

# JRC



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**Institute for the Protection  
and Security of the Citizen**

## ANNUAL REPORT 2007

Joint Research Centre • Institute for the Protection and Security of the Citizen • Annual Report 2007

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The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.



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### IPSC Mission

The mission of the IPSC is to provide research results and to support EU policy-makers in their effort towards global security and towards protection of European citizens from accidents, deliberate attacks, fraud and illegal actions against EU policies.

### European Commission

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### Abstract

The annual report of the Institute for the Protection and Security of the Citizen highlights the major achievements and resources related to its work during 2007. An overview is given of IPSC mission and its implementation, the scientific activities and the relations with the outside world.

ANNUAL REPORT  
2007

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JRC

Institute for the Protection  
and Security of the Citizen

POLICY AREA  
**1. PROSPERITY IN A KNOWLEDGE  
INTENSIVE SOCIETY**

POLICY AREA  
**2. SOLIDARITY AND THE RESPONSIBLE  
MANAGEMENT OF RESOURCES**

POLICY AREA  
**3. SECURITY AND FREEDOM**

POLICY AREA  
**4. EUROPE AS A WORLD PARTNER**

POLICY AREA  
**5. EURATOM**

**European Commission**  
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\* The IPSC Annual Report is structured according to the JRC Multiannual Workprogramme 2007-2013, composed by "Policy areas" and "Agendas". The present report covers only those agendas under which IPSC's actions are carried out.



## Message from the Director

Dear Reader,

In 2007, the Institute for the Protection and Security of the Citizen had another very successful year, intensifying the good relationships with the client Directorates-General from the European Commission by a substantial number of cooperation projects and even strengthening its excellent competitive research position in the transition period from the Sixth Framework Programme (FP6) to FP7. The Institute's results are backed up by a large variety of research activities that provide a solid scientific basis.

It is worth mentioning that the strong IPSC position is based on the highly motivated work of every single staff member, and was accomplished mainly under the acting directorship of Dr. Alois Sieber, to whom I owe special thanks as he was heading the Institute from December 2006 to the end of October 2007.

As you will see in the Annual Report, the Institute has covered a wide variety of different research topics and has supported the European Commission on numerous policy support matters in the areas of protection and security. IPSC researchers therefore have deployed a multitude of technologies, ranging from econometric calculations and numerical simulations to tangible test laboratories, from remote sensing to nuclear safety training, from risk and vulnerability assessment to open source data analysis.

The 2007 IPSC results have provided valuable support to the creation of European policies and have attracted significant attention at research conferences, in scientific expert journals and also in the press. On the other hand, the wide variety of IPSC activities and its strong position in policy support also mean a challenge for the definition of a future IPSC focus and balance, but this will be a matter for 2008.

The IPSC 2007 Annual Report shall give the interested reader a good overview of the Institute's activities, but cannot really be considered a comprehensive documentation of a full year's work involving more than 400 IPSC researchers. In the report, the large variety of IPSC topics is structured along the lines of the JRC's Multiannual Workprogramme 2007-2013.

I wish you a pleasant and informative read!

*Stephan Lechner*

## Work structure

The JRC's activities are mainly financed as "direct actions" by the Framework Programme for Research and Technological Development and the Framework Programme of the European Atomic Energy Community (EURATOM). The JRC can also participate in projects funded as "indirect actions" of the above mentioned Framework Programmes.

The Seventh Framework Programme (FP7) will cover the period 2007-2013, while the EURATOM Framework Programme will cover the period 2007-2011.

The current work of the JRC is based on the Multiannual Workprogramme 2007-2013, which is organised into five policy areas:

1. Prosperity in a Knowledge Intensive Society.
2. Solidarity and the Responsible Management of Resources
3. Security and Freedom
4. Europe as a World Partner
5. the EURATOM Programme

Each policy area is in turn divided into "agendas" and "sub-agendas". Each sub-agenda is carried out by means of one or more "actions" across the seven JRC institutes.

This report presents the main achievements and future challenges of the actions carried out in 2007 at the Institute for the Protection and Security of the Citizen, according to the thematic structure of the JRC Multiannual Workprogramme 2007-2013.

In 2007, the JRC-IPSC's workprogramme comprised 29 actions, distributed over all the 5 policy areas.

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# 1



## Prosperity in a Knowledge Intensive Society

A key objective of the FP7 is to maximize the leverage of investments in research to stimulate the competitiveness of the European economy. The JRC's FP7 portfolio will include a broad range of items which contribute to this overarching objective. Elements such as fostering research and innovation, developing a culture of excellence, establishing standards, improving market transparency, setting up of appropriate regulatory context, anticipating critical issues affecting society and designing sustainable management practices in a broad range of economic activities fall into that category of activities which feed the knowledge society.

