge. The information system is freely available on the Internet at www.sicherheitsforschung-europa.de. With an average of about 230 visits per day, it enjoyed increasing popularity in 2014 (average 2013: 165 visits per day). The evaluation of internal and external data suggests that esfo is one of the most popular German-language information sources for the structures and research activities of the European Defence Agency (EDA) and NATO.



1 esfo's categories and interrelations

BUSINESS UNIT “CORPORATE TECHNOLOGY FORESIGHT”

Dr. Martin Brüchert



CTF, the newly-established Business Unit “Corporate Technology Foresight”, focuses on technology, innovation and the future for the business world. With in-depth scientific methods, particularly technology forecasting, the Unit’s applied research supports strategic issues for companies from a wide range of sectors. CTF shows up future technological changes, analyzes and evaluates them and develops solutions together with its clients. Broad technology screening reveals trends and potential risks for business companies.

In general, the starting point is the comprehensive overview that the whole Technology Analysis and Strategic Planning Department has of almost the entire future technology landscape, with a time horizon stretching from current changes to the long-term. In an age where innovation transforms entire business ecosystems for a period of more than ten years, this view shows up cross-industry innovations in good time and breaks down such complex, long-term technological changes like “Industrie 4.0” or “The Industrial Internet” for the specific strategy of a single company.

As well as the overall perspective (360°), the entire planning horizon is covered, from short to long-term forecast. Setting up such competence internally is usually too costly, especially for small and medium sized enterprises. This keeps long-term complex technological developments out of sight for many companies, although they are of great importance for long-term success.

CTF closes this gap for companies or supplements a company’s own vantage point with a neutral perspective, thus helping to develop a sustainable, long-term technology strategy for each customer. The basic questions are: What technological developments can we expect? What technology is sustainable and can be used as long as possible until the next change? What new technologies will change my business models or even make them obsolete? What new products or services can be realized with future technologies?

With CTF answering these questions, trends and technological developments are moved into a company-relevant context, possible development paths are identified, their meanings are analyzed. On this basis, recommendations for action are developed; a short-term strategy can thus be compared for example with expected long-term developments. Especially the latter requires not only expertise in participatory methods, but also a close, trusting relationship, which has been Fraunhofer INT’s code for decades.

These services are based on the core competence of technology analysis and strategic planning and the systematic technology and planning monitoring of the department TASP. Here, fundamental knowledge on trends in virtually the entire technological spectrum is generated. Knowledge that can be quickly absorbed into projects and customized to client requirement. CTF concentrates on that company-oriented view of technological trends.



FUTURE TECHNOLOGY CHECK S/M/L

Dr. Martin Brüchert

CTF (*Corporate Technology Foresight*) is the Business Unit that provides businesses with the eponymous ability they need to recognize discontinuous technological changes early enough to interpret the consequences for their own purposes, and to formulate effective responses to secure the long-term survival and success of the company.

According to a Shell study from 1997, most companies that operate in a dynamic technical environment fail in the long run to survive the upheavals of technological change and the distorted competition scenarios that go with them. For example, life expectancy for Fortune Global 500 companies is less than 50 years, as most firms of this size are not able to adapt their organization to changes in their environment.

The bandwidth of seemingly relevant technological trends and developments is very large and steadily expanding; at first sight, the interrelationships between different technology fields and the complex interdependencies of individual technologies are unmanageable. This makes it all the more difficult for management to pinpoint the technological developments and changes that are really relevant to the company, and follow up with a promising new research and development strategy.

The three largest challenges for a company's top management are:

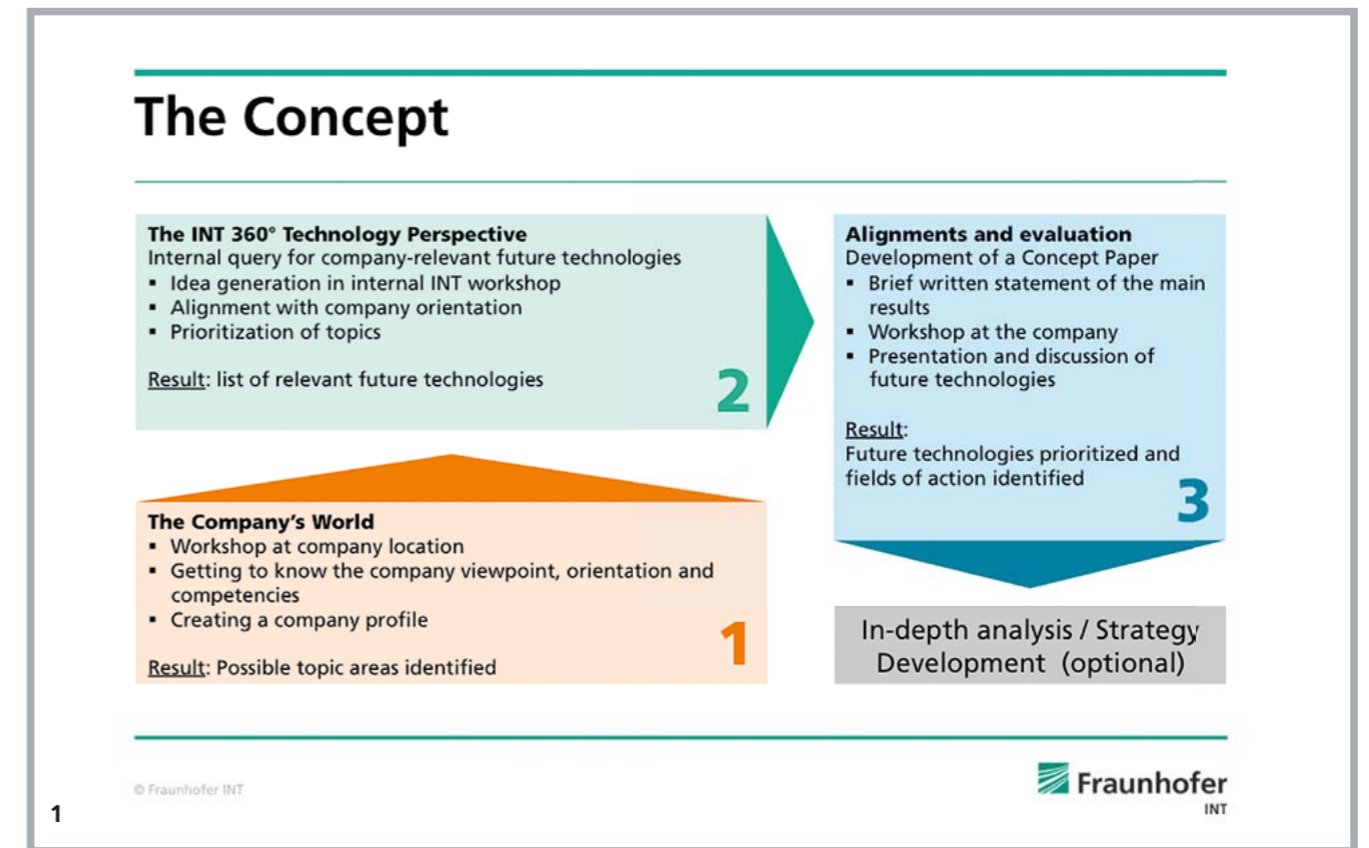
- The *high speed* at which technical change can happen. This may cause a rapid shortening of product life cycles, and accelerated and more diffused innovation.
- The *inherent ignorance* of large organizations with regard to technological change – a result of short-term technical developments that cannot be integrated into long-term strategic planning cycles, and of a glut of information that is too big for top management to be able to grasp, interpret and act on. In addition, middle management often systematically filters out relevant information in an attempt to protect its own work area from change.

- The *inertia* of a company due to complex internal and external structures, the lack of will to compete short-term with its own existing lines of business, the sometimes obsessive focus on existing technologies that leads to innovative laziness and prevents businesses from benefiting from real technological breakthroughs.

This is where *CTF* can help to master the challenges identified. To this end, it uses a network of experts (internal and external) and recognized technology foresight methods. At strategic level, *CTF* identifies relevant new technologies and business areas, and supports the internal realignment of the company (*strategic planning*, e. g. with *technology roadmapping*). Moreover, it can put a company's current research work to the test and, applying the technological advances recognized, serve new products and business models as a *development benchmark*.

CTF is in essence a more or less complex process – depending on the technologies concerned – that is usually only viable for larger organizations. This does not mean that small and medium-sized companies are spared the same risks from technological change that larger organizations are subject to. In order to make *Technology Foresighting* attractive for small and medium-sized enterprises (SME), Fraunhofer INT has developed *FTC*, the *Future Technology Check S / M / L*. With a minimum of effort in a streamlined three-step process, *FTC* makes it possible for an SME to identify relevant future technologies and corresponding actions, such as in research and development, products and business models.

In step 1 (see Figure 1), a maximum half-day workshop on location at the SME gives INT's experts an insight into the company's current technological orientation, as well as the company's viewpoint and competence. In dialog with management and company specialists, our experts use the workshop results to generate a company profile and identify relevant technologies. The company profile and the topics identified serve as *input* for the INT internal query session, using Fraunhofer INT's *360° Technology Radar*, which constantly searches for



and observes important trends and future technologies. The expertise of more than 40 scientists with science and technology backgrounds and more than 40 years of experience in technology analysis and strategic planning thus flows into a tailor-made *Future Technology Shortlist* (FTSL). This is then checked against the company profile and its relevant contents are given a preliminary prioritization. As a third step, a concept paper is developed on the basis of the FTSL. The results of this are presented to the SME's management and experts.

1 *The Future Technology Check*
 – three steps to tailor-made action

In an ensuing workshop, discussion and evaluation of relevant future technologies lead to action recommendations. This close cooperation guarantees that results are finely tuned to the needs of the SME.

With the help of Future Technology Checks, also small and medium-sized enterprises can operate the important function of Corporate Technology Foresighting, can with little effort learn about technological trends and developments of major significance for them, identify vital action areas essential for survival, and equip themselves for things to come. Among the key advantages of *FTC* are:

- Identifying truly relevant technological developments and changes in the context of the company and deriving recommendations for action at little cost

WORKSHOP ROUND UP

Dr. Sabine Müller

- Accessing the expertise of more than 40 Foresight scientists at Fraunhofer INT and more than 40 years of experience in monitoring technology
- Identifying important follow-ups (further CTF consultation by Fraunhofer INT, referral to further contacts and to specialist research institutes in the Fraunhofer world)
- Low financial outlays thanks to public funding for FTC, e. g. through innovation vouchers from the Federal States and other promotion programs

With its new Business Unit “Corporate Technology Foresight”, Fraunhofer INT has specifically opened its doors to the corporate world, facilitating joint discussions on future issues and the identification of their strategic relevance. This included working together in workshops to analyze complex technology trends such as Industrie 4.0 (also known as Industrial Internet) and Connected Reality. In addition, contact was especially sought with regional small and medium-sized enterprises (SMEs). For Industrie 4.0 last year, it was mainly the big companies and their strategies that determined the route. For SMEs, this topic seems to be too distant, and it is almost impossible to realize strategy work on top of daily business. As part of the corporate world (in Germany 99.6 % of all enterprises are SMEs, and their share of total turnover is about 36%) these companies can and should also shape the way. This is especially true since the fourth industrial revolution is a process that will extend over the next 15 years, a process that has already begun. Fraunhofer INT helps SMEs to break down complex technology trends and to network with each other through the use of workshops.

“viertelvoracht” Business Breakfast at Fraunhofer INT

Around 75 guests from the regional business world attended the “viertelvoracht” (“7:45 AM”) business breakfast, held on June 11, 2014, at Fraunhofer INT – an event which is regularly organized by the business promoting community in the Euskirchen district. The objective is to connect different regional actors, focusing on companies from the global player to the small craft business. Many of the guests were making first direct contact with Fraunhofer INT, and over tea or coffee, they were presented with information in talks by INT’s Director, Prof. Michael Lauster, and by Dr. Martin Brüchert. The guests also made good use of the opportunity of a tour of the Institute’s laboratory area and the experimental hall. The event resulted in numerous personal contacts being made, a number of projects, e. g. the practical performance of Future Technology Checks (see contribution on page 36), and the initiation of more cooperation projects. A positive effect of the event for Fraunhofer INT was

the way it significantly increased the Euskirchen district’s awareness of the Institute, as well as the degree of networking.

Rethinking Business: Future Lab “ConnectedReality2025”

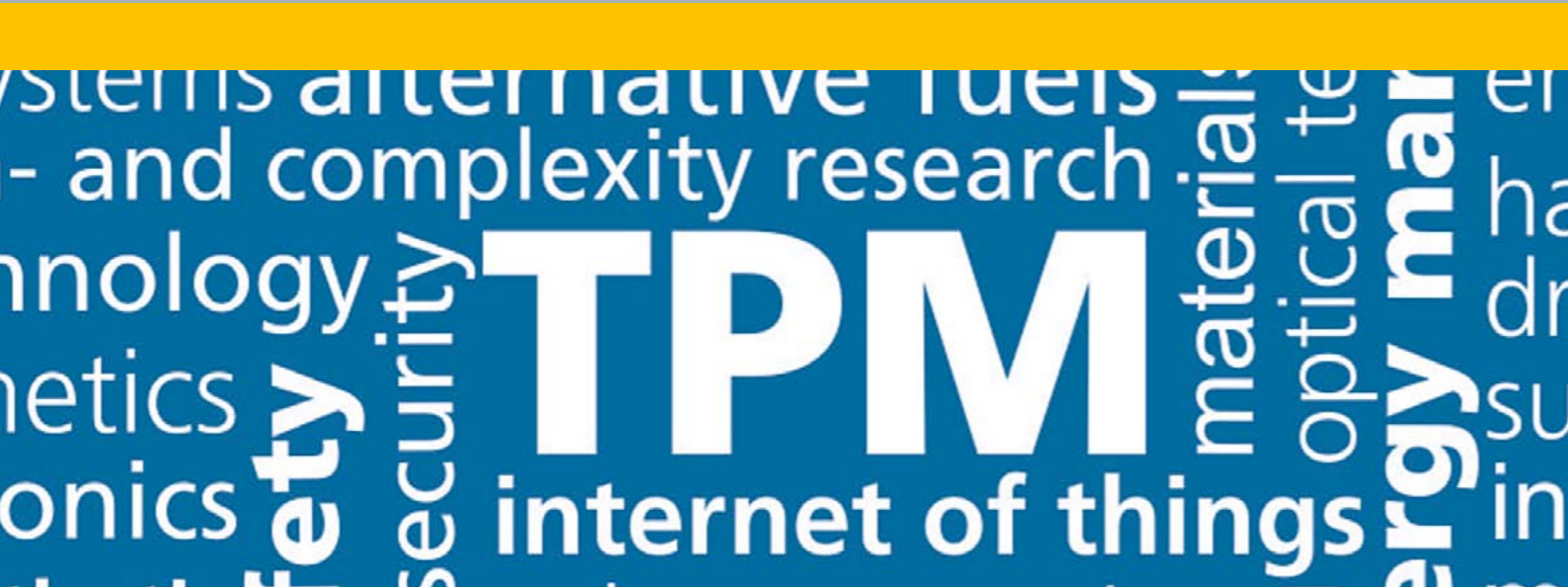
In cooperation with Z_punkt, an international consultancy specialized in strategic future issues, Fraunhofer INT hosted a half-day “Future Lab” strategy workshop in Cologne on July 10, 2014. Together with participants from a wide corporate range, Klaus Burmeister from Z_Punkt and Martin Brüchert from CTF discussed the digital transformation of society and its influence on future strategies of companies from varying sectors. Which technologies will drive development toward Connected Reality? What does the roadmap of super convergence look like? Which sectors are affected? How will business models and value creation change? The target group for this interactive “Future Lab” event was companies that wished to address issues such as “technology convergence and disruptive developments”, or to discuss the question of potential new products or services, and the lifestyle changes that go hand in hand with them.

Workshop “Sensors in Industrie 4.0”

On November 3, 2014, the Kreissparkasse Euskirchen, svS Capital Partners and Fraunhofer INT held a workshop for SMEs on the subject of “Sensors in Industrie 4.0”. The transition toward Industrie 4.0 has already begun, but is barely noticeable. New trends and falling prices in sensors are leading to more and more sensors being installed in cars, smart phones and other products or production systems, optimizing them and making them more intelligent. This makes sensors a first step and an important driver for Industrie 4.0. The workshop laid special emphasis on how selected technologies (such as smart sensors) will change tomorrow’s production processes. In order to profit from the expertise of those present, the workshop included audience participation as well as talks. This gave the participants a comprehensive insight into the technological developments that can be expected and their implications.

STRATEGIC PROJECT: TECHNOLOGY TRENDS AND STRATEGIES

Dr. Claudia Notthoff



Especially in a time when technology is developing ever faster and becoming more and more unclear, there is steady growth in the demand for ways of monitoring technological progress. The main challenge is to identify alternative technologies that may be more cost-effective, environmentally friendly and future-oriented than established processes. This is particularly difficult if these alternatives come from another field of technology and there has been no direct association with the client's products or needs. This complex environment makes considerable demands on policy makers in industry and the public sector. Proactive support of these two groups in identifying relevant future technologies is one of Fraunhofer INT's main tasks.

To this end, traditional monitoring methods such as desk research and expert interviews are combined with those used in quantitative information analysis (web / text mining, clustering, bibliometrics, etc.). This includes methodological approaches designed and developed for the purpose at the Institute. A central task of the project is developing an information platform that makes generally available the collected information on technology topics with future potential, thereby supporting INT's Business Units in identifying and evaluating new technology trends, quickly, efficiently and client-oriented.

Other activities

The strategic project Technology Trends and Strategies (Technologie- und Planungsmonitoring – TPM) was launched at the start of 2014 to continue development of INT's established technology monitoring process and to secure comprehensive, systematic and continuous technology foresight.

A permanent task for the Strategic Project is organizing and editing the "Neue Technologien (New Technologies)" section in the journal "Europäische Sicherheit und Technik (European Security and Technology)", which INT now publishes on its website. Also in 2014, INT cooperated with the Fraunhofer institutes ISI, IAO and MOEZ to develop a methodology for assessing the future research attractiveness of selected fields of technology.

The distinctive feature of INT's monitoring process is the analysis of the scientific information concerned (key sources), in order to identify current key technological developments: highly dynamic research topics with large application potential. The Institute benefits from the interdisciplinary focus of all the staff involved in planning and monitoring technology. This methodological approach begins with the recognition that tomorrow's technological solutions are generally only feasible if they are already being developed and tested in research laboratories today. The information analysis therefore involves evaluating application-oriented sources, but also the study of individual results from basic research. Another feature of technology monitoring is the observation and analysis of national and international R & T plans and strategies, as this is where technological development takes place. We thus make international, publicly funded research available for every client. Since varying technological needs and the analysis period depend on the client group, the focus is on technologies that are shortly before the application stage (3 to 5 year period) and on long-term usability prospects (10 to 20 year period).



NUCLEAR EFFECTS

Dr. Stefan Metzger

For the Department of Nuclear effects (NE), and thus for one of the two core competences of the Institute, 2014 was a year of change in more ways than one. For one thing, 2014 was for NE, as for INT as a whole, the first year of the new strategy. In addition, Dr. Wolfgang Rosenstock retired as Head of the Department. He passed a powerful, competent and highly motivated Department on to his successor. His retirement also triggered a string of departmental staff changes. The changes particularly affected the group Nuclear Effects in Electronics and Optics (NEO), whose leader, Dr. Stefan Metzger, became the new Head of Department. His place at the head of NEO was taken by Dr. Jochen Kuhnhenh, who hitherto had been deputy group leader. The new deputy is Dr. Stefan Höffgen. There was also a staff change in the Scientific Technical Support group (WTI), where Sven Ruge took on the newly-created post of deputy leader. One important result of the strategy process was recognizing that dividing up groups and business units according to scientific disciplines, active policy in NE since 2010, is appropriate and will be continued.

At first, the strategy had no effect on consistently high order levels or on the successful acquisition of new orders. Despite high capacity utilization, it was still possible to address and meet several of the core targets set out in the strategy process. One such target was the expansion of expertise in Single Event Effects (SEE). By taking on the two new scientists Dr. Max Baum and Dr. Michael Steffens, existing areas of expertise are better covered, while at the same time, Dr. Höffgen will be concentrating on expanding SEE expertise. Examined were the risks and benefits of ISO 9001 certification for the entire Department, a step that would create a meaningful expansion of quality management for the Department in 2015.

Another strategic core competence goal is even better adaptation to the requirements of the main client, the Federal Ministry of Defense. With special regard to the ongoing restructuring in the Ministry and downstream agencies, joint consultation with the Ministry identified new points, and existing research services were accordingly adapted. A good example of this is

the increased cooperation with the Bundeswehr Research Institute for Protection Technologies (Wehrwissenschaftliches Institut für Schutztechnologien WIS), which was significantly expanded in 2014 and is expected to grow in the future.

With the agreement of the companies Airbus D&S and OHB as co-organizers, and of the Radecs Organisation, INT is taking on the scientific management of RADECS 2016, the European Radiation Effects Conference that will be taking place in Germany for the first time next year. In addition to the regular issues, much of its agenda will be devoted to the hazards from Single Event Effects on accelerators or from atmospheric neutrons, and to the special challenges of ESA's JUICE mission (JUperiter ICy moons Explorer).

To keep pace with current research in the various scientific communities, a main task for NE is acting as consultant for renowned specialist journals such as IEEE or Nuclear Instruments and Methods. Over and above this, Department staff again took session chairs at several conferences, including Future Security, the International Conference on Space Optics, and the Nuclear and Space Radiation Conference. The NE groups also contributed their expertise to the work of various standardization bodies, such as DIN and IEC, as well as in NATO.

Overall, 2014 can be seen as a very successful year for NE. This is all the more remarkable when considering the many strategic changes that were carried out during normal working operations.

RADIATION HARDNESS TESTS FOR UAV COMPONENTS WITHIN THE ANCHORS PROJECT

Wolfram Berky

ANCHORS is a French-German consortium project tasked with developing a special **U**n**m**anned **A**erial **V**ehicles (UAV) system equipped with detectors for radioactive materials. With the full title “UAV-Assisted Ad Hoc **N**etworks for **C**risis Management and **H**ostile Environment **S**ensing”, the ANCHORS UAV package also includes autonomous communication networking with each other and the ability to exchange data with a mobile ground base. Possible deployment scenarios are natural disasters and accidents at nuclear facilities. The system is intended for areas where access for human helpers is difficult or impossible, because of physical obstacles or high radiation for example. The project began in May 2012, has a term of 3 years and is funded by the Federal Ministry of Education and Research (BMBF) and the French L’Agence nationale de la recherche (ANR) (see also INT Annual Report 2012 and INT Annual Report 2013).

In this project, Fraunhofer INT is supporting the development of the radiation detector, and measures performance at high radiation levels (up to 580 Gray). INT also measures the radiation immunity of the detector, the UAVs and their components, and is involved in planning and conducting exercises that demonstrate the system’s capabilities. A key aspect of the work in the year under review was tests on the function at high doses of radiation and on the immunity aspect of electromagnetic compatibility (EMC). These investigations were carried out at INT irradiation facilities. Radioactivity came from a Co-60 source and EMC measurements were conducted in INT’s TEM waveguide (TEM = transverse-electromagnetic). In addition, performance tests were carried out on location at INT, in which for the first time a detector was integrated in a UAV and a radioactive source was detected in flight.

The UAV in-flight measurements produced important first results, but at this stage of development also showed up technical difficulties that were overcome a few months later. For example, the flight route map display and GPS signal detection needed improvement, and an analysis of the recorded gamma spectra was not yet possible. The measurements for radiation hardness were carried out at selected doses which reflected realistic con-

ditions in the scenarios referred to above. Owing to the space available in the irradiation chamber, it was only possible to test individual UAV components. Furthermore, calibration measurements were carried out with the detector at high dose rates. There was enough space in the TEM waveguide to test the immunity aspect of EMC of the whole UAV, as well as of the detector. Test frequencies and frequency values were derived from the deployment scenarios developed by the consortium.

The measurements for radiation hardness and EMC showed that the design had sufficient strength against ionizing and non-ionizing radiation. It can thus be assumed that the UAV and the detector will operate reliably in the conditions of the scenarios foreseen.

The Project involves all three business units of the Nuclear and Electromagnetic Effects Department.

BUSINESS UNIT “NUCLEAR SECURITY POLICY AND DETECTION TECHNIQUES”

Dr. Theo Köble



The Business Unit “Nuclear Security Policy and Detection Techniques” (Nukleare Sicherheitspolitik und Detektionsverfahren – NSD) conducts theoretical and experimental research in the fields of nuclear security policy and nuclear detection methods. Besides basic studies, research projects are carried out for industrial clients (nuclear research and technology) and public bodies (mainly for offices and organizations concerned with security, and major research centres). Furthermore, with basic funding from the Federal Ministry of Defense (BMVg), NSD also deepens and expands the national ability to discern threats from nuclear and radiological weapons and associated asymmetrical areas. Projects are also carried out with the Bundeswehr Research Institute for Protective Technologies and NBC Protection (WIS) in Munster.

NSD’s work is supported by its up-to-date technical equipment. For simulating physical processes a Linux cluster with 64 processor cores is available. Besides coupled neutron and gamma transport calculations, e.g. for simulating detector spectra, coupled neutron and hydrodynamics calculations are also performed. Several neutron generators (14 MeV and 2.5 MeV) and an isotope laboratory are used in research work. The isotope sources and experimental facilities are occasionally made available to external users for their own investigations. For the safe operation of the irradiation facilities and for handling the numerous radioactive substances, INT has the appropriate radiation protection infrastructure and a permit to work in third-party nuclear facilities (e. g. research reactors, nuclear power plants). All experimental work is supported by a precision engineering workshop and an electronics laboratory.

With regard to nuclear disarmament and possible proliferation, political and especially technological developments were continuously pursued. These are especially analyzed regarding their physical and technical aspects. In particular, nuclear developments in Iran and North Korea were observed, analyzed and evaluated. As part of the collaboration in the ESARDA (European Safeguards Research and Development Association) Working Group on Verification Technologies and Methodologies (VTM),

which is organized by the Non Proliferation and Nuclear Safeguards Unit at the Joint Research Centre (JRC) in Ispra, the Business Unit investigated developments in international disarmament treaties, including export controls and new safeguard technologies for the International Atomic Energy Agency (IAEA).

In June, an exercise with an open day was conducted on the training ground of the North Rhine-Westphalia Fire Brigade Institute in Münster, with the purpose of demonstrating the capabilities of the measuring vehicle DeGeN at detecting concealed radioactive and nuclear objects (see separate contribution in this Annual Report).

For the prevention or early disclosure of terrorist acts involving nuclear or radioactive material, the Business Unit investigated latest measurement systems for the detection and non-destructive identification of such materials. The focus was on the suitability of the systems for use in the field.

NSD also continues its work as partner in several international projects dealing with CBRNE threats (Chemical, Biological, Radiological, Nuclear, Explosives) and countermeasures that deal with them. Naturally, the Unit contributes its R and N expertise to the consortia concerned. The following introduces these projects in brief.

The German-French project ANCHORS (UAV Assisted Ad Hoc Networks for Crisis Management and Hostile Environment Sensing) is aimed at developing a cooperating swarm of UAVs (unmanned aerial vehicles) and UGVs (unmanned ground vehicles) for obtaining a comprehensive situation picture of the hazards in case of disaster. Octocopters serving as UAVs will also detect radioactivity and be used as relay stations to ensure smooth communication. Using the Institute’s radioactive and electromagnetic irradiation facilities, extensive tests were carried out on both UAV and radiation detector. At the end of the project, a fully integrated, functioning model should be available (see separate article in this Annual Report).

The large EU demonstration project EDEN (end-user driven demo for CBRNe) has the goal of demonstrating a comprehensive system of measures against CBRNE attacks or accidents and their consequences. More than 30 partners from across the EU are involved in the project. NSD is inter alia involved in the needs and gaps analyses of the end-users. These analyses incorporate the results of earlier EU projects, results that have been complemented by special end-user workshops in various EU states. The Business Unit also participated in the development of RN scenarios and upcoming RN demonstrations. A partial demonstration on nuclear smuggling will be carried out under the responsibility of INT. The demonstrations aim at showing the effective interaction of the comprehensive system of measures against CBRNE attacks and accidents, and how gaps are closed by systems newly developed within the project.

In the EU-FP7 project SCINTILLA (Scintillation Detectors and New Technologies for Nuclear Security), the Business Unit was involved in the development of new detector technologies based on scintillators for radioactive and nuclear materials that are difficult to detect. Another objective of this project was to find a suitable replacement for the neutron detector material He-3. This material is used in many safeguard systems based on neutron detection, and is now almost prohibitively expensive. One project task for NSD in the year under review was the "final assessment", the concluding evaluation for any system in any technology, which judges the extent to which the original criteria have been fulfilled. To this end, realistic tests were also carried out, e. g. in the Nuclear Medicine Department at the University Hospital of Bonn. The SCINTILLA project was successfully completed at the end of the year after 3 years of work.

MEASUREMENT CAMPAIGN: SEARCHING FOR AND IDENTIFYING RADIOACTIVE MATERIAL

Dr. Monika Risse

Man has no sense organ with which he can detect radioactive material. So he relies on measuring instruments that can reveal such material. For differing scenarios, there are different measuring tasks. Scenarios could be where radioactive material is lost, or stolen to be used for non-peaceful purposes.

Depending on the situation, the necessary search that follows may be simply local or cover a much larger area. Possible in the first case is a search on foot, measuring only with hand-held devices; a larger scale search may involve a vehicle that contains special measurement instruments.

The business unit NSD possesses and operates various measurement instruments for the task of "searching for and identifying radioactive and nuclear material". The test vehicle DeGeN (Detektion von Gamma einschließlich Neutronen – Gamma and Neutron Detection) has been developed for large-scale search and identification (see Figure 1). Neutron measurement is done by large volume slab counters containing tubes filled with helium-3 gas, which enables neutron detection via a nuclear reaction.

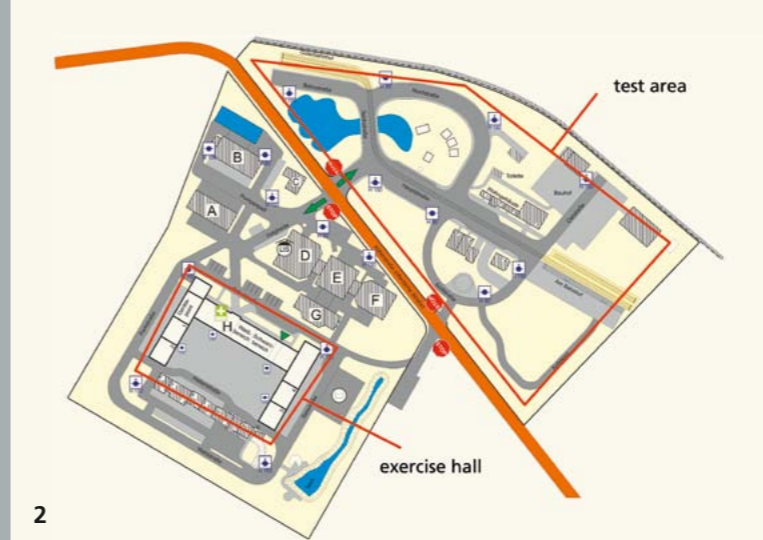
For gamma detection, plastic scintillators with an NBR (Natural Background Rejection) function are used. This makes it possible to distinguish between natural and artificial radiation. Systems



for detecting both gamma and neutron sources are installed on both sides of the vehicle, so it is possible to determine on which side of the car the source is located. Since it can be installed in any conventional, large station wagon, this vehicle-mounted measuring system is well suited for concealed radioactive source searching.

Experience has shown that regularly checking the performance of all measuring instruments is not enough to ensure the viability of the system. It is necessary to practice the use under real conditions and to get to know the system's performance. A test area used for this purpose therefore has to be large enough for realistic measurements using the vehicle. It also needs to be possible to deal with radioactive sources in the test area, and the sources need to be appropriate. INT's premises are not suitable for such measurements. Very well-suited is the outdoor area of the North Rhine-Westphalia Fire Service Institute (Institut der Feuerwehr – IdF). At its location in Münster-Handorf / Telgte, a one-week measuring campaign was held from June 16 – 20, 2014. Figure 2 shows a site plan.

The measurement campaign focused on the vehicle-based search for radioactive sources, with the aim of a systematic study of the quality of search and identification results derived from the complete measurement system. The influence of the user on the measurement result was given particular attention. In a measurement series using the DeGeN vehicle, 17 teams with a total of 33 people all searched for radioactive sources in the test area under the same conditions (sources hidden at the same places). Involved were NSD's own staff, partners from the ANCHORS Project (see below) and participants who operate their own measuring vehicles at their own facilities. Also taking part were 15 firefighters from Münster Fire Department and the Volunteer Fire Service at Dülmen. After the DeGeN trials, they also took the opportunity to carry out test drives with their own detection vehicles "ABC-Erkunder" along the same course. A comparison with the much better equipped DeGeN vehicle was very enlightening.

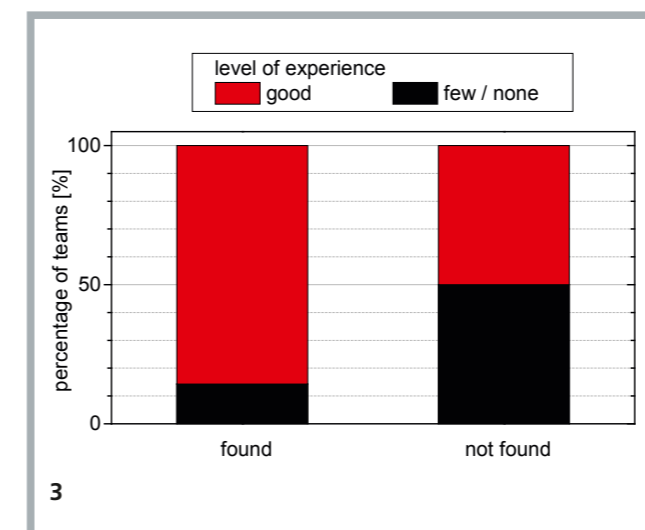


2

In order to gauge a potential correlation between user experience and the quality of the measurement result, a questionnaire was drawn up for the teams. They also received information about the test vehicle and the scenario, along with a results sheet. Evaluation showed that, after the briefing, all teams were capable of fulfilling the search and identification task with INT's DeGeN vehicle. It became apparent that the DeGeN vehicle made it possible to detect strong sources, irrespective of the user's experience of the vehicle. For a weaker source, a link was found between search result and experience level. Teams with good previous experience were much more likely to find the source than teams with no or only little experience (see diagram). In itself, this result is not surprising, although verifiable on the basis of the study.

As well as the elaborate series with the DeGeN vehicle, measurements were carried out with high-resolution germanium detectors (for gamma detection), which were also installed in a vehicle. These very robust devices – the Detective-200 type – were made available by the company ORTEC. They were used with software that allows the use of multiple detector devices while in motion, even at a great distance from the source.

Searches using this system were conducted in the test area



3

with other hiding places for the radioactive sources compared to the aforementioned measurements.

Development and availability of the DeGeN vehicle also comes under the European FP7 Project EDEN (End-User driven Demo for cbrNe). This Project makes available a variety of instruments that demonstrate comprehensive systems of responses to CBRNE attacks or accidents and their impact. CBRNE stands for chemical, biological, radiological, nuclear and explosive hazards. The test vehicle, as with the portable INT detection system NaNu (Nachweis Nuklear – evidence of nuclear radiation), has been included in the Project as a possible instrument.

In another project, the French-German Project ANCHORS (UAV Assisted Ad Hoc Networks for Crisis Management and Hostile Environment Sensing), NSD is participating in the development of a detector from the Consortium Partners of Mirion, intended for mounting on a UAV (Unmanned Air Vehicle) (see also the article on page 47). Under the ANCHORS Project and in parallel with the vehicle-based measurements, the IdF site was also where tests were run with a multicopter fitted with a radiation detector.

1 Measuring Vehicle DeGeN on IdF test area, a Detective 200 is inserted in the back

2 Outdoor area of IdF. Highlighted are the test area where the vehicle-based measurements and demonstrations took place on visiting day, and the exercise hall where visitors received a thematic introduction and benefited from a professional exchange.

3 Search result for weak source in relation to level of experience



4

Apart from extensive measuring and Project work, the measurement campaign included an open day. After being introduced to the subject matter, visitors were able to watch the DeGeN vehicle and the multicopter in action in the test area. During the ensuing vehicle exhibition, there was an opportunity to exchange ideas. The vehicles on display are shown in Figure 3. The large number of various radioactivity test vehicles was unique and very impressive.

Besides the exhibition, visitors who had brought their own measuring equipment were given the opportunity of testing their own vehicles during the morning. Sources were laid out in the test area for this purpose. With detection exercise possibilities being so scarce, the opportunity was widely taken up and comparisons could be made between the various vehicles.

All told, 90 people were present for the measuring campaign in Münster, of whom 55 attended the open day (see Figure 4). Participants came from various authorities and organizations dealing with security, as well as from industry.

To get an overall impression of the campaign's effectiveness, all participants were given a feedback form. The result was very positive. Especially high ratings were given to the well-suited terrain, the variety of the available measuring systems in the vehicle exhibition, the chance to exchange experience, to take active part, the very good practical demonstrations, the mix between theory, exhibition and practice with real sources, and the organization. There was general consensus that similar events should be held in the future.