The activities of the JRC undertaken in the five policy agendas described in Policy Area 1 cover critical areas of the Union's life and contain potential developments which will affect the citizen for years to come. R&D support to the knowledge society must keep pace with those developments. The JRC research agenda will adapt to the changing context driven by the political evolution of the Union itself, by an ever increasing globalisation of the economy, by continuous and sometimes unpredictable impacts of new technologies and by a growing concern for health and security.



## 1.1 Competitiveness and Innovation

### Econometrics

This Agenda addresses the growing demand for the development of Commission in-house capacity to operate advanced econometric modelling and sensitivity analyses in a wide range of policy fields. Priority has been given to the financial, internal market and fiscal policies, as well as education policy. A focus on the development, evaluation and use of composite indicators is maintained as these indicators experience recurring acceptance problems at the EC service level and in Member States. Associated with this agenda is an activity responding to the emerging demand for a better understanding of the relationship between the needs of the knowledge society and the provision of education. Of particular relevance is the common evaluation of the efficiency of investments in education in Member States.

### Indicators and intelligence for the knowledge society

This area covers a range of research and monitoring activities dedicated to the Lisbon Agenda in terms of indicators and scoreboards, demographics of skilled manpower, as well as process and conditions for stimulating industrial innovation. It will provide guidance on the development of research policy items, on the Lisbon agenda, on stimulating the knowledge society objectives, and on improving employment in advanced and innovative sectors of the European economy.

### Data harmonization

The competitiveness of European economy also benefits from increased access to harmonised information and interoperable services related to the reporting on items of community policy relevance. The JRC will contribute to the data and information management for Global Monitoring for Environment and Security initiative (GMES) including the procurement of community satellite data sets for a broad range of uses.

EEMC, FINECON, QSI,  
STATIND, CID

## 1.3 Energy and Transport

Sustainable transport relates to environment quality, mobility, competitiveness, single market and innovation. The JRC will follow safety issues related to air transport and will develop methods and supporting technologies for assessing vulnerability of transport systems to unintended and malintended acts.

ECCAIRS, VATDIS

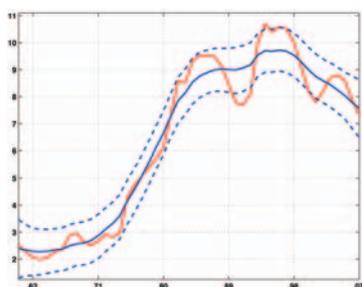


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*EC Berlaymont Building during 2007 Council Spring Meeting.*



*EU12 Non Accelerating Rate of Unemployment.*

## Euro Area Economy Modelling Centre (EEMC)

Monetary policy is decided at EU12 level and fiscal policies are co-ordinated through the Council's committee "Economic and Financial Affairs" (ECOFIN) following the rules of the Stability and Growth Pact. In 2004 the European Union went through an unprecedented enlargement with the accession of 10 former planned economies. Despite these achievements in socio-economic and political integration, the Union is facing a fairly difficult period in its economic history. The ageing population trend is on the one side generating stress on pension systems, Member States budgets and, indirectly, on financial markets. On the other hand, it calls for reforms of labour market regulations, aimed at reducing unemployment and at increasing the participation rate. International competition from the US and Far-East Countries calls for productivity enhancing policies, to keep up a comparable growth pace. The present Commission adopted the 'Partnership for Growth and Jobs' blueprint to re-launch and re-focus the Lisbon Strategy that gained full support from the 2005 Spring European Council. Following this decision, the European Commission adopted a new 3-year "Integrated Guidelines Package" (IGP) for 2005 to 2008, designed to spur growth and jobs in Europe. The IGP prioritises a number of goals, reforms areas and monitoring schemes listed in 4 main themes:

1. Macroeconomic policies for growth and jobs
2. Ensuring a dynamic and well-functioning Euro area
3. Microeconomic reforms to raise the EU's growth potential
4. New Employment Guidelines for more and better jobs

Each of these themes requires adequate economic analysis as well as up to date monitoring tools. To provide sound methodological support, the Euro-area Economy Modelling Centre (EEMC) was created in 2007, upon request of the Directorate General for Economic and Financial Affairs (DG ECFIN).