5

4 Professional exchange with vehicle exhibition in the exercise hall, vehicles from left to right: Idf (Fire Dept. Institute): CBRN reconnaissance car NRW, BBK (Federal Office for Civil Protection and Disaster Assistance): CBRN Federal reconnaissance car (CBRN ErkW), LIA.nrw (Land Institute of Industrial Design NRW), German Rail (Radiation Protection): IN-SITU test vehicle, Fraunhofer INT: measuring vehicle DeGeN, BfS (Federal Office for Radiation Protection): ODL service vehicle, KHG (Kerntechnischer Hilfsdienst GmbH): sample collection vehicle

5 Octocopter with detector, during demonstration

6 The participants of the campaign

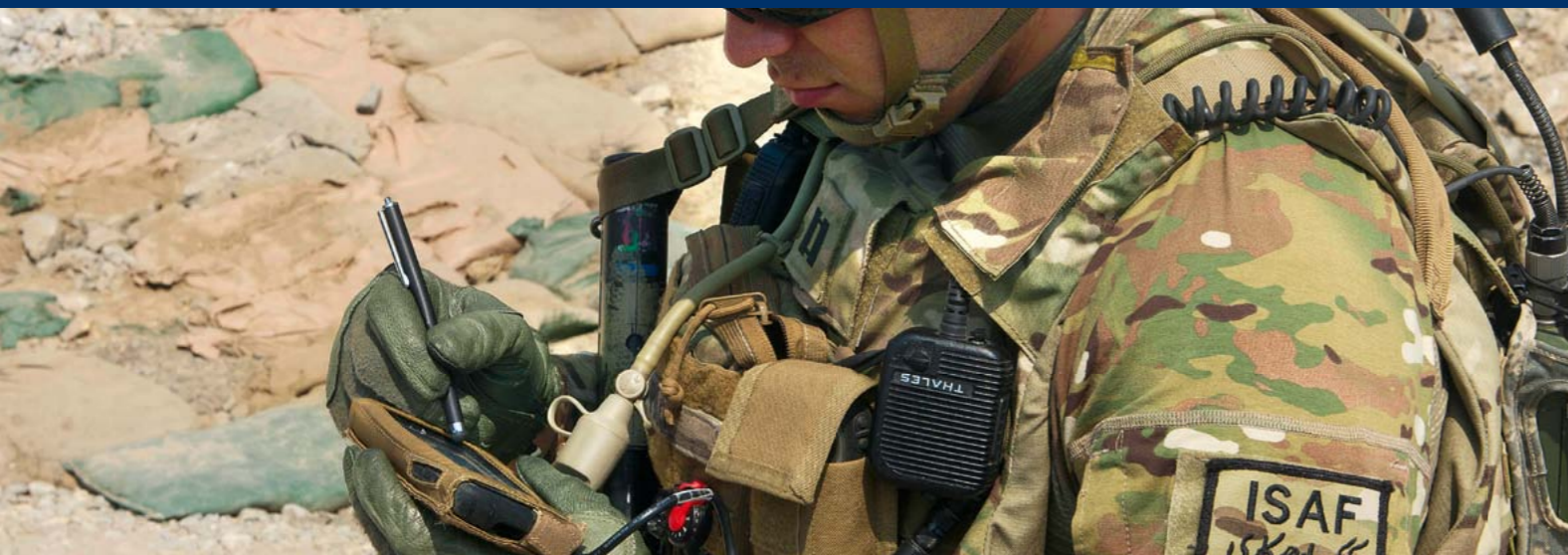


6

BUSINESS UNIT

“ELECTROMAGNETIC EFFECTS AND THREATS”

Dr. Michael Suhrke



With basic funding from the Federal Ministry of Defence – MoD, this Business Unit is tasked with facilitating the evaluation of electromagnetic effects with regard to a military threat. Since this task is only processed to an extent in the military field, EME (Electromagnetic Effects and Threats) conducts its own theoretical and experimental research in consultation with MoD and in cooperation with the defense industry. Research also includes developments in metrology. Over and above MoD-funded research, contract research projects for clients outside the defense sector (civil security research) and projects for industry are becoming increasingly important.

The Unit's experimental work on electromagnetic threats, especially high power microwaves (HPM), includes investigations into the coupling of electromagnetic fields in structures and concrete systems, as well as studies on the vulnerability of electronics through high-intensity fields. The work ranges from studies on the vulnerability of IT equipment and systems based on current technology, and especially on wired and wireless data transmission technology (network engineering) from high power electromagnetics (HPEM), to HPEM susceptibility testing in civilian communications and security technology. In addition, there is basic research and experimental work on detection methods for electromagnetic threats, in particular from HPM.

The Unit has developed its own TEM waveguide (Transverse Electromagnetic Mode), which is housed in a shielded hall and covers the frequency range from 1 MHz to 8 GHz. This allows linear coupling measurement for determining transfer functions and studies on electromagnetic compatibility (EMC), as well as the investigation of interference susceptibility with constant and pulsed fields with strengths of up to several kV/m on objects up to m³. For measuring outside the Institute, the division has also developed its own mobile HPM irradiation facility, with which up to 5 kV/m can be generated by radiation via different antennas in the frequency range between 150 MHz and 3.4 GHz field strengths. These systems are complemented by a reverberation chamber fitted with high-energy sources for generating field strengths above 10 kV/m over the frequency range from

500 MHz to 18 GHz, to reflect the growing number of applications of modern sensor and communication technology in the higher gigahertz range, as well as a small anechoic chamber to 40 GHz and extensive radio frequency and microwave measurement instruments.

As part of the research work for MoD in 2014, the Unit also completed two projects financed by the Bundeswehr Procurement Office (BAAINBw) on the HPM threat from electronic devices. Work also began on a new commission from the Bundeswehr Research Institute for Protective Technologies (WIS), in Munster, to develop an HPM detector. Also started was investigation into generation dependency regarding HPEM vulnerability for electronics, and into HPEM coupling into buildings.

In civil security research, the Unit is also active in the EU Commission's 7th Framework Program for Security Research (FP7), operating under Norway's Defence Research Establishment (FFI) as a partner in the HIPOW Consortium that is working on the "Protection of Critical Infrastructures against High Power Microwave Threats". In this context, laboratory tests continued on the HPM sensitivity of critical infrastructure. The work was presented in several conference contributions (AMEREM 2014 in Albuquerque and Future Security 2014 in Berlin). Work on the development of a system for detecting and identifying HPM threat signals was presented at two more conferences: EMV 2014 in Dusseldorf and EMC Europe 2014 in Gothenburg. At national level, EME is participating in the Civil Security Re-search program which is part of the "High-Tech Strategy" at the Federal Ministry of Education and Research (BMBF). Here, the Unit is involved in Franco-German studies on electromagnetic compatibility, part of the joint project ANCHORS (UAV-Assisted Ad hoc Networks for Crisis Management and Environment Sensing). This work was also presented at two conferences. In an industrial project, studies continued on new approaches for HPM source development.

HPM-VULNERABILITY STUDIES ON SMARTPHONES AND TABLETS

Michael Jöster

Research for the NATO STO SCI-250 Task Group “Radio Frequency Directed Energy Weapons in Tactical Scenarios” was completed in 2014. Work also began on the conception of a follow-up group: NATO STO SCI-284 Task Group “RF Directed Energy Weapons Applications and Countermeasures”.

EME is also widely active in standardization. This includes the DIN working groups “TEM Waveguide and Reverb Chamber” and “EMC Semiconductors”, the VG (German defence equipment) standard boards on NEMP and lightning rods, and on electromagnetic compatibility. The Unit is also national representative in the IEC’s Joint Task Force Reverberation Chamber. A concept for a standard for HPEM susceptibility tests was presented at AMEREM 2014 in Albuquerque. Further development of the HPEM standard is also to be a subject for the planned NATO STO SCI-284 Task Group. To characterize the TEM waveguide, tests for the statistical evaluation of field homogeneity and quality of the TEM mode were carried out in the TEM waveguide. This was in the context of developing the corresponding IEC standard, in cooperation with the Leibniz University, Hanover.

The threat from high power microwaves was again the subject of external presentations in 2014. At the 9th Future Security Conference in Berlin, one session dealt with Directed Energy Research. In addition, to help in coordinating the exchange of expertise at national level, EME contributed a presentation at a meeting of the National Working Group EME / HPEM, in Munster.

In 2014, EME saw the conclusion of a bachelor thesis on the “Further Development of the User Interface for the HPEM Detector”, and of a master’s thesis on “HPEM Vulnerability in the Smart Grid”.

When Apple introduced its new “iPhone” in 2007, with an operating system where the user swipes a touch screen, the company kick started the rapid development of a new type of device: the smartphone. This became possible because, for the first time, the computing power of a single-chip computer (System on a Chip, SoC), in combination with lithium-ion batteries, was sufficient for graphical user interface (GUI) with acceptable battery life. Motion sensors, video cameras and a GPS module round off the concept of using environment parameters and position for personalized and location-based information processing. The essence of this new operating concept was reducing input options down to virtual buttons and swiping, and thus eliminating mechanical keys. Another class of device, the tablet, combines smartphone development with developments in laptops and notebooks.

Other examples of new ways of human-computer interaction are spoken dialogue with language interpretation, and live video with simultaneously superimposed text and image information – known as the computer-aided expansion of reality perception (also named Augmented Reality). This of course means that sensor data must be linked to information which is not locally available on the smartphone in the diversity and time necessary. For faster data processing, it is possible to access dedicated servers on the Internet which provide much more computing power for more exacting tasks. To meet the corresponding

demand for exchanging larger data volumes with the Internet, radio modules for fast WiFi and the mobile communications standard 4G and also as fallback alternatives for the predecessors 3G and 2G networks are key tools that have been installed in smartphones and tablets. For wireless near-field applications such as audio transmission and identification for cashless payments, Bluetooth and NFC (Near Field Communication) modules are often integrated as well. Thus, for these devices to be able to operate fully, there has to be permanent connection with external servers.

Together with the services provided by a variety of companies in the Internet, the information processing mediated by the smartphone and rapid access make things very convenient. There is a great incentive to use these facilities, as evidenced by the impressively wide use of such devices.

In an industrial setting, process parameters can be monitored and controlled with mobile computers, e. g. on a production line (Figure 2). If thinking extends, for example, to the energy supply, then tablets and smartphones become part of a critical infrastructure.



The Military have recognized the benefits of processing situational and personal data, examples being the use of civil equipment in the U. S. Army programme “Nett Warrior”, and a military

smartphone for networking between soldiers which is being developed on the basis of a civil series device (Figure 3).

In many deployment scenarios, maintaining the device function is highly important, even security-critical. Studying susceptibility to potential interference therefore deserves high priority. Looking more closely at the technology of touch screens, it is possible to presume susceptibility to irradiation with high-frequency, high-power electromagnetic waves. At many fre-



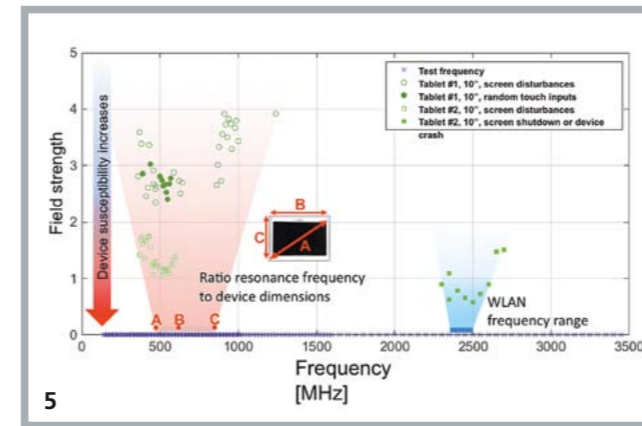
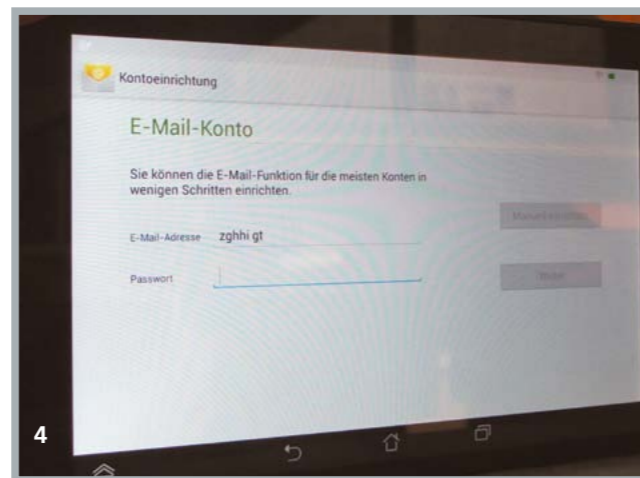
quencies, radio modules inherently allow energy into the electronics via antennas. By blocking data exchange, interference sources on the reception frequencies could therefore seriously limit the functionality required of the tablet or smartphone. There is also the possibility of permanent damage to the radio modules or the remaining electronics. To investigate this suspected vulnerability more closely, Fraunhofer INT's Business Unit EME asked how smartphones and tablets behave when irradiated with pulsed high-frequency, high-power signals. Investigated were entry-level and mid-priced devices.

Tests were carried out in Fraunhofer INT's waveguide. The radio frequency (RF) field strengths used were up to three decades above those prescribed in the tests for electromagnetic compatibility (EMC) that such devices have to pass prior to market launch. The tested frequency range covered many frequency ranges of the radio modules installed.

The WLAN module in one of the smart phones was in fact damaged in the course of the test series. However, the dominant failure on many devices was the accidental activation of the touch screens, thus terminating running applications or distorting parameters. In one test run, a video replay stopped on one device, the configuration interface for setting up an email account opened and random letter combinations were entered on it (Figure 4). Also observed were screen distortion and changes in background brightness, even causing illegibility. Switching off and resets of the digital system occurred only rarely and only at high field strengths, while the aforementioned screen distortions happened at lower field strengths.

An important conclusion of the test campaign is that a screen with capacitive multi-finger touch recognition is a gateway for RF. At a certain level of irradiation, the device is no longer operable; functions are even triggered at random and settings changed. Screen disturbance and backlight changes made the device unreliable or unusable.

In general, there is a connection between the size of the device and effective interference frequencies. Transferring the observed default thresholds to a graph of field strength over frequency, as shown in Figure 5, one can identify a frequency range which is limited by the dimensions of the device. These



resonance effects result in field strength peaks that can cause faults in the device. Entire groups of failures can be assigned to this frequency range, as highlighted with colored shading against the background in Figure 5. The devices are markedly more sensitive to coupling into the electronics via the receiver unit in the WLAN communication frequency band, which is reflected in the lower malfunction thresholds in the diagram, bottom right.

1 Smartphones and tablets in the INT waveguide

2 Operating industrial plant with touch-sensitive screens (wikimedia commons; http://commons.wikimedia.org/wiki/File:Industrie_4.0_Information-management.png; User: Dickdavid; Lizenz: CC BY-SA 3.0)

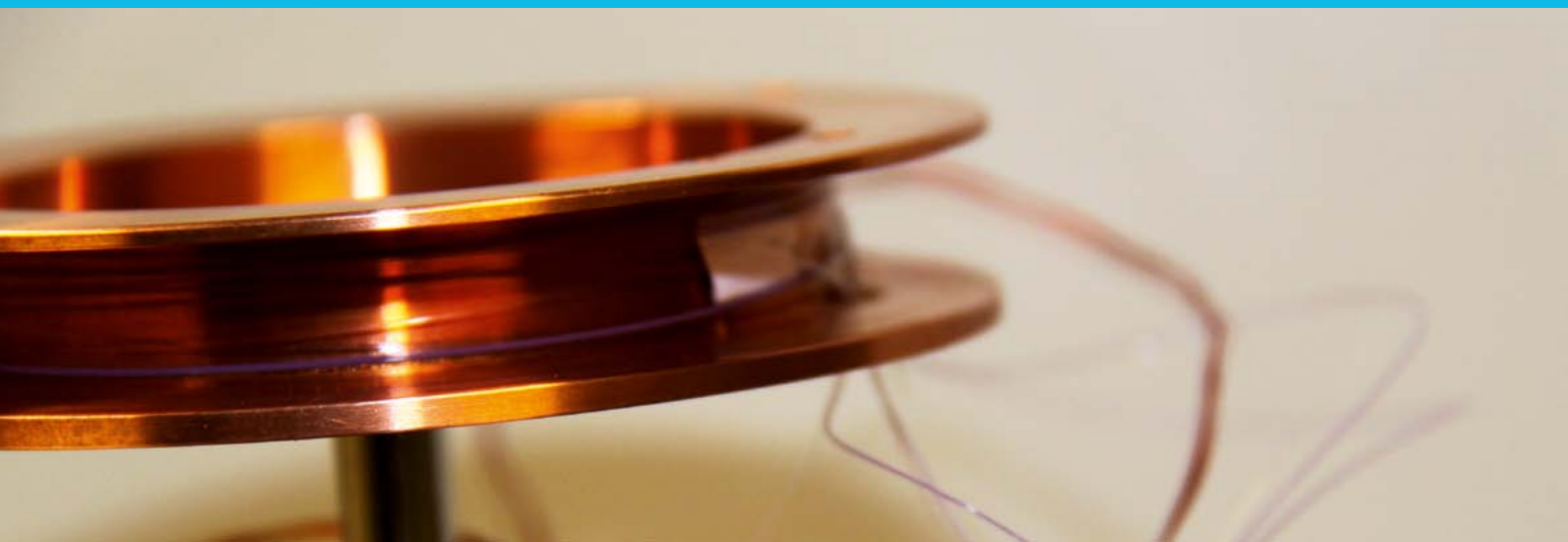
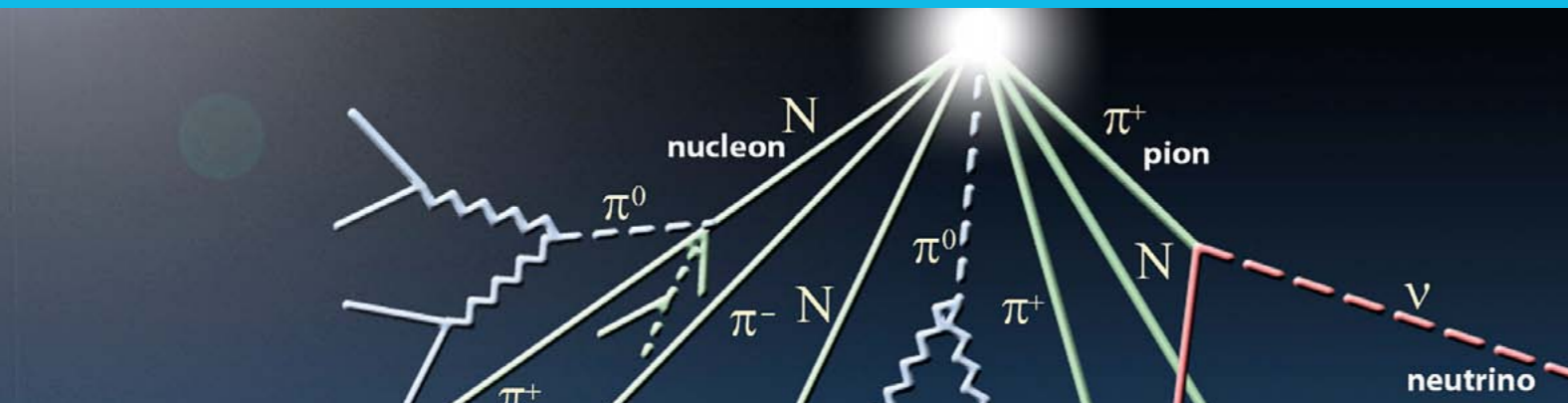
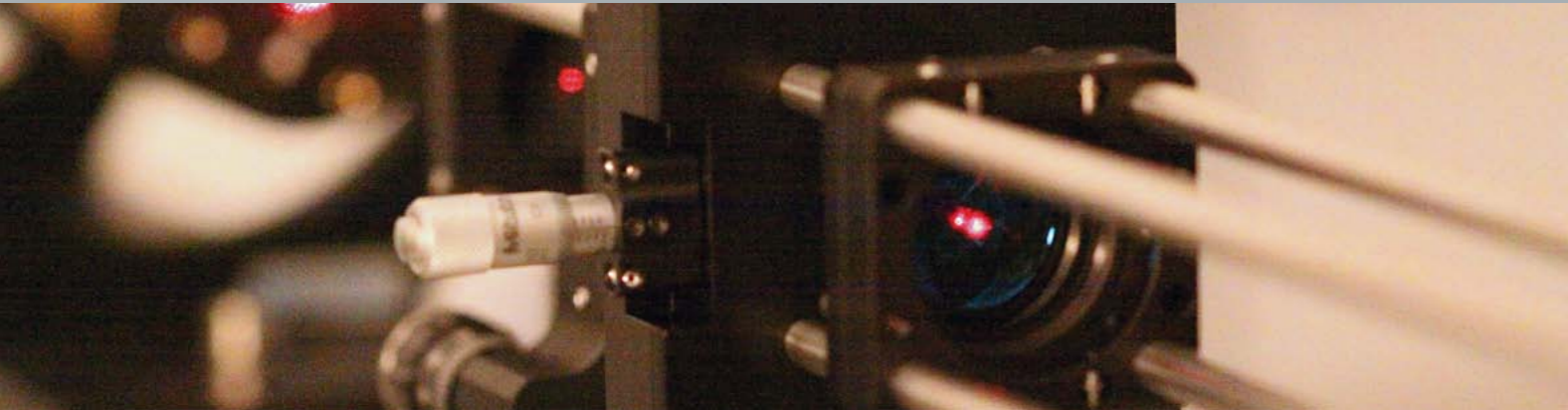
3 Soldier equipped with a smartphone (flickr; <https://www.flickr.com/photos/peoc3tmedial15865920671/>; User: PEO C3T; Title: Nett Warrior, CC BY-ND 2.0)

4 Typical failure during the INT tests: activation of a settings assistant and random letter input

5 Diagram showing the default thresholds of two 10" tablet PCs, with default groups allocated to device dimensions and communications radio frequency

BUSINESS UNIT “NUCLEAR EFFECTS IN ELECTRONICS AND OPTICS”

Dr. Jochen Kuhnhehn



Fraunhofer INT's Business Unit NEO (Nuclear Effects in Electronics and Optics) is specialized in the effects of ionizing radiation on electronic, optoelectronic and optical components and systems. NEO conducts these radiation tests in accordance with recognized standards and advises companies in radiation qualification and hardening, for example for satellites or accelerators. This knowledge is also used in the development of radiation sensors. Radiation tests are mainly carried out in INT's own facilities, although external facilities are also used. In total, INT's radiation facilities are unique in Europe. They make it possible to recreate in the laboratory all radiation types and the effects they induce – relevant for satellites for example. In addition, NEO has the latest available technology for measuring even the smallest changes in parameter characteristics.

The beginning of the new strategy process meant a new emphasis for NEO as well. Work in Single Event Effects (SEE) moved into the foreground in particular. This objective is derived from the ever-increasing sensitivity of especially digital electronic systems and power electronics to the effects of individual charged particles. Hitherto, these have been able to cause malfunction or failure, particularly in space applications or high-energy accelerators. Yet even in airplanes or sensitive ground systems, cosmic radiation increasingly leads to challenging effects for manufacturers and users. This area brings with it new and scientifically exacting tasks for NEO.

To achieve this goal, new academic staff was taken on, and the Unit's technical equipment was extended. In cooperation with longstanding partners, NEO is establishing itself in the SEE sector, initially in space and accelerator applications. This is also to meet the demand of other markets in the medium term (see also the separate article on page 65 of this Annual Report).

The well-established cooperation between NEO and the European nuclear research center CERN continued successfully in the year under review. While in previous years tests were mainly carried out on optical fibers, NEO has for several years also

acted for CERN with studying effects on electrical components, systems and materials. These experiments were carried out both at home on NEO's own Co-60 irradiation facilities, as well as on external high-dose irradiation plants. Last year, for example, various cables were examined, as were magnetic materials, integrated components of various kinds, and entire systems. At the same time, large-scale tests continued on optical fibers, including the complete monitoring of the production of several 1000 km of radiation-resistant optical fibers, involving a total of about 70 individual tests.

Extensions to NEO's testing facilities that were launched the previous year were concluded in 2014 when a cryostat for radiation tests at very low temperatures was successfully taken into service. Meanwhile, CERN has already commissioned several tests to use this facility for reliable qualification work, in cooperation with ITER (see separate article on page 63 of this Annual Report).

A first for NEO was its presence with its own stand at the most important international radiation effects conference NSREC (Nuclear and Space Radiation Effects Conference) in July 2014, in Paris. The Conference was held in Europe for the first time. Preparations continued for the staging of RADECS 2016 (Radiation Effects on Components and Systems Conference), a joint undertaking with OHB, Bremen, and Airbus Defence & Space.

Following the founding of the Fraunhofer Space Alliance, several events brought the participating institutes together in 2014, with NEO always being involved. A special highlight was the Alliance's joint stand in the Space Hall at the ILA Air Show in Berlin. Several joint stands at other national and international conferences, also including NEO as a participant, met with great interest (see page 73).

NEO continued to participate in various tenders for the European Space Agency. Four projects have been won, and work is currently proceeding on them. This includes developing and investigating novel concepts for shielding against electromag-

CONSTRUCTION OF A CRYOGENIC SYSTEM FOR IRRADIATION

Udo Weinand, Dr. Olaf Schumann, Dr. Jochen Kuhnenn

netic and ionizing radiation, reducing its weight while having the same shielding efficiency.

For the first time, NEO was also successful in the acquisition of an EU-funded project under the leadership of the company Areva (France). In this KIC InnoEnergy project, fiber optic sensors are being developed for use in nuclear power plants.

Finally, as part of an MEF application, means were acquired for the development of a low-cost, miniaturized sensor system – a project being jointly undertaken with Fraunhofer IPMS. This is intended to market Smart Security Glass, which INT patented.

To promote the next generation of scientists, NEO is actively involved in their education. Accordingly, NEO and the RheinAhr Campus at Koblenz University are jointly supervising a practical project leading to a bachelor's degree on the influence of the sample preparation of optical fibers on light transmission and radiation sensitivity. NEO is also supporting a doctoral thesis at CERN, in the field of radiation sensors with optical fibers.

Optical fibers are routinely used in harsh environments for signal transmission or sensor applications, for example in space or in accelerators such as the Large Hadron Collider (LHC) at CERN, the European Organization for Nuclear Research, in Geneva.

At CERN, the optical fibers are exposed to a very harsh environment, often characterized by very high or very low temperatures, vacuum and ionizing radiation. Isolated, these influences have been extensively studied for their effect on optical fibers, but in combination their effect has not been fully tested.

For this reason, Fraunhofer INT has developed a system that can both irradiate optical fibers at temperatures from 350 K to about 20 K (+77 °C to –253 °C) with gamma radiation from a Co-60 source, and record the radiation-induced attenuation online.

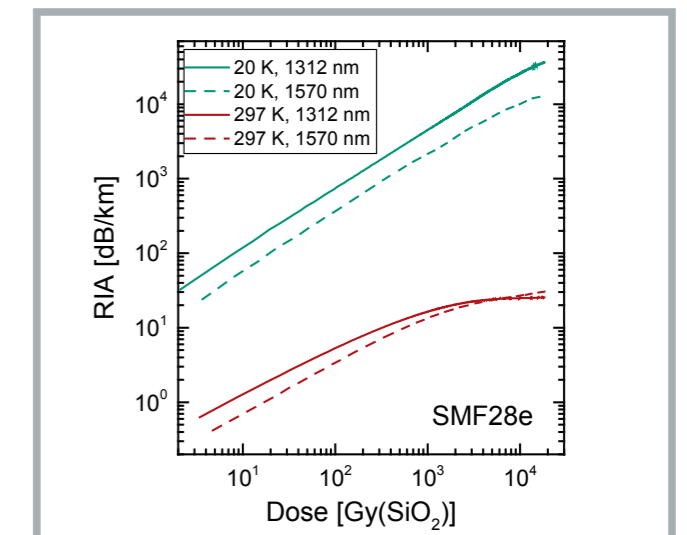
For this purpose, a commercially available cryocooler was obtained, which follows the Gifford-McMahon principle to compress gaseous helium in a closed circuit and re-expand it in a cyclic process. At the tip of the cold head where the helium is expanded, the temperature reaches approximately 5 K.

In a first step, an optical fiber wound on a copper reel was mounted directly on the tip of the cold head, and the fibers were routed through the insulating vacuum to the outside. The temperature was estimated by two fiber Bragg gratings integrated in the optical fiber. This setup caused temperature differences within the reel of several 10 K. This is due to the lack of thermal coupling between individual fiber layers and the copper reel, and the poor thermal conductivity of the fibers. To improve this, INT engineers designed and manufactured a much more elaborate structure in the workshop.

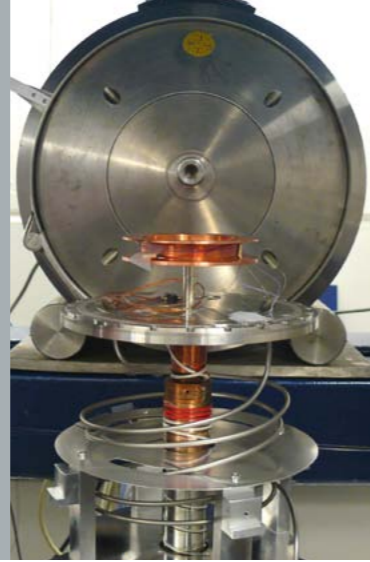
The optical fiber coil is now placed inside a helium-filled sample chamber. The helium is used as an exchange gas and provides significantly improved heat dissipation from the optical fiber.

At the low temperatures, convective heat transfer by helium is much more effective than heat conduction along the fiber itself, thus greatly reducing temperature differences. The sample chamber is located within an insulating vacuum. A radiation shield between the "cold" sample chamber and the "hot" outer wall of the vacuum chamber significantly reduces the heat transfer by thermal radiation between these two surfaces.

Since conventional sealing materials become hard and porous at low temperatures and therefore cannot be used, a helium-tight indium seal is used for the sample chamber. Stainless steel capillaries lead the optical fiber from the helium-filled, cold sample chamber through the insulating vacuum to the outside. The feed-trough for leading the optical fibers from the helium atmosphere to the outside can thus be placed at room temperature, posing no problem. Testing has shown that both the indium insulation and the fiber feed trough are leak tight and no helium leaks even after several days of operation. Measurement with fiber Bragg gratings revealed no temperature differences within the fibers.

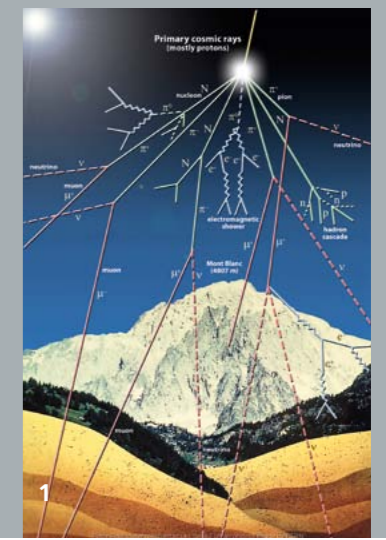


The figure shows the results of two irradiations at room temperature (red) and at 20 K (green). In both cases, the radiation-induced optical attenuation is represented by the standard



ATMOSPHERIC NEUTRONS, A GROWING THREAT

Dr. Stefan Höffgen



SMF fiber 28e. The measurements were made at wavelengths of 1312 nm (solid line) and 1570 nm (broken line) in dB/km to 20 kGy (SiO₂). The figure is in double logarithmic form.

Except for the temperature, the setup for both irradiations was the same. The measurement results at room temperature (red) are typical for this type of fiber and agree perfectly with numerous tests carried out in our laboratory. The effects of the low temperature are dramatic. It is seen that attenuation at low temperature (green) is up to 1000-times greater than at room temperature (red). At low temperatures, the fibers are thus considerably more sensitive to radiation.

Such pronounced effects had hitherto not been observed, and to our knowledge, these measurements are unique. These test results have attracted great interest among users from the space and accelerator community, and there are already several requests for further measurements.

Our solar system is constantly bombarded by high-energy radiation from the depths of space. This cosmic radiation consists of highly ionized particles which can generate such a great charge in a component that one such particle is sufficient to trigger a noticeable effect in electronic components. These effects may cause a change in the content of a memory cell, a Single Event Upset or SEU. They can also lead to the destruction of the component, as in the case of a Latchup (SEL), Burnout (SEB) or Gate Rupture (SEGR). The influence of cosmic rays on the electronics of satellites in space has long been known. It is one of the subjects examined by Fraunhofer INT, which uses heavy ion accelerators or high power lasers for the purpose.

Here on Earth, our atmosphere protects us from cosmic radiation. The high-energy radiation particles react with the atmosphere and create a cosmic ray shower of secondary particles, most of which are, in turn, absorbed by the atmosphere. Only the long-lived neutrons remain in any noticeable quantity. Although electrically neutral, they can generate highly charged products (secondary particles) by nuclear reaction. This can induce the same effects as the original cosmic radiation, although the event rate is lower by several orders of magnitude.

The increasing sensitivity of modern electronics for Single Event Effects (SEE) – well-known from space – is leading increasingly to SEE problems from atmospheric neutrons on Earth, in spite of the significantly lower event rate. The first industry to experience this was aviation. SEUs in avionics, the control electronics on planes, have already led to near-disasters in air traffic.

Avionics, as with space components, must meanwhile also be tested for SEU sensitivity, and hardened or configured redundantly. However, SEUs are not the sole problem. The destructive effects are not to be underestimated, particularly in power components. Their presence in safety-critical components can mean a serious hazard for an aircraft.

Even here on the Earth's surface, atmospheric neutrons are a problem, causing SEU risks in coronary pacemakers or with

the power electronics in high-speed trains. An important issue for the future will be the automotive industry, both with regard to the electronic control system for autonomous driving, and to the massive use of power electronics in electric mobility. In this industry, awareness of the dangers is currently still low.

The Business Unit NEO undertook several tests on power electronics for an aerospace supplier in 2014. Also, NEO and the Automotive Engineering Department at the University of Applied Sciences in Aachen agreed to cooperate in work on neutron sensitivity in typical power electronics. Another research area will examine whether it is necessary to investigate the effects of atmospheric neutrons at high energy accelerators, which simulate the atmospheric spectrum, or whether it is possible, in specific cases, to make quantitative statements by using 14 MeV neutron generators or short pulsed laser facilities. The latter would lead to significantly less expensive tests for industry.

¹ Cosmic radiation shower: image by Peter Reid, with kind permission by the University of Edinburgh, based on original material by CERN

SCIENTIFIC-TECHNICAL SUPPORT

Peter Clemens

The Department Nuclear and Electromagnetic Effects (NE), has an extensive scientific-technical infrastructure that supports experimental work in its three Business Units. Belonging to this infrastructure is a precision engineering workshop which makes special mechanical parts for experimental apparatus, and an electronics workshop which produces specific electronics for experiment work and carries out servicing and repairs.

The Department also has its own secretariat. The following is a selective overview of the tasks performed:

Precision-engineering laboratory

- Tailored assemblies and setup modifications for experiments, e. g. improvements on cryostat for low temperature investigations of optical fibers
- Radio frequency probes used for shielding effectiveness of housings
- Special mountings and fastenings for irradiation work
- Shielded housings for radio frequency applications
- Preparing platforms for presentations and exhibitions

Electronics laboratory

- Providing extensive support for all fields in preparing and conducting experimental work
- Manufacturing of devices, e.g. hardware development for EU-HPM-Detector
- Repairing of devices, e.g. repairing of TWT-amplifier
- Developing irradiation and measuring boards
- Servicing and operating the neutron generators for irradiation projects
- Operating the measuring computer network
- Consulting in the planning of INT's new buildings
- Work safety, fire protection and office technology
- Hosting 4 scientific assistants
- Hosting 4 school-age trainees (from 1 to 2 weeks)

Secretariat

- Formatting and producing posters
- Providing organizational support for projects
- Formatting study reports, radiation protection documentation
- Preparing and drafting EU project applications (e. g. Framework Programme 7)
- Preparing and hosting workshops



BUSINESS ADMINISTRATION AND CENTRAL SERVICES

Prof. 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 is also responsible for employer functions such as workplace safety and security.

The Department subdivides into Finance, Human Resources and Law (FPR), and Central Infrastructure (ZI). In addition, the sectors Library, Security, Marketing, and PR operate independently.

The group **Finance, Human Resources and Law** is responsible for book-keeping, accounting, controlling, human resources and travel management. **Book-keeping** is conducted in accordance with German commercial and tax law. 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). The department also manages the INT cash office, handling all cash and non-cash payments.

Controlling covers all monetary processes within Fraunhofer INT, which includes the continuous supervision and control of the Institute's entire budget. There is also administrative support for project budgets in other departments. Since sponsors continuously conduct internal and external audits of the Institute, the department also deals with all audit inquiries.

Human Resources supports the Institute's 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. **Travel management** assists staff on every aspect of official travel, covering planning and preparation, transport and hotel bookings, and travel expense accounting in accordance with Federal Law.

Central Infrastructure is responsible for Facility Management/Internal Services and Central IT Services. A major task was providing the Institute's administration and management with advice and support in paving the way for construction work on the premises. Central IT Services cover the Institute's entire IT infrastructure, providing first level support for the users.

The **Marketing and Public Relations** section does all the necessary communications and marketing work for results produced by INT's various business units. Together with the Institute's event management team, the section played a large part in organizing the 40-year celebration, including the PR work.

The predominant task of the **Library and Specialized Information Service** is procuring and managing the media required by the Institute, and supporting the scientists in research work and information accessing. Depending on project needs, additional specialized databases and other information sources are licensed and made available. The library also trains media and information specialists in information and documentation work. In the period under review, the library moved to its new home, transferring the whole collection of books, journals and other publications to the new premises.

Security and Secrecy supports information security management and the implementation and maintenance of secrecy regulations.



CONSTRUCTION



After nearly five years of almost uninterrupted construction work, the 2014 Annual Report includes another update on new buildings and conversions at Fraunhofer INT. The master plan, launched in 2010 with the construction of a new office building, was not completed in the reporting period. However, North Rhine-Westphalia's Construction and Real Estate Management Authority (BLB) and the Federal Office for Bundeswehr Infrastructure, Environmental Protection and Services (BAIUSBw) handed over the new library and the new seminar room – two very important components for INT, and a real milestone in master plan implementation.

Construction work on these buildings, which increase the Institute's area by 1000 qm, took up all of 2014 (and some of 2013), leaving the staff with much to put up with in their daily work. It was especially the staff in facility management, technical services and security who mastered the constant challenges of maintaining smooth, and above all safe, working conditions for the Institute.

Before going to press with this report, the first events had already been staged in the new seminar room, with great success and lots of positive feedback from the participants. The new building makes significantly larger events possible, with room for up to 100 participants. A retractable partition can divide the larger space into two smaller rooms, allowing for more flexible event planning.

The new library has also been well accepted by the staff. It offers a pleasant atmosphere for studying the numerous literature sources in the Institute inventory or to look for material at the three online research stations. Another plus point of the new building: the two ladies and the trainee on the Specialized Information Services team are now working directly next to the book sources, so they are immediately available to help with further queries.

Although the new seminar room and the library are in service, building work at INT has not yet finished. The newfound space

in the old complex allows for a number of transformations. As an example, the old seminar room is being converted into a canteen, which makes space available for redesigning and modernizing the laboratory tract. A passageway between the old and new buildings should round off the complex, creating an integrated research campus.

In parallel, the last step to completing the master plan has already been started: building upwards on top of the new office structure. When this report appears, construction work will be in full swing, and can be finished in 2015 if all goes to plan. By raising the height of the building, 14 new offices will be created – an increase that has become necessary in light of the Institute's continued growth in past years. The whole project will be completed with landscape work on the gardens. This will see the planting of a large number of ornamental apple trees, something of a tribute to the Institute's address: Appelsgarten 2.