The activities of the Euro-Area Modelling Centre focus on providing methodological and technical support to EU macroeconomic policy coordination tasks. With its expertise in econometrics, statistics, time series analysis, EEMC supports the Commission and Member States bodies with three main areas of activity, which are directly linked to themes 1 and 2 of the IGP:

- Macroeconomic models estimation and model screening.
- Short-term economic analysis, with focus on output gap and Non-Inflation-Accelerating-Rate of Unemployment (NAIRU).
- Econometric training

The ordinary activities of EEMC feed as input to the EU2007 review, one of the main economic policy yearly documents issued by the Commission. The software "GAP", developed by EEMC, which provides an estimate of the Non-Inflation-Accelerating-Rate of Unemployment (NAIRU) is used by DG ECFIN and Member States Ministries of Economics in their forecasting activities.

## Major 2007 achievements

The second course of “Global Sensitivity Analysis for Macroeconomic Models” was held in Ispra on 12-13 April 2007. The course was attended by 30 participants mainly from Member States Central Banks and Ministries of Finance, but it also attracted officers from the Central Banks of Canada, Indonesia and Brasil. The course gave an introductory to the sensitivity analysis methodologies developed at EEMC and coded in DYNARE 4.0 MatLab Tool Box and the state of art modelling environment of macroeconomic modelling. Between 16 and 19 April the routines were downloaded from the EEMC site by 106 registered users, mainly from the organisations of the participants. EEMC staff was invited by the Bank of Italy and the Bank of Brazil to start up a co-operation in macroeconomic modelling.

On 29-30 May 2007 the first course on Dynamic Stochastic General Equilibrium (DSGE) Models Estimation took place in Brussels at the DG ECFIN premises. The course provided to DG ECFIN staff an introductory to the Bayesian estimation of DSGE models. The course was meant for DG ECFIN econometricians/economists, but it was opened up to other DGs.

In autumn 2007, EEMC was invited by DG ECFIN to be part of the Commission representative on the Council’s Economic Policy Committee meeting of the Lisbon Methodology Working Group. The scope of the working group, formed by the Commission, the European Central Bank and representatives of Member States’ Economic Ministries, is to coordinate the development of appraisal methodologies for structural reforms. EEMC was invited because of its competencies in macroeconomic modelling. Following the meeting, EEMC was granted a two-year project; the scope being the calibration of a structural macroeconomic model for each of the 27 Member States.

## Challenges for the future

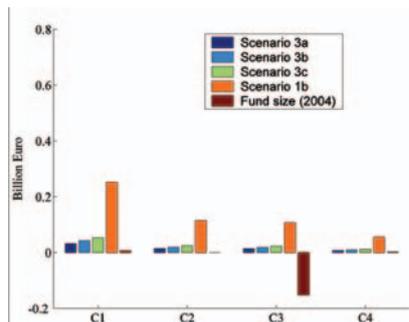
EEMC will continue its methodological support to DG ECFIN and the Economic Policy Committee. The challenge for the near future will be the development of adequate algorithms to handle the estimation of large scale macroeconomic models.



*ECOFIN Council Spring Meeting 2007.*

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*Impact of changing the funding of deposit protection systems (for DG Internal Market) – sample of four EU schemes.*

## Financial Econometrics for a Single Market and Competitiveness Policies (FINECON)

The Single European Market stands for ‘free movement’ of people, goods, services and capital. This means the possibility for EU citizens to live, work, and do business throughout the EU as well as to enjoy a wide choice of competitively priced goods and services. Competition policy is also a key element of a well functioning economy. It is essential to make sure that companies compete with each other and, in order to sell their products, innovate and offer good prices to consumers.

Achieving a Single Market and ensuring that competition in the EU market is not distorted, thereby contributing to the welfare of consumers and to the competitiveness of the European economy, are among the key objectives of the European Commission, time and again reconfirmed within the Lisbon process and its periodic revision.

With its expertise in financial modelling, econometrics, and statistics, FINECON supports Internal Market policies of the European Union with focus on consumers’ protection, market access, enhanced transparency, and single market efficiency.

### Major 2007 achievements

#### Enhancing the efficiency of the EU Deposit Protection Systems

Directive 94/19/EC on Deposit Guarantee Schemes provides a safety net for citizens holding a bank deposit, so that, if a credit institution fails, they will recover at least part of their bank deposits.

The Directive was subject to a review by the European Commission between 2004 and 2006 and it ended up with a Communication identifying a number of improvements that the EU banking industry could introduce by ‘self-regulatory’ means. FINECON played a central role in the review process, performing all quantitative analysis which fed into the Communication. As a follow-up to this Communication, FINECON was asked to investigate the efficiency of the current systems in facing potential financial crises, and to analyse risk-based models to adjust deposit insurance premiums.

In 2007 FINECON prepared and distributed a survey to collect data among EU deposit protection schemes and built a dataset for future analyses. Moreover, FINECON analyzed available approaches to adjust deposit insurance premiums to account for the risk the credit institutions are exposed