COOPERATIONS

SPACE ALLIANCE LAUNCHED

Thomas Loosen



On February 10, 2014, 13 Institutes met at Fraunhofer HQ in Munich to launch the new Fraunhofer Space Alliance, the 24th alliance of its type in the Fraunhofer Gesellschaft. During summer, two more Fraunhofer Institutes joined, bringing the current Alliance total to 15 Institutes. Prof. Dr. Michael Lauster, Director of Fraunhofer INT, was elected Alliance Spokesman, with Dr. Frank Schäfer, of Fraunhofer EMI, as his Deputy. The Alliance operates from the Fraunhofer INT premises.

The background for the venture is the highly individual, although numerous, space research activities that the Gesellschaft's Institutes conduct. The main objective of the Alliance is to combine these activities to present the wide range of potential clients with a broad expertise spectrum, and to attract business which would be too large or too complex for a single Institute.

The market for research services for space applications is very large. In addition, there is the ground segment which is necessary for operating space infrastructures – also of major importance for the Alliance. As for the potential customer, the national market is characterized by the three major public actors MoD (BMVg), the German National Aeronautics Space Research Center (DLR) and the European Space Agency (ESA), as well as the two industrial companies OHB and Airbus Defense and Space, and numerous smaller and medium-sized enterprises.

Through numerous individual meetings and specially-designed workshops, the Alliance already made successful contact with these stakeholders in 2014, identifying specific research needs and initiating corresponding orders. Taking account of individual competences, the Alliance set up business units and appointed unit managers in order to secure the best possible market positions. This was done on the basis of a comprehensive analysis of the overall Alliance portfolio and on the needs of the market.

The result was the following business units:

- Communication and Navigation
- Materials and Processes
- Energy and Electronics
- Surfaces and Optical Systems
- Protection Technology and Reliability
- Sensor Systems and Analysis

In addition, a number of measures that would have been difficult for a single institute to manage were initiated and implemented. Foremost among these are various PR and marketing activities, a common Internet address (www.space.fraunhofer.de) and joint appearances at trade shows and conferences.

The key highlight for 2014 in this context was the joint stand in the Space Hall at the Berlin International Aerospace Exhibition (ILA 2014) in May, with 11 Institutes taking part. Using presentations and personal talks, the Institute representatives were able to demonstrate the Space Alliance's technological versatility to an international audience.

Two other good examples of cooperation within the Alliance were the joint appearances at the Space Forum of the German Society for Military Technology in Bonn, with 4 Institutes participating, and the International ESA Conference on Space Optics in Tenerife, with 3 Institutes present.

In 2014, the Alliance was so successful in its internal structuring and external positioning that first orders have already been acquired. Overall, this made an excellent start for the Alliance, which points up good prospects for 2015.



METHODS AND TRAINING STAFF POSITION

Dr. Birgit Weimert



The Methods and Training Staff Position was set up already in 2013 to promote method development and validation and to sustain the expansion of INT's methodological competence. Producing and maintaining a comprehensive overview of the methods landscape, continuously updating method and process knowledge and monitoring its own research activities in this field are an integral part of competent technology analysis and forecasting.

Tasks are divided into three key areas: the Staff Position of the Director of the Institute, Head of the Competence Center "Methodology and Training", and acting as contact point for the "Institute for Technology Analysis and Foresight in the field of Security Research" at RWTH University, Aachen.

The Staff Position supported Fraunhofer INT's Director in the past year through strategic acquisition activities, by managing or taking part in projects, and by providing scientific advice.

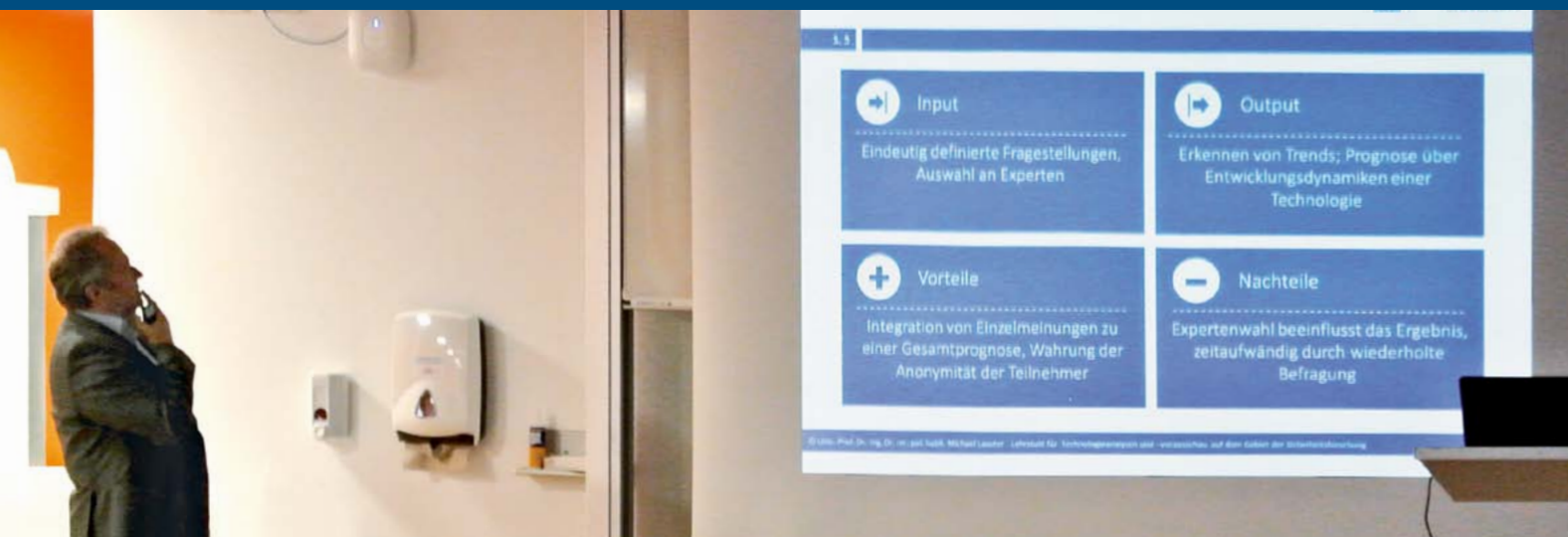
The Competence Center Methodology and Training is tasked with developing the methods of technology foresight necessary at INT. It adapts and constantly improves these methods, provides advice on practical applications, and designs and executes its own projects.

For this reason, the Task Force for the "Development of Quantitative Methods of Future Research" was set up in 2014, for the purpose of coordinating (further) development in institute-wide methods in the fields of bibliometrics and text mining. In the future, these activities will be extended to the patent landscape. In addition, a Research Agenda was drawn up, linking scientific objectives with optimal support for the various business units within Fraunhofer INT.

Already in 2013, the Staff Position also began work on the design of a method framework that from mid/end of 2015 is expected to be available as a Fraunhofer INT service package.

In addition, work regarding course content and methodology for the "Institute for Technology Analysis and Foresight in the field of Security Research" was successively pursued at RWTH University, Aachen. The purpose of the Chair is to provide university students with quantitative and qualitative future research methods in the context of application-oriented teaching and learning concepts. This includes both the epistemological foundation of methods and the investigation of extensive methodologies in future research, in terms of its suitability and optimization possibilities.

The Chair is focused on the analysis of forecasting processes in technological fields as well as on the adaptation, development and improvement of appropriate procedures and methods. The continuously generated research findings support science-based decision-making on issues in relation to the temporal evolution of technologies.



APPENDIX

University Courses

Chmel, S.: lecture and exercise "Physics", Bachelor's course Naturwissenschaftliche Forensik (2. Semester), "Bonn-Rhein-Sieg University of Applied Sciences", summer term 2014

Chmel, S.: lecture and exercise "Measuring Techniques" Bachelor's course Naturwissenschaftliche Forensik (3. Semester), "Bonn-Rhein-Sieg University of Applied Sciences", winter term 2014/2015

John, M.: "Leben und Arbeiten mit dem Cochlea Implantat – Funktionsweise, Chancen, Risiken und Erfahrungen im Hinblick auf die medizinische Rehabilitation" – Module as part of the Advanced Course of Rehabilitation Medicine of the Academy of Social Medicine, Berlin, 2/14/2014

John, M.: "Die Technisierung des Menschen – über Cochlea Implantate, Cyborgs und Human Enhancement", Bachelor's course Technical Journalism/PR, lecture, "Bonn-Rhein-Sieg University of Applied Sciences", Sankt Augustin, 4/2/2014

John, M.: "Das Cochlea Implantat: Funktionsweise, Entwicklung, Chancen, Risiken und Erfahrungen im Hinblick auf die logopädische Praxis", IB-Medical Academy, School for Logopaedia, Berlin, 7/25/2014

Jovanović, M.: "Projektmanagement"; University Dusseldorf, winter term 2013/2014

Jovanović, M.: "Bibliometrische Analysen", lecture "Diskurs"; "Bonn-Rhein-Sieg University of Applied Sciences", 3/26/2014

Jovanović, M.: "Bibliometrische Analysen"; "Bonn-Rhein-Sieg University of Applied Sciences", 6/12/2014

Jovanović, M.: "Bibliometrische Analysen"; (AS II: Informatik – Kurs 1); University Dusseldorf, summer term 2014

Köble, T.: "Radioaktivität", Lesson physics 8th grade, "Emil-Fischer-Gymnasium", Euskirchen, 6/12/2014

Kohlhoff, J.: Lecture and exercise on the subject "Elektromobilität", seminar "Technik und gesellschaftlicher Wandel", "Bonn-Rhein-Sieg University of Applied Sciences", 4/30 and 5/14/2014

Offenberg, D.: "Climate Engineering – kann Technik das Klima retten?", lecture series Technology and Environmental Ethics, "Bonn-Rhein-Sieg University of Applied Sciences", Sankt Augustin, summer term 2014, 4/17/2014

Schulte, A.: "Selbstreinigende Oberflächen nach dem Vorbild der Lotusblätter", lesson Biology, "Emil-Fischer Gymnasium", 5/5/2014

Suwelack, K.-U.: "Biogasaufbereitung und -einspeisung", during the lecture "Verfahrenstechnik biogener Brenn- und Kraftstoffe", "University of Hohenheim", Stuttgart, 11/28/2014

Thorleuchter, D.: "Semantisches Textmining", Bachelor's course Technical Journalism/PR, lecture, "Bonn-Rhein-Sieg University of Applied Sciences", Sankt Augustin, 3/26/2014

Wiemken, U.: Lecture/seminar Bachelor's course Technical Journalism, Module "Technik und Gesellschaft", "Bonn-Rhein-Sieg University of Applied Sciences", Sankt Augustin, summer term 2014

Wiemken, U.: Lecture/seminar Master Studiengang Technik- und Innovationskommunikation, Module "Technik und Gesellschaft", "Bonn-Rhein-Sieg University of Applied Sciences", summer term 2014

Wiemken, U.: "Technik und Gesellschaft Ethische Aspekte technischer Autonomie – Google, Facebook und die NSA", lecture series Technology and Environmental Ethics, "Bonn-Rhein-Sieg University of Applied Sciences", summer term 2014, 4/10/2014

Wirtz, H.: "Change- und Innovationsmanagement", lecture Hochschule Fresenius, winter term 2013/2014

Wirtz, H.: "Investitionsrechnung", lecture Hochschule Fresenius, winter term 2013/2014

Wirtz, H.: "Finanzierung", lecture Hochschule Fresenius, winter term 2013/2014

Wirtz, H.: "Prozessmanagement", lecture Hochschule Fresenius, summer term 2014

Wirtz, H.: "Change- und Innovationsmanagement", lecture Hochschule Fresenius, summer term 2014

Wirtz, H.: "Investitionsrechnung", lecture Hochschule Fresenius, summer term 2014

Wirtz, H.: "Finanzierung", lecture Hochschule Fresenius, summer term 2014

International Cooperation

Adami, C., Joester, M., Pusch, T., Ruge, S., Suhrke, M., Taenzer, H.-J.: EU-FP7-Project HIPOW (Protection of Critical Infrastructure against High Power Microwave Threats), 14 project partners

Baum, M., Höffgen, S., Kuhnenn, J., Kündgen, T., Lennartz, W., Metzger, S., Schmitz, S., Steffens, M., Weinand, U., Wolf, R.: CERN, Geneva, Switzerland

Berky, W., Chmel, S., Friedrich, H., Köble, T., Risse, M., Rosenstock, W., Schumann, O.: Project ANCHORS (UAV-Assisted Ad Hoc Networks for Crisis Management and Hostile Environment Sensing), Cooperation with French partners, May 2012 – April 2015

Berky, W., Chmel, S., Friedrich, H., Köble, T., Risse, M., Rosenstock, W., Schumann, O.: FP7 Project SCINTILLA (Scintillation Detectors and new Technologies for Nuclear Security), 9 project partners, January 2012 – December 2014

Berky, W., Chmel, S., Friedrich, H., Köble, T., Risse, M., Rosenstock, W., Schumann, O.: FP7 Project EDEN (End-user Driven Demo for CBRNE), 38 project partners, September 2013 – August 2016

Grigoleit, S., Pastuszka, H.-M.: Contribution to FP7 security research project ETTIS (European Security Trends and Threats in Society, vgl. <http://ettis-project.eu/>); 10 project partners, January 2012 – December 2014

Höffgen, S., Kuhnenn, J., Metzger, S., Steffens, M.: ESA-ESTEC Noordwijk, the Netherlands

Jovanović, M., Burbiel, J.: Coordination of FP7 security research project EvoCS (The evolving concept of security: A critical evaluation across four dimensions); 9 project partners, June 2014 – November 2015

Kuhnenn, J.: Areva France, France

Kuhnenn, J.: Université St. Etienne, France

Kuhnenn, J., Metzger, S.: Seibersdorf Laboratories, Seibersdorf, Austria

Reschke, S.: TNO Soesterberg, the Netherlands

Rosenstock, W.: Cooperation in the Program Committee IAEA 2014 "Safeguards Symposium – Linking Strategy, Implementation and People", Vienna, Austria

Schietke, R., Grigoleit, S., Missoweit, M.: Cooperation in the FP7 security research project SOURCE (Virtual centre of excellence for research support and coordination on societal security, vgl. <http://www.societalsecurity.net/>); 12 project partners, January 2014 – January 2019

Suhrke, M., Jöster, M., Adami, C., Ruge, S., Taenzer, H.J.: Cooperation in the NATO STO SCI-250 Task Group Radio Frequency Directed Energy Weapons in Tactical Scenarios

Suwelack, K.-U., Grigoleit, S.: Cooperation in the FP7 security research project D-BOX (Comprehensive Toolbox for Humanitarian Clearing of Large Civil Areas from Anti-Personal Landmines and Cluster Munitions, vgl. <http://www.d-boxproject.eu/>); 20 project partners, January 2013 – December 2015

International Reviews

Burbiel, J.: Tetrahedron Letters

Burbiel, J.: Medicinal Chemistry Communications

Höffgen, S.: Journal of Instrumentation, International School for Advanced Studies und Institute of Physics Publishing

Höffgen, S., Kuhnenn, J.: Optics Letters, The Optical Society

Höffgen, S., Kuhnenn, J., Metzger, S.: NSREC 2014 Conference Proceedings

Jovanović, M.: Scientometrics

Jovanović, M.: ASLIB Journal of Information Management

Kuhnenn, J.: Nuclear Instruments and Methods in Physics Research A, Elsevier

Kuhnenn, J.: Optics Express, The Optical Society

Kuhnenn, J.: Journal of Lightwave Technology, IEEE

Lubkowski, G.: PIER (Progress In Electromagnetics Research)

Reschke, S.: Defence Science Journal

Suhrke, M.: IEEE Transactions on Electromagnetic Compatibility

Thorleuchter, D.: Technological Forecasting and Social Change

Thorleuchter, D.: Electronic Commerce Research and Applications

Thorleuchter, D.: International Journal of Information Science

Thorleuchter, D.: Journal of Advanced Computer Science & Technology

Thorleuchter, D.: International Journal of Advanced Robotic Systems

Thorleuchter, D.: Information Sciences

Thorleuchter, D.: Decision Support Systems

Thorleuchter, D.: Expert Systems with Applications

Collaboration in Committees

Burbiel, J.: Ethical Advisory Board of the EDEN project

Chmel, S.: Coordination of AG "Projektmanagement", Fraunhofer EU-Network

Hecht-Veenhuis, S.: Berufsbildungsausschuss NRW, subcommittee, "Geprüfter Fachwirt / Geprüfte Fachwirtin für Medien- und Informationsdienste in NRW"

Höffgen, S.: Fraunhofer INT Representative, Wissenschaftlich-Technischer Rat (WTR) of the Fraunhofer-Gesellschaft

Kuhnhenh, J.: ICSO 2014, Chair of Session "Impact of Radiation on Fibers"

Kuhnhenh, J.: Panel organizer at ICSO 2014

Metzger, S.: Chair of Radiation Effects Data Workshop, NSREC 2014, Paris, France, July 14–18, 2014

Missoweit, M.: H2020 Secure Societies Advisory Group

Missoweit, M.: H2020 Advisory Group on International Cooperation

Missoweit, M.: H2020 Advisory Group on Gender

Missoweit, M.: EARTO Eurotech Security Working Group

Missoweit, M.: European Organisation of Security, Board

Neupert, U.: Contribution Weiterentwickler-Netzwerk A16+, Streitkräftebasis

Römer, S.: Disruptive Technologies Group (Letter of Intent 6 EDIR / FA)

Suhrke, M.: Chair of Session "Directed energy research" at the Future Security 2014

Suhrke, M.: HPEM Fellow of the Summa Foundation

Thorleuchter, D.: Spokesman of the Fachgruppe Betrieb von Informations- und Kommunikationssystemen der Gesellschaft für Informatik e.V. (GI)

Thorleuchter, D.: Editorial Board of the International Journal of Information Science

Thorleuchter, D.: Editorial Board of the Journal of Advanced Computer Science & Technology

Thorleuchter, D.: Editorial Board of the International Journal of Digital Contents and Applications

Thorleuchter, D.: Editorial Board of the International Journal of Advances in Robotic Systems

Thorleuchter, D.: Program Committee of WorldCIST'14: 2014 World Conference on Information Systems and Technologies, Madeira, Portugal, April 15–18, 2014

Thorleuchter, D.: Editor of Lecture Notes in Information Technology (LNIT)

Participation in Norming Processes

Adami, C.: NA140-00-19AA, creation of VG-Normen VG96900-96907, NEMP- und Blitzschutz

Adami, C.: NA140-00-20-02UA, creation of VG-Normen VG95370 ff., Elektromagnetische Verträglichkeit

Adami, C.: NATO HPM Standardization (NATO STO SCI-250 Task Group)

Jöster, M.: DKE / AK 767.13.5, EMV von Halbleitern, DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Köble, T.: DIN and VDE DKE/GUK 967.2, "Aktivitätsmessgeräte für den Strahlenschutz"

Suhrke, M.: National Representative Joint Task Force Reverberation Chamber of IEC

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

Lectures and Presentations

Brüchert, M.:
"Neue Technologien – heute wissen, was morgen kommt",
Unternehmerfrühstück viertelvoracht, Euskirchen, 6/11/2014

Brüchert, M.:
"Technologische Umbrüche und Entwicklungspfade",
Workshop ConnectedReality2025, Cologne, 7/10/2014

Brüchert, M.:
"Das Potenzial neuer Sensortechnologien", Workshop "Sensorik
als Treiber für die Industrie 4.0", Euskirchen, 11/3/2014

Burbiel, J.:
"Präparative Produktkennzeichnungstechnologien",
17. Europäischer Polizeikongress, Berlin, 2/19/2014

Chmel, S.:
Air-bound measurements of radioactive material with swarm-
behaved UAVs – The ANCHORS project, 9th Future Security
2014. Security Research Conference, Berlin, September 16–18,
2014

Höffgen, S.:
"Schutz der Satellitenelektronik vor stürmischem Weltraum-
wetter – ein Überblick", DWT Konferenz Forum Weltraum,
Bonn, September 9–10, 2014

Höffgen, S.:
"Brief outlook on radiation and EMC tests", Workshop on
radiation shielding for space applications, Munich, October
30–31, 2014

Huppertz, G.:
Unmanned Combat Aerial Vehicles – Möglichkeiten und
Herausforderungen, Thementag Unbemannte Systeme 2014,
Fraunhofer FKIE, Wachtberg, 11/4/2014

Jöster, M.:
HPM-Detektionssystem mit Frequenzbestimmung, EMV 2014,
Dusseldorf, 3/13/2014

Jöster, M.:
HPEM Untersuchungen an kritischer Infrastruktur, Treffen der
Nationalen Arbeitsgruppe HPEM, Muenster, May 13–14, 2014

Jöster, M.:
High-Power-Electromagnetics on Halbleitern, Elektronik am
Limit III, Symposium für Halbleiter, IVAM / SGS INSTITUT
FRESENIUS GmbH, Dortmund, 5/27/2014

Jöster, M.:
HPEM Tests of Security Systems, AMEREM 2014, Albuquerque,
USA, 7/31/2014

Jöster, M.:
Definition und Test der Elektromagnetischen Störfestigkeit von
UAS für Krisenreaktionskräfte, Kleinheubacher Tagung 2014,
Miltenberg, 9/29/2014

John, M.:
"Bibliometrie als Werkzeug für die Technologiefrühaufklärung.
Praktische Erfahrungen und erste Ergebnisse" – lecture at the
colloquium of the European Academy, Bad Neuenahr-Ahrweiler,
8/28/2014

John, M., Neupert, U.:
Through-The-Wall Sensing – Current Technological Develop-
ments, Challenges and Future Prospects; 2nd International
Urban Operations Conference, Berlin, October 20–22, 2014

John, M., Fritsche, F., Grüne, M.:
"Trend archaeology – profiling future technologies by retro-
spective bibliometric analyses" –, Poster for 5th International
Conference on Future-Oriented Technology Analysis, FTA 2014,
Engage today to shape tomorrow, Brussels, Belgium,
November 27–28, 2014

Jovanović, M., Burbiel, J.:
"The evolving concept of security: A critical evaluation across
four dimensions", 9th Future Security 2014, Berlin, 9/18/2014

Jovanović, M.:
"Customers who cited this item also cited ... – Comparing data
from Amazon.com with the new Book Citation Index", lecture
German-Chinese seminar at the INT, Euskirchen, 10/20/2014

Köble, T.:
Proliferation Resistance in the Thorium Cycle, 36th Annual
Meeting ESARDA, Luxembourg, Luxembourg, May 12–15,
2014

Köble, T.:
Mobile techniques for rapid detection of concealed nuclear
material, IAEA International Safeguards Symposium:
Linking Strategy, Implementation and People, Vienna, Austria,
October 20–24, 2014

Köble, T.; Berky, W.; Chmel, S.; Friedrich, H.; Risse, M.;
Schumann, O.; Rosenstock, W.:
DeGeN – Measurement Vehicle for Radioactive and Nuclear
Material, Poster, Fourth European IRPA Congress, Radiation
Protection Culture – A global challenge, Geneva, Switzerland,
June 23–27, 2014

Kuhnhen, J.:
"Fiber optic sensors at accelerators – considerations and pitfalls",
3rd oPAC Topical Workshop on Beam Diagnostics, Vienna,
Austria, 5/9/2014

Kuhnhen, J.:
Irradiation tests on optical fibres below 20 K, ICSO 2014,
Tenerife, Spain, 10/8/2014

Kuhnhen, J.:
Radiation tests – good and bad practice, ICSO 2014, Tenerife,
Spain, 10/8/2014

Metzger, S.:
"Atmosphärische Neutronen – Eine zunehmende Gefährdung
am Boden und in der Luft", DWT Konferenz Angewandte
Forschung für Verteidigung und Sicherheit in Germany, Berlin,
February 3–5, 2014

Metzger, S.:
"Halbleiter in Umgebungen mit hoher Röntgen- und Gamma-
strahlung", ELEKTRONIK AM LIMIT III, SGS, Dortmund,
5/27/2014

Metzger, S.:
"Bedrohung der Weltrauminfrastruktur durch exoatmos-
phärische Kernwaffenexplosionen", DWT Konferenz Forum
Weltraum, Bonn, September 9–10, 2014

Missoweit, M.:
DRIVER – Driving Innovation in crisis management for
European Resilience, DG ENTR Community of Users (CoU)
Event, Brussels, Belgium, November 24–25, 2014

Missoweit, M.:
Policy Perspectives & Responses to SECILE FP7 project,
Panel discussion, SECILE final conference, Dublin, Ireland,
10/13/2014

Missoweit, M.:
Update from the Horizon 2020 Advisory Group on
International Cooperation, Workshop Fraunhofer International
Business Development Network, Brussels, Belgium,
October 8–10, 2014

Missoweit, M.:
From Research to Products: The 5 Demonstration Programs
of FP7, Panel discussion 9th Fraunhofer Future Security
Conference, Berlin, September 16–18, 2014

- Missoweit, M.:
The surveillance society, Electric Picnic Festival, Panel discussion, Stradberry, Ireland, August 29–31, 2014
- Missoweit, M.:
The current security R&I drivers/actors in Europe, World International Studies Committee Conference, Round table on Civil Security: A new Paradigm for Security Research and Policy?, Frankfurt, August 5–8, 2014
- Missoweit, M.:
Security, Acceptance & Innovation, 6th Biannual Surveillance & Society Conference, Barcelona, Spain, 4/24/2014
- Missoweit, M., Kraus, F.:
DRIVER – DRiving InnoVation in crisis management for European Resilience, DG ENTR Policy-Science-Industry Event, Brussels, Belgium, 1/30/2014
- Missoweit, M.:
Moderation of Session “Fight against Crime and Terrorism”, SMIZG-Meeting, Brussels, Belgium, January 23–24, 2014
- Missoweit, M.:
Secure Societies in H2020 & Fraunhofer priorities and views in EU security research, Horizon 2020 Conference, Bratislava, Slovakia, January 21–22, 2014
- Müller, S.:
Technologiefrüherkennung, Fraunhofer-Seminar Marktrecherche, Berlin, 6/17/2014
- Müller, S.:
Foresight-Management aus der Perspektive unterschiedlicher Anwender – eine ganzheitliche Betrachtung, DIFI-Tagung Foresight-Management, Darmstadt, 9/16/2014
- Pastuszka, H.-M.:
Civil security R&D from a scientific perspective, Erfahrungsaustausch Zivile Sicherheitsforschung, Trilateral Meeting THW (DE), DGSCGC (FR) und KGSP (PL), Berlin, 1/24/2014
- Pastuszka, H.-M.:
Civil security R&D within the EU, Erfahrungsaustausch Zivile Sicherheitsforschung, Trilateral Meeting THW (DE), DGSCGC (FR) und KGSP (PL), Berlin, 1/25/2014
- Pastuszka, H.-M.:
Situation awareness of Civil Protection decision-making solutions – preparing the ground for a Pre-commercial Procurement (PCP), Round Table Discussion at KGSP (PL), Warsaw, Poland, May 15–16, 2014
- Pastuszka, H.-M.:
Pre-Commercial Procurement (PCP) in Horizon 2020: an opportunity for cross-border R&D cooperation in civil protection?, Discussion panel, Trilateral Meeting THW (DE), DGSCGC (FR) und KGSP (PL), Warsaw, Poland, 6/6/2014
- Pastuszka, H.-M., Neupert, U.:
Strategische Vorausschau am Fraunhofer INT – Technologiefrühaufklärung und Wehrtechnische Zukunftsanalyse, 1. Konferenz/Werkstatttag “Strategische Vorausschau in der Praxis”, Bundesakademie für Sicherheitspolitik (BAKS), Berlin, 7/3/2014
- Pastuszka, H.-M., Grüne, M., Huppertz, G.:
Wehrtechnische Zukunftsanalyse Robotik, Vertiefungsmodul “Methodik der Zukunftsanalyse” (Reihe IntegrPlgBw), Führungsakademie der Bundeswehr (FüAkBw), Hamburg, 10/7/2014
- Pastuszka, H.-M., Huppertz, G., Grüne, M.:
Langfristige technologische Trends in der Robotik, Thementag Robotik 2014, Fraunhofer FKIE, Wachtberg, 11/4/2014
- Pusch, T.:
Vulnerability of Personal Radiation Meters to Intentional Electromagnetic Interference (IEMI), Proc. 9th Future Security 2014, Berlin, 9/17/2014
- Reschke, S.:
Generative Fertigungsverfahren – Metalle, Institute course at the Bundeswehr Research Institute for Materials, Fuels and Lubricants, Erding, 3/14/2014
- Reschke, S.:
Industrie 4.0: Chancen für den Mittelstand durch neue Werkstoffe, Verfahren und Robotik!?, Conference/Workshop, AG Mobil, RKW Hessen, Oberursel, 5/27/2014
- Reschke, S.:
Keynote Address: Industry 4.0 vs. Human 1.x: How to become adequate for which challenge?, NeuroVation 2014 Symposium, Muntgebouw Utrecht, Utrecht, Netherlands, October 6–7, 2014
- Risse, M.:
The influence of shielding – gamma-measurements of nuclear material, DPG-Frühjahrstagung 2014, Arbeitsgruppe Physik und Abrüstung (AGA), Berlin, March 17–21, 2014
- Risse, M.:
Comparison of analysis results of SNM measurements by means of device implemented automatic analysis routines, FRAM and MGA/MGAU, 55th Annual Meeting INMM, Atlanta, USA, July 20–24, 2014
- Römer, S.:
“Nanotechnology in Germany” at “Kooy Symposium 2014: Towards Nanotechnology for Defence”, of Koninklijk Instituut Van Ingenieurs (KIVI), Amsterdam, the Netherlands, 4/9/2014
- Steffens, M.:
“Radiation shielding for electronics and sensitive parts”, Workshop on radiation shielding for space applications, Munich, October 30–31, 2014
- Suhrke, M.:
Overview of Fraunhofer INT WP contributions, HIPOW Steering Group Meeting, Athens, Greece, 1/14/2014
- Suhrke, M.:
Overview of Fraunhofer INT WP4 contributions, HIPOW WP4 Meeting, Toulouse, France, 4/9/2014
- Suhrke, M.:
Overview of Fraunhofer INT WP3 contributions, HIPOW WP3 Meeting, Toulouse, France, 4/10/2014
- Suhrke, M.:
HPEM Tests of Communication Devices, AMEREM 2014, Albuquerque, USA, July 28–31, 2014
- Suhrke, M.:
HPM detector system with frequency identification, EMC Europe 2014, Gothenburg, Sweden, September 2–4, 2014
- Suhrke, M.:
Introduction Business Unit Electromagnetic Effects and Threats (EME), Strategischer Workshop – Seibersdorf Laboratories und Fraunhofer INT, Seibersdorf, November 3–4, 2014
- Suhrke, M.:
HPM/NNEMP Detection, HIPOW End-Users Workshop, Athens, Greece, 11/5/2014
- Thorleuchter, D.:
Priorisierung im Rahmen der Rüstungsabschirmung, Meeting of the AG Rüstungsabschirmung, Euskirchen, 3/6/2014

Thorleuchter, D., Van den Poel, D.:
Using Text Summarizing to support Planning of Research and Development, World Conference on Information Systems and Technologies, Madeira, Portugal, 4/16/2014

Vollmer, M.:
Innovative tools in crisis management – dependency of their success to enhance societal resilience from laws, policies, and institutional structures. Conference proceedings, 5th IDRC Davos, Switzerland, August 24–28, 2014

Weinand, U.:
Lecture SSG (Smart Security Glass), Perimeter Protection, Nürnberg, 1/15/2014

Weinand, U.:
"Entwicklung einer intelligenten Sicherheitsglasscheibe mittels FBG", The University of Applied Sciences Mittweida, Internationale Wissenschaftliche Konferenz, Mittweida, November 5–6, 2014

Wiemken, U.:
"Technik und der Wandel in der Gesellschaft – Gesamtgesellschaftliche Aspekte der Verteidigungs- und Sicherheitsforschung", Sicherheitspolitisches Tagesseminar, Bickenbach, 3/29/2014

Wiemken, U.: "Technik und der Wandel in der Gesellschaft – Gesamtgesellschaftliche Aspekte der Verteidigungs- und Sicherheitsforschung", Deutsche Gesellschaft für Wehrtechnik Jahrestagung 2014, Bad Godesberg, 5/14/2014

Wiemken, U.: "40 Jahre INT – Der Weg in das Standardmodell der Fraunhofer-Gesellschaft", Festkolloquium, Euskirchen, 9/25/2014

Wiemken, U.: "Technik und der Wandel in der Gesellschaft – Gesamtgesellschaftliche Aspekte der Technik", RAC Voreifel,

Bornheim, 11/5/2014

Wiemken, U.: "Technik und der Wandel in der Gesellschaft – Gesamtgesellschaftliche Aspekte der Verteidigungs- und Sicherheitsforschung", 2. Informationsveranstaltung der DWT für das Planungsamt der Bundeswehr, Berlin-Köpenick, 11/13/2014

Wiemken, U.: "Die Entwicklung technischer Autonomie – Was können und was dürfen Automaten?", 8. Bonner Symposium "Das Leben der Zukunft – Intelligente Häuser, Internet der Dinge und Ambient Assisted Living", Poppelsdorfer Schloss, Bonn, 11/19/2014

Publications

Adami, C.; Chmel, S.; Jöster, M.; Pusch, T.; Suhrke, M.:
Definition und Test der Elektromagnetischen Störfestigkeit von UAS für Krisenreaktionskräfte: Vortrag gehalten auf der Kleinheubacher Tagung 2014, Miltenberg, Germany, 9/29–10/1/2014 (Kleinheubacher Tagung <2014, Miltenberg>) 2014, URN urn:nbn:de:0011-n-3263758

Adami, C.; Jöster, M.; Suhrke, M.; Taenzer, H.-J.:
HPEM tests of communication devices (AMEREM <2014, Albuquerque/NM>)
In: University of New Mexico: AMEREM 2014. Book of Abstracts: Albuquerque, New Mexico, USA, July 27–31, 2014. Albuquerque/NM, 2014, Art. ID 039, URN urn:nbn:de:0011-n-3181607

Adami, C.; Jöster, M.; Suhrke, M.; Taenzer, H.-J.:
HPEM tests of security systems (AMEREM <2014, Albuquerque/NM>)
In: University of New Mexico: AMEREM 2014. Book of Abstracts: Albuquerque, New Mexico, USA, July 27–31, 2014. Albuquerque/NM, 2014, Art. ID 040, URN urn:nbn:de:0011-n-3181317

Adami, C.; Braun, C.; Clemens, P.; Jöster, M.; Ruge, S.; Suhrke, M.; Schmidt, H. U.:
HPM detector system with frequency identification (International Symposium on Electromagnetic Compatibility (EMC Europe) <2014, Gothenburg>)
In: Institute of Electrical and Electronics Engineers -IEEE-: International Symposium on Electromagnetic Compatibility, EMC Europe 2014. Vol.1: Gothenburg, Sweden, September 1–4, 2014; Proceedings. Piscataway, NJ: IEEE, 2014, pp.140-145, DOI 10.1109/EMCEurope.2014.6930892, URN urn:nbn:de:0011-n-3263775, URN urn:nbn:de:0011-n-326377-12

Adami, C.; Braun, C.; Clemens, P.; Jöster, M.; Schmidt, H. U.; Suhrke, M.; Taenzer, H.-J.:
HPM detector with extended detection features
In: Sabath, F.: Ultra-wideband, short-pulse electromagnetics 10. Dordrecht: Springer Science+Business Media, 2014, pp.345-353, DOI 10.1007/978-1-4614-9500-0_31

Adami, C.; Braun, C.; Clemens, P.; Jöster, M.; Suhrke, M.; Schmidt, H. U.; Taenzer, H.-J.:
HPM-Detektionssystem mit Frequenzbestimmung (Internationale Fachmesse und Kongress für Elektromagnetische Verträglichkeit (EMV) <2014, Düsseldorf>)
In: Garbe, H.: EMV 2014, Internationale Fachmesse und Kongress für Elektromagnetische Verträglichkeit: Düsseldorf, 11–13/03/2014; Europas Branchentreffpunkt für EMV. Berlin: VDE-Verlag, 2014, pp.573-580, URN urn:nbn:de:0011-n-3020221

Adami, C.; Berky, W.; Jöster, M.; Suhrke, M.; Pusch, T.:
Vulnerability of personal radiation meters to international electromagnetic interference (IEMI) (Security Research Conference "Future Security" <9, 2014, Berlin>)
In: Thoma, K. (Ed.) et al.: 9th Future Security 2014. Security Research Conference: September 16–18, 2014, Berlin; Proceedings. Stuttgart: Fraunhofer Verlag, 2014, pp.418-426, URN urn:nbn:de:0011-n-3180601

Bark, R.A.; Lieder, E.O.; Lieder, R.M.; Lawrie, E.A.; Lawrie, J.J.; Bvumbi, S.P.; Kheswa, N.Y.; Ntshangase, S.S.; Madiba, T.E.; Masiteng, P.L.; Mullins, S.M.; Murray, S.; Papka, P.; Shirinda, O.; Chen, Q.B.; Zhang, S.Q.; Zhang, Z.H.; Zhao, P.W.; Xu, C.; Meng, J.; Roux, D.G.; Li, Z.P.; Peng, J.; Qi, B.; Wang, S.Y.; Xiao, Z.G.:
Studies of chirality in the mass 80, 100 and 190 regions
In: International journal of modern physics. E, Nuclear physics, Vol.23 (2014), No.7, Art. 1461001, pp.8, DOI DOI: 10.1142/S0218301314610011

Bergersen, S.; Kaufmann, M.; Missoweit, M.; Swart, L. de; Slot, B.; Birkman, L.:
D91.3 – Ethical Procedures, Risks and Safeguards, Oslo, Finnland, 2014, URN urn:nbn:de:0011-n-3323259

Berky, W.; Chmel, S.; Friedrich, H.; Höffgen, S.K.; Jöster, M.; Köble, T.; Lennartz, W.; Metzger, S.; Pusch, T.; Risse, M.; Schumann, O.; Rosenstock, W.; Weinand, U.:
Air-bound measurements of radioactive material with swarm-behaved UAVs – the ANCHORS project (Security Research Conference “Future Security” <9, 2014, Berlin>)
In: Thoma, K. (Ed.) et al.: 9th Future Security 2014. Security Research Conference: September 16 – 18, 2014, Berlin; Proceedings. Stuttgart: Fraunhofer Verlag, 2014, pp.64-70, URN urn:nbn:de:0011-n-3180597

Berky, W.; Friedrich, H.; Köble, T.; Risse, M.; Rosenstock, W.; Schumann, O.:
The influence of shielding – gamma-measurements of nuclear material (Deutsche Physikalische Gesellschaft (DPG Frühjahrstagung) <78, 2014, Berlin>)
In: Deutsche Physikalische Gesellschaft e.V. -DPG-, Arbeitskreis Atome, Moleküle, Quantenoptik und Plasmen: 78th Annual Meeting of the DPG and DPG-Frühjahrstagung (Spring Meeting) of the Section on Atomic, Molecular, and Plasma Physics and Quantum Optics [SAMOP] and further divisions 2014: Environmental Physics, Extraterrestrial Physics, Gravitation and Relativity, Theoretical and Mathematical Physics, as well as the Working Groups: Energy, Equal Opportunities, Information, Philosophy of Physics, Physics and Disarmament, young DPG ; March, 17 – 21, 2014, Humboldt-Universität zu Berlin. Bad Honnef: DPG, 2014. (Verhandlungen der Deutschen Physikalischen Gesellschaft. Reihe 6 49.2014, Nr.2), 52 Folien, URN urn:nbn:de:0011-n-3278980

Berky, W.; Köble, T.:
Rapid detection of hazardous nuclear materials using modern portable measuring devices
In: Bundesministerium der Verteidigung -BMVg-, Unterabteilung AIN II, Bonn: Military Scientific Research Annual Report 2013: Defence research for the German Armed Forces. Bonn: BMVg, 2014, pp.30-31

Berky, W.; Köble, T.:
Schneller Nachweis von nuklearen Gefahrstoffen mit modernen tragbaren Messsystemen
In: Bundesministerium der Verteidigung -BMVg-, Unterabteilung AIN II, Bonn: Wehrwissenschaftliche Forschung. Jahresbericht 2013: Wehrwissenschaftliche Forschung für deutsche Streitkräfte. Bonn: BMVg, 2014, pp.30-31, URN urn:nbn:de:0011-n-3180554

Burbiel, J.; Schietke, R.:
Comparative analysis of methods for strategic security research planning (Security Research Conference “Future Security” <9, 2014, Berlin>)
In: Thoma, K. (Ed.) et al.: 9th Future Security 2014. Security Research Conference: September 16 – 18, 2014, Berlin; Proceedings. Stuttgart: Fraunhofer Verlag, 2014, pp.476-483, URN urn:nbn:de:0011-n-3181283

Burbiel, J.; Schietke, R.:
ETCETERA – Evaluation of critical and emerging security technologies for the elaboration of a strategic research agenda. Final report, Euskirchen: Fraunhofer INT, 2014, URN urn:nbn:de:0011-n-2981693

Burbiel, J.:
Nanocellulose
In: Europäische Sicherheit & Technik : ES & T, Vol.63 (2014), No.4, pp.70

Burbiel, J.:
Nanocellulosen – Hightech aus Holz
In: Das Blatt. Mitarbeiterzeitung, (2014), No.3, pp.20-21, URN urn:nbn:de:0011-n-3037677

Euting, T.:
Big Data
In: Europäische Sicherheit & Technik: ES & T, Vol.63 (2014), No.3, pp.87 (Europäische Sicherheit & Technik)

Fichte, L. O.; Stiemer, M.; Potthast, S.; Sabath, F.; Adami, C.; Suhrke, M.:
First thoughts on a standard for future HPEM immunity tests (AMEREM <2014, Albuquerque/NM>)
In: University of New Mexico: AMEREM 2014. Book of Abstracts: Albuquerque, New Mexico, USA, July 27 – 31, 2014. Albuquerque/NM, 2014, Art. ID 109, URN urn:nbn:de:0011-n-3181612

Frech, I.; Vollmer, M.; Tagarev, T.; Petkov, V.; Hayes, B.; Birkman, L.; de Swart, L.; Giroud, F.; MacDonagh, P.; Mackin, M.; O’Byrnes, R.; Iarossi, N.; Rebuffi, L.; Tani, K.; Norrby, M.; Mülayim, A.Y.; Politou, N.; Jager, B. de; Eich, F.; Schirnhöfer, S.:
D82.11 – CM organisations & capabilities report, Euskirchen: Fraunhofer INT, 2014, URN urn:nbn:de:0011-n-3323230

Freudendahl, D.; Langner, R.; Reschke, S.:
Werkstofftrends: 2D-Materialien
In: Werkstoffe in der Fertigung, (2014), Nr.2, pp.3

Freudendahl, D.; Langner, R.; Reschke, S.:
Werkstofftrends: Kohlenstoffbasierte Festschmierstoffe
In: Werkstoffe in der Fertigung, (2014), No.3, pp.3

Freudendahl, D.; Langner, R.; Reschke, S.:
Werkstofftrends: Organische 2D-Polymere
In: Werkstoffe in der Fertigung, (2014), No.6, pp.3 (Werkstoffe in der Fertigung)

Grigoleit, S.; Jovanovic, M.; Schietke, R.; Kliuyeva, K.; Neumann, A.; Martin-Maze, M.; Gabrielsen Jumbert, M.; Garcia Canales, J. E.; Herrera, J. F.:
D2.4 Overview and analysis of modes of exchange between relevant sectors: Deliverable submitted 23 December 2014 (M12) in fulfilment of requirements of the FP7 project, SOURCE – Virtual Centre of Excellence for research support and coordination on societal security (SEC-2012.7.4-2: Networking of researchers for a high level multi-organisational and cross-border collaboration), Euskirchen: Fraunhofer INT, 2014, URN urn:nbn:de:0011-n-3264584

Grigoleit, S.; Pastuszka, H.-M.; Eriksson, A.; Graca Carvalho, M. da; Kastrinos, N.; Liem, T.-K.; Bierwisch, A.; Burgess, J. P.; Haisma, I.; Brown, I.; Weber, M.; Lagazio, M.:
D7.4 Report on High Level Event: Deliverable submitted in December 2014 (M36) in fulfilment of the requirements of the FP7 project, ETTIS ? European security trends and threats in society, Euskirchen: Fraunhofer INT, 2014, URN urn:nbn:de:0011-n-3264571

Grigoleit, S.:
Graphen
In: Europäische Sicherheit & Technik : ES & T, Vol.63 (2014), No.9, pp.59

Guillermain, E.; Kuhnenn, J.; Ricci, D.; Weinand, U.:
Macro-bending influence on radiation induced attenuation measurement in optical fibres
In: IEEE Transactions on Nuclear Science, Vol.61 (2014), No.4, pp.1834-1837, DOI 10.1109/TNS.2014.2306992

Heuer, C. M.:
Transkranielle Stimulation
In: Europäische Sicherheit & Technik : ES & T, Vol.63 (2014), No.11, pp.78

- Huppertz, G.:
Kinodynamische Wegplanung
In: Europäische Sicherheit & Technik : ES & T, Vol.63 (2014), No.2, pp.82
- John, M.; Fritsche, F.; Grüne, M.:
Trend archaeology ? profiling future technologies by retrospective bibliometric analyses: Poster presented at 5th International Conference on Future-Oriented Technology Analysis, FTA 2014, Engage today to shape tomorrow, Brussels, Belgium, 27–28 November 2014, (International Conference on Future-Oriented Analysis (FTA) <5, 2014, Brussels>), 2014, URN urn:nbn:de:0011-n-3180549
- Jovanovic, M.; Burbiel, J.:
The evolving concept of security: A critical evaluation across four dimensions (Security Research Conference "Future Security" <9, 2014, Berlin>)
In: Thoma, K. (Ed.) et al.: 9th Future Security 2014. Security Research Conference: September 16 – 18, 2014, Berlin; Proceedings. Stuttgart: Fraunhofer Verlag, 2014, pp.499-503, URN urn:nbn:de:0011-n-3181292
- Klerx, J.; Parys, J.; Wepner, B.; Wanzenböck, I.; Weber, M.; Eriksson, A.; Sweijts, T.; Grigoleit, S.; Burgess, J. P.; Bellanova, R.:
D.6.1 Security research priorities and the role of government policy: Deliverable submitted in December 2014 (M36) in fulfilment of the requirements of the FP7 project, ETTIS – European security trends and threats in society, Vienna, Austria, 2014, URN urn:nbn:de:0011-n-3264568
- Klerx, J.; Dönitz, E.; Grigoleit, S.; Carlsen, H.:
D4.2 ETTIS methodology note: Deliverable submitted in February 2014 in fulfilment of the requirements of the FP7 project, ETTIS – European security trends and threats in society Vienna, Austria, 2014, URN urn:nbn:de:0011-n-2800641
- Köble, T.; Berky, W.; Chmel, S.; Friedrich, H.; Risse, M.; Rosenstock, W.; Schumann, O.:
DeGeN – Measurement vehicle for radioactive and nuclear material: Poster presented at 4th European IRPA Congress 2014, June 23–27, 2014, Geneva, Switzerland (International Radiation Protection Association (IRPA European Congress) <4, 2014, Geneva>), 2014, URN urn:nbn:de:0011-n-3279896, URN urn:nbn:de:0011-n-327989-11
- Kohlhoff, J.; Müller, S.:
Technological implications for a "Post-fossil Bundeswehr"
In: Bundesministerium der Verteidigung -BMVg-, Unterabteilung AIN II, Bonn: Military Scientific Research Annual Report 2013: Defence research for the German Armed Forces. Bonn: BMVg, 2014, pp.33-34
- Kohlhoff, J.; Müller, S.:
Technologische Implikationen für eine "Postfossile Bundeswehr"
In: Bundesministerium der Verteidigung -BMVg-, Unterabteilung AIN II, Bonn: Wehrwissenschaftliche Forschung. Jahresbericht 2013: Wehrwissenschaftliche Forschung für deutsche Streitkräfte. Bonn: BMVg, 2014, pp.32-33, URN urn:nbn:de:0011-n-3180563
- Kuhnhenh, J.; Höffgen, S.K.; Köhn, O.; Schumann, O.; Weinand, U.; Wolf, R.:
Irradiation tests on optical fibres below 20 K: Presentation held at International Conference on Space Optics, ICSO 2014, October 6–10, 2014, La Caleta, Tenerife, Spain (International Conference on Space Optics (ICSO) <10, 2014, La Caleta/Tenerife>), 2014, URN urn:nbn:de:0011-n-3321758, URN urn:nbn:de:0011-n-332175-15
- Kuhnhenh, J.:
Radiation tests on optical fibres – good and bad practice: Presentation held at International Conference on Space Optics, ICSO 2014, October 6–10, 2014, La Caleta, Tenerife, Spain (International Conference on Space Optics (ICSO) <10, 2014, La Caleta/Tenerife>), 2014, URN urn:nbn:de:0011-n-3321768, URN urn:nbn:de:0011-n-332176-14
- Langner, R.; Freudendahl, D.; Reschke, S.:
Werkstofftrends: Recycling von Seltenerdmetallen
In: Werkstoffe in der Fertigung, (2014), No.4, pp.3 (Werkstoffe in der Fertigung)
- Lauster, M.:
Technologische Trends. Intelligenz in technischen Produkten
In: Wehrtechnischer Report, (2014), No.1, IT-Report 2014, pp.66-69, URN urn:nbn:de:0011-n-3160243
- Lauster, M.:
Trends und Entwicklungen in Forschung und Technologie (Internationales Wirtschafts- und Transportforum <24, 2013, Bremerhaven>)
In: Scheibe, Heinz-Jürgen (Ed.): Europa im Spannungsfeld globaler und multipolarer Herausforderungen: Ergebnisse des 24. Internationalen Wirtschafts- und Transportforums, 17. – 19. 04. 2013, Bremerhaven. Ritterhude: DGAW, 2014. (Beiträge zu internationalen Wirtschafts- und Transportfragen 12), pp.62-68, URN urn:nbn:de:0011-n-3160231
- Lieder, E.O.; Lieder, R.M.; Bark, R.A.; Chen, Q.B.; Zhang, S.Q.; Meng, J.; Lawrie, E.A.; Lawrie, J.J.; Bvumbi, S.P.; Kheswa, N.Y.; Ntshangase, S.S.; Madiba, T.E.; Masiteng, P.L.; Mullins, S.M.; Murray, S.; Papka, P.; Roux, D.G.; Shirinda, O.; Zhang, Z.H.; Zhao, P.W.; Li, Z.P.; Peng, J.; Qi, B.; Wang, S.Y.; Xiao, Z.G.; Xu, C.:
Resolution of chiral conundrum in 106 Ag: Doppler-shift lifetime investigation
In: Physical review letters, Vol.112 (2014), No.20, Art.202502, pp.6, DOI 10.1103/PhysRevLett.112.202502
- Nätzker, W.:
All electric aircraft
In: Europäische Sicherheit & Technik : ES & T, Vol.63 (2014), No.6, pp.77
- Neupert, U.:
Technische Entwicklungen im maritimen Bereich
In: Jopp, Heinz-Dieter (Ed.): Maritime Sicherheit im 21. Jahrhundert. Baden-Baden: Nomos Verlagsgesellschaft, 2014. (Demokratie, Sicherheit, Frieden 215), pp.179-194
- Neupert, U.:
Metall-Luft-Batterien
In: Europäische Sicherheit & Technik: ES & T, Vol.63 (2014), No.7, pp.64
- Önnheim, K.; Christenson, K.; Gabl, M.; Burbiel, J. C.; Müller, C. E.; Oprea, T. I.; Bylund, J.; Dahlgren, C.; Forsman, H.:
A novel receptor cross-talk between the ATP receptor P2Y2 and formyl peptide receptors reactivates desensitized neutrophils to produce superoxide
In: Experimental Cell Research, Vol.323 (2014), No.1, pp.209-217, DOI 10.1016/j.yexcr.2014.01.023
- Preinersdorfer, A.; Adami, C.; Jöster, M.; Pusch, T.; Suhrke, M.; Bumerl-Lexa, R.; Kolosnev, N.; Neubauer, G.:
Investigation of the impact of various IEMI sources to electronic passport readers (Security Research Conference "Future Security" <9, 2014, Berlin>)
In: Thoma, K. (Ed.) et al.: 9th Future Security 2014. Security Research Conference: September 16 – 18, 2014, Berlin; Proceedings. Stuttgart: Fraunhofer Verlag, 2014, pp.427-433, URN urn:nbn:de:0011-n-3180614
- Reschke, S.; Langner, R.; Freudendahl, D.:
Werkstofftrends: Elektrischer Energiespeicher auf Lithium-Basis
In: Werkstoffe in der Fertigung, (2014), No.5, pp.3 (Werkstoffe in der Fertigung)

Reschke, S.; Langner, R.; Freudendahl, D.:
Werkstofftrends: Nanogeneratoren
In: Werkstoffe in der Fertigung, (2014), No.1, pp.3

Risse, M.; Berky, W.; Friedrich, H.; Köble, T.; Rosenstock, W.; Schumann, O.:
Comparison of analysis results of SNM measurements by means of device implemented automatic analysis routines, FRAM and MGA/MGAU: Paper presented at INMM 55th Annual Meeting 2014, Atlanta (Institute of Nuclear Materials Management (INMM Annual Meeting) <55, 2014, Atlanta/Ga.>), 2014, URN urn:nbn:de:0011-n-3279882

Römer, S.; Baumela, J.; Acuna Benito, A.; Bueno Atance, I.; Burbiel, J.; Criado de Pastors, H.; Lega de Benito, J.; Requejo Morcillo, L.; Salemi, F. C.; Schietke, R.:
Stand-off bio detection – a realistic option?
(Security Research Conference “Future Security” <9, 2014, Berlin>)
In: Thoma, K. (Ed.) et al.: 9th Future Security 2014. Security Research Conference: September 16 – 18, 2014, Berlin; Proceedings. Stuttgart: Fraunhofer Verlag, 2014, pp.625-629

Rosenstock, W.; Köble, T.; Risse, M.; Berky, W.:
Mobile techniques for rapid detection of concealed nuclear material (Symposium on International Safeguards <12, 2014, Vienna>)
In: International Atomic Energy Agency -IAEA-, Wien: Symposium on International Safeguards 2014. Linking strategy, implementation and people: October 20–24, 2014, Vienna, Austria. Wien: IAEA, 2014, Paper 443, pp.8, URN urn:nbn:de:0011-n-3278782

Ruhlig, K.:
Deep Learning
In: Europäische Sicherheit & Technik : ES & T, Vol.63 (2014), No.10, pp.76

Saloot, M. A.; Idris, N.; Aw, A.; Thorleuchter, Dirk:
Twitter corpus creation: The case of a Malay Chat-style-text Corpus (MCC)
In: Digital Scholarship in the Humanities: DSH, (2014), Online First, pp.17, DOI 10.1093/llc/fqu066

Schietke, R.; Pinzger, B.; Werner, T.; Hoffknecht, A.; Teichert, O.; Braun, M.; Schulze, J.:
Influenza pandemic in Germany 2020: Scenarios and action options
In: Fraunhofer Verlag, 2014, Stuttgart, ISBN 3-8396-0703-5 ISBN 978-3-8396-0703-9, URN:nbn:de:0011-n-2871102

Schulte, A.:
Bioinspirierte reversible Haftsysteme
In: Europäische Sicherheit & Technik: ES & T, Vol.63 (2014), No.1, pp.76

Schulte, A.:
Künstliche Spinnenseide
In: Europäische Sicherheit & Technik: ES & T, Vol.63 (2014), No.5, pp.106

Somnath Nag; Purnima Singh; Singh, A.K.; Bürger, A.; Carpenter, M.P.; Chmel, S.; Fallon, P.; Hagemann, G.B.; Herskind, B.; Hübel, H.; Janssens, R.V.F.; Juhasz, K.; Khoo, T. L.; Kondev, F.G.; Korichi, A.; Lauritsen, T.; Nyako, B.M.; Ragnarsson, I.; Rogers, J.; Sletten, G.; Timar, J.; Wilson, A.N.; Zhu, S.:
Revised level structure of 120Te
In: Physical Review. C, Vol.90 (2014), No.3, Art. 037302, DOI 10.1103/PhysRevC.90.037302

Tagarev, T.; Petkov, V.; Frech, I.; Vollmer, M.; Hayes, B.; Birkman, L.; Swart, L. de; Giroud, F.; MacDonagh, P.; Mackin, M.; O’Byrnes, R.; Iarossi, N.; Rebuffi, L.; Tani, K.; Norrby, M.; Mülayim, A. Y.; Politou, N.; Jager, B. de; Eich, F.; Schirrhofer, S.:
D83.11 – CM policy & legislation report, Sofia, Bulgaria, 2014, URN urn:nbn:de:0011-n-3323240

Thorleuchter, D.; Poel, D. van den:
Quantitative cross impact analysis with latent semantic indexing
In: Expert Systems with Applications, Vol.41 (2014), No.2, pp.406-411, DOI 10.1016/j.eswa.2013.07.066, URN urn:nbn:de:0011-n-2643850

Thorleuchter, D.; Poel, D. van den:
Semantic compared cross impact analysis
In: Expert Systems with Applications, Vol.41 (2014), No.7, pp. 3477-3483, DOI 10.1016/j.eswa.2013.10.051, URN urn:nbn:de:0011-n-2777732

Thorleuchter, D.; Scheja, T.; Poel, D. van den:
Semantic weak signal tracing
In: Expert Systems with Applications, Vol.41 (2014), No.11, pp.5009-5016, DOI 10.1016/j.eswa.2014.02.046, URN urn:nbn:de:0011-n-3035121

Thorleuchter, D.; Poel, D. van den:
Using text summarizing to support planning of research and development (World Conference on Information Systems and Technologies (WorldCIST) <2014, Funchal>)
In: Rocha, Á.: New perspectives in information systems and technologies. Vol.1: This book contains a selection of articles from the 2014 World Conference on Information Systems and Technologies (WorldCIST’14), held between the 15th and 18th of April in Funchal, Madeira, Portugal. Cham: Springer International Publishing, 2014. (Advances in Intelligent Systems and Computing 275), pp.23-29, DOI 10.1007/978-3-319-05951-8_3, URN urn:nbn:de:0011-n-3035132

Toccafondo, I.; Brugger, M.; Pasquale, F. di; Guillermain, E.; Kuhnhen, J.:
First steps towards a distributed optical fiber radiation sensing system: Poster presented at ICSO 2014, International Conference on Space Optics, Tenerife, Canary Islands, Spain, October 7–10, 2014, (International Conference on Space Optics (ICSO) <10, 2014, La Caleta/Tenerife>), 2014, URN urn:nbn:de:0011-n-3350637, URN urn:nbn:de:0011-n-335063-13

Vollmer, M.; Frech, I.; Hayes, B.; Lindner, R.; Albrecht, P.; Birkman, L.; Swart, L. de; Tagarev, T.; Ratchev, V.:
D81.1 – SP8 work plan, Euskirchen, 2014, URN urn:nbn:de:0011-n-3282077

Vollmer, M.; Frech, I.; Hayes, B.; Lindner, R.; Albrecht, P.; Birkman, L.; Swart, L. de; Tagarev, T.; Ratchev, V.:
D81.21 – Objectives of SP8, Euskirchen, 2014, URN urn:nbn:de:0011-n-3282083

Vollmer, M.:
Innovative tools in crisis management – Dependency of their success to enhance societal resilience from laws, policies, and institutional structures (International Disaster and Risk Conference (IDRC) <5, 2014, Davos>)
In: Stal, Marc (Ed.): 5th International Disaster and Risk Conference, IDRC 2014. Integrative Risk Management – The role of science, technology and practice: August 24–28, 2014, Davos, Switzerland. Davos, 2014, pp.741-743, URN urn:nbn:de:0011-n-3281412

Weinand, U.:

Entwicklung eines intelligenten Sicherheitsglases mittels FBG (Internationale Wissenschaftliche Konferenz Mittweida (IWKM) <23, 2014, Mittweida>)

In: Hochschule für Technik und Wirtschaft -HTW-, Mittweida: 23. Internationale Wissenschaftliche Konferenz Mittweida, IWKM 2014. Smarte Systeme in Technik und Naturwissenschaften: Lärmschutz in Bezug auf Mobilität und regenerative Energien; November 5–6, 2014, Mittweida. Mittweida, 2014. (Scientific Reports. Journal of the University of Applied Sciences Mittweida 5/2014), pp.3-4, URN urn:nbn:de:0011-n-3180351

Wiemken, U.:

Aspekte einer Kulturgeschichte der Technik: Der Blick zurück Euskirchen: Fraunhofer INT, 2014 (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3323142

Wiemken, U.:

Ethische Aspekte technischer Autonomie Euskirchen: Fraunhofer INT, 2014 (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3325955

Wiemken, U.:

Der horror vakui und das andauernde Elend mit den zwei Kulturen: Was das Nichts und die Entscheidungsfreiheit miteinander zu tun haben, Euskirchen: Fraunhofer INT, 2014 (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3325940

Wiemken, U.:

Die Rolle von Forschung und Technologie für die innere und äußere Sicherheit (Teil 1): Eine historische Reminiszenz Euskirchen: Fraunhofer INT, 2014 (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3323167

Wiemken, U.:

Die Rolle von Forschung und Technologie für die innere und äußere Sicherheit (Teil 2): Neue Konfliktbilder für Zielfindung und Planung, Euskirchen: Fraunhofer INT, 2014, (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3323953

Wiemken, U.:

Die Rolle von Forschung und Technologie für die innere und äußere Sicherheit. Teil 3 und Abschluss: Von der "asymmetrischen Bedrohung" zur "Resymmetrisierung" der globalen Konflikte (auch: Warum wir bei der Außen- und Sicherheitspolitik historisch etwas weiter ausholen müssen) Euskirchen: Fraunhofer INT, 2014, (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3323964

Wiemken, U.:

Technik und ihre Eigendynamik: Anmerkungen zur Freiheit und zur Rolle des Liberalismus, Euskirchen: Fraunhofer INT, 2014 (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3325964

Wiemken, U.:

Über die Technik: Versuch einer Annäherung an den "Geist der Zeit", Euskirchen: Fraunhofer INT, 2014 (Diskurs Technik und gesellschaftlicher Wandel), URN urn:nbn:de:0011-n-3323153

Other Reports

ESA-RAPRO Technical Note 1, Beitrag: Radiation Environment (im Rahmen von NEO-13-073) ESA-FAIRter

Personalia

Masterthesis (at Fraunhofer INT): "Neutronendetektion mit Bor-10 als feste Konvertierungsschicht: Ein Vergleich mit Helium-3 Zählrohren", Thomas Brall, course Applied Physics of the Fachhochschule Koblenz, RheinAhrCampus Remagen

Bachelorthesis, Susanne Kastenholz, Detektion von HPM-Wellen, FH Aachen University of Applied Science, 2014

Masterthesis, Marian Lanzrath, "Untersuchung der Verwundbarkeit des Intelligenten Stromnetzes durch Beeinflussung von elektronischen Systemkomponenten mittels elektromagnetischer Hochfrequenzfelder hoher Leistung, "Cologne University of Applied Sciences", 2014

Practice project Sarah Wolffs: "Identifikation und Quantifizierung von Einflussgrößen auf die Lichttransmission in Lichtwellenleiterwicklungen"

Co-Supervision Promotion by Iacopo Toccafondo, CERN

Completion of studies meteorology, Renata Blab

Other Events

February 3–5, 2014

Exhibition booth: DWT Konferenz “Angewandte Forschung für Verteidigung und Sicherheit in Deutschland”, Berlin

April 8–9, 2014

VG-Normensitzung “NEMP- und Blitzschutz”, Fraunhofer INT, Euskirchen

May 20–25, 2014

Exhibition booth: ILA, Berlin

June 16–20, 2014

Berky, W., Chmel, S., Glabian, J.; Friedrich, H., Köble, T., Risse, M., Rosenstock, W., Schumann, O.:

Durchführung einer Messkampagne für die Suche und Identifikation von radioaktivem Material und Organisation eines Besuchertages auf dem Außengelände des Instituts der Feuerwehr NRW, Münster

July 14–18, 2014

Exhibition booth: NSREC 2014, Paris, France

September 9–10, 2014

Exhibition booth: DWT Forum Weltraum, Bonn

October 7–10, 2014

Exhibition booth: International Conference on Space Optics, Tenerife, Spain

October 28, 2014

Höffgen, S., Metzger, S., Steffens, M.:

Organisation Expertenmeeting zum ESA-FAIR Projekt: ESA-ESTEC Noordwijk, the Netherlands

October 30, 2014

Pastuszka, H.-M.:

Standards: Your innovation bridge, European Conference, Panel Discussion in Breakout Session 5 ‘Strategic Decisions’, Brussels, Belgium

November 10–12, 2014

Römer, S., Pastuszka, H.-M., Neupert, U., Thorleuchter, D.: Wirkmittelanalyse mit der Methode Assessment Game, Workshop-Durchführung im Rahmen der Future Study 2014, Planungsamt der Bundeswehr (PlgABw), Berlin

November 20, 2014

Grigoleit, S., Pastuszka, H.-M.:

FP7-SEC-Projekt ETTIS, Durchführung des High-Level Events, Brussels, Belgium

Press Releases

New Study: “Pandemische Influenza in Deutschland 2020”, Fraunhofer INT, 1/7/2014

<http://www.int.fraunhofer.de/content/dam/int/de/documents/Pressemeldungen/Pandemische%20Influenza.pdf>

Workshop für Unternehmer zum Thema “Industrie 4.0”, Fraunhofer INT, 10/14/2014

http://www.int.fraunhofer.de/content/dam/int/de/documents/Pressemeldungen/PI_Industrie_4-0.pdf

EU-Project DRIVER: “Neue Ansätze für das europäische Krisenmanagement testen und etablieren”, Fraunhofer INT, 11/6/2014

<http://www.int.fraunhofer.de/content/dam/int/de/documents/Pressemeldungen/Driver.pdf>

Institute Course

Grypstra, K. (MPIfR Bonn):

Der Radiohimmel über Effelsberg, Euskirchen, 1/8/2014

Engelbach, W. (Fraunhofer IAO Stuttgart):

Ergebnisse des FP7 CRISMA Projekts, Euskirchen, 1/15/2014

Steinmüller, K. (Z_punkt GmbH, Berlin):

Foresight in Europa – Geschichte und Perspektiven, Euskirchen, 1/22/2014

Dermühl, K. (BIOLAB Technology Deutschland GmbH, Berlin): Human Enhancement, Euskirchen, 1/29/2014

Hinkenjann, A. (Hochschule Bonn-Rhein-Sieg):

Der Widerspenstigen Zähmung: Bessere Computergrafik mit GPUs, Euskirchen, 2/5/2014

Bauckhage, C. (Fraunhofer IAIS Sankt Augustin):

Collective Attention on the Web, Euskirchen, 2/26/2014

Gericke, W. (Fraunhofer INT Euskirchen):

Informationssicherheit, nur ein Wust von Gesetzen, Vorschriften, Normen und Empfehlungen?, Euskirchen, 3/19/2014

Blab, R. (Fraunhofer INT Euskirchen):

Feuchtemessungen in der Atmosphäre, Euskirchen, 4/2/2014

Suwelack, K.-U. (Fraunhofer INT Euskirchen):

Die Entwicklung der Biogas-Erzeugung und Nutzung in Deutschland, Euskirchen, 5/7/2014

Bierwisch, A. (Fraunhofer ISI Karlsruhe):

“Grand Challenges” und integrierter Foresightansatz zur Technologiebewertung, Euskirchen, 5/14/2014

Missoweit, M. (Fraunhofer INT Euskirchen): DRIVER – Driving InnoVation in crisis management for European Resilience, Euskirchen, 5/21/2014

Ritter-Dausend, D. (Ministerium für Inneres und Kommunales des Landes NRW): Wirtschaftsspionage – Ihre Unternehmensdaten im Visier fremder Nachrichtendienste, Euskirchen, 5/28/2014

Vollmer, M. (Fraunhofer INT Euskirchen): United Nations University – Vulnerabilitätsabschätzungen gegenüber Naturgefahren, Euskirchen, 6/11/2014

Pusch, T. (Fraunhofer INT Euskirchen): "Nutzung von Hohlraumresonanzen zur Bestimmung von Strahleigenschaften an einem Teilchenbeschleuniger", Euskirchen, 6/25/2014

Reith, D. (Hochschule Bonn-Rhein-Sieg): Multiskalen-Simulationen in Naturwissenschaft und Technik: Methoden – Anwendungen – Nutzen, Euskirchen, 8/27/2014

Hellerforth, M. (Anwalt und Executive Advisor für Sicherheitspolitik): Operation SERVAL, Operation SANGARIS – Hintergründe der frz. Einsätze in Afrika, Euskirchen, 9/3/2014

Römer, S. (Fraunhofer INT Euskirchen): Ferndetektion biologischer Agenzien – eine realistische Perspektive?, Euskirchen, 9/10/2014

Grüger, H. (Fraunhofer IPMS Dresden): MEMS basierte Spektroskopiesysteme zur Analyse organischer Verbindungen, Euskirchen, 10/22/2014

Risse, M. (Fraunhofer INT Euskirchen): Messkampagne für die Suche und Identifikation von radioaktivem Material im Juni 2014 auf dem Außengelände des Instituts der Feuerwehr NRW in Münster, Euskirchen, 11/19/2014

Albrecht, T. (Planungsamt der Bundeswehr): Missionsmodule im maritimen Umfeld, Euskirchen, 12/3/2014

Grüne, M. (Fraunhofer INT Euskirchen): "Multiperspektivische Zukunftsanalyse im Rahmen des deutschen Verteidigungs-Innovationssystems", Euskirchen, 12/10/2014

BUSINESS UNITS AND CONTACTS



DIRECTOR'S OFFICE

Director

Prof. Dr. Dr. Michael Lauster

Phone +49 2251 18-117/-217

Fax +49 2251 18-327

michael.lauster@int.fraunhofer.de

Vice Director

Dr. Stefan Metzger

Phone +49 2251 18-214

stefan.metzger@int.fraunhofer.de

Commercial Director

Prof. Dr. Harald Wirtz

Phone +49 2251 18-237

harald.wirtz@int.fraunhofer.de



BUSINESS UNIT

DEFENSE TECHNOLOGY
FORESIGHT

Hans-Martin Pastuszka
Phone +49 2251 18-298
hans-martin.pastuszka@int.fraunhofer.de

Dr. Ulrik Neupert
Phone +49 2251 18-224
ulrik.neupert@int.fraunhofer.de

BUSINESS UNIT

CORPORATE TECHNOLOGY
FORESIGHT

Dr. Martin Brüchert
Phone +49 2251 18-229
martin.bruechert@int.fraunhofer.de

Kay Uwe Suwelack
Phone +49 2251 18-340
kay.uwe.suwelack@int.fraunhofer.de

BUSINESS UNIT

NUCLEAR SECURITY POLICY
AND DETECTION TECHNIQUES

Dr. Theo Köble
Phone +49 2251 18-271
theo.koeble@int.fraunhofer.de

Dr. Monika Risse
Phone +49 2251 18-253
monika.risse@int.fraunhofer.de

BUSINESS UNIT

NUCLEAR EFFECTS IN ELECTRONIC
AND OPTICS

Dr. Jochen Kuhnhenh
Phone +49 2251 18-200
jochen.kuhnhenh@int.fraunhofer.de

Dr. Stefan Höffgen
Phone +49 2251 18-301
stefan.hoeffgen@int.fraunhofer.de

BUSINESS UNIT

INTERNATIONAL RESEARCH
AND TECHNOLOGY MANAGEMENT

Dr. Merle Missoweit
Phone +49 2251 18-315
merle.missoweit@int.fraunhofer.de

Dr. Miloš Jovanović
Phone +49 2251 18-265
milos.jovanovic@int.fraunhofer.de

BUSINESS UNIT

TECHNOLOGY TRENDS
AND STRATEGIES

Dr. Claudia Notthoff
Phone +49 2251 18-288
claudia.notthoff@int.fraunhofer.de

Dr. Anna Julia Schulte
Phone +49 2251 18-379
anna.schulte@int.fraunhofer.de

BUSINESS UNIT

ELEKTROMAGNETIC EFFECTS
AND THREATS

Dr. Michael Suhrke
Phone +49 2251 18-302
michael.suhrke@int.fraunhofer.de

Michael Jöster
Phone +49 2251 18-258
michael.joester@int.fraunhofer.de

FURTHER CONTACTS

Marketing and Public Relations

Thomas Loosen
Phone +49 2251 18-308
thomas.loosen@int.fraunhofer.de

Library and Specialized Information Services

Siegrid Hecht-Veenhuis
Phone +49 2251 18-233
siegrid.hecht-veenhuis@int.fraunhofer.de

Staff Position Methods and Training

Dr. Birgit Weimert
Phone +49 2251 18-307
birgit.weimert@int.fraunhofer.de

Central Infrastructure

Udo Rector
Phone +49 2251 18-270
udo.rector@int.fraunhofer.de

BUSINESS UNIT

PUBLIC RESEARCH
AND TECHNOLOGY MANAGEMENT

Dr. Joachim Burbiel
Phone +49 2251 18-213
joachim.burbiel@int.fraunhofer.de

Dr. Silke Römer
Phone +49 2251 18-313
silke.roemer@int.fraunhofer.de

HOW TO REACH US

By road

Autobahn A1: leave at exit 110 "Euskirchen"; or
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:

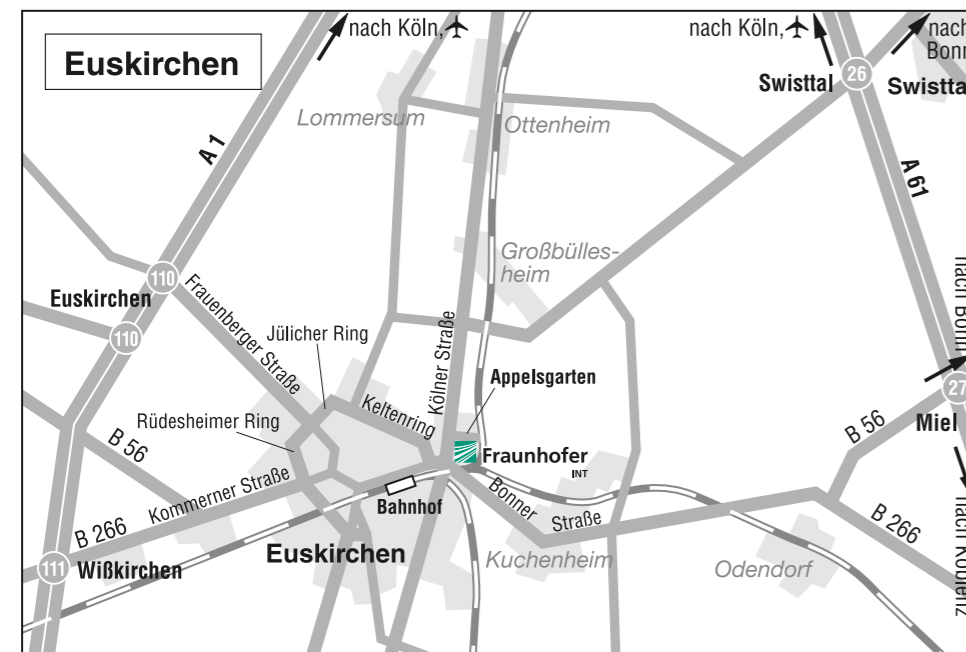
Bonn Hauptbahnhof and Cologne Hauptbahnhof.
Regular rail connections between Bonn or Cologne Main
Stations (Hauptbahnhof) and Euskirchen;
from Euskirchen Station, Bus No 875 in direction "Großbüllesheim";
or Bus No 806 in direction "Fronhof" to "Appelsgarten"

Fraunhofer Institute for Technological Trend Analysis INT

Appelsgarten 2
53879 Euskirchen

Phone +49 2251 18-0
Fax +49 2251 18-277

info@int.fraunhofer.de
www.int.fraunhofer.de



PUBLISHING DETAILS

Editor

Thomas Loosen

Design, Realisation, Production

Konzeptbüro Horst Schneider, Ertstadt

Picture Credits

Michael Pasternak, Frankfurt
Peter Reid, Edinburgh
Sandra Diederhagen, Cologne
Österreichisches Rotes Kreuz, Vienna
Dagmar Grömping, Bad Münstereifel

Printing

Fraunhofer Verlag,
Fraunhofer-Informationszentrum Raum und Bau IRB

Editor's Address

Fraunhofer-Gesellschaft
Presse- und Öffentlichkeitsarbeit
Appelsgarten 2
53879 Euskirchen

Phone +49 2251 18-0
Fax +49 2251 18-277

Reproduction of this publication requires the permission
of the Editors.

© Fraunhofer-Gesellschaft, Euskirchen 2015

General inquiries via Email to:
thomas.loosen@int.fraunhofer.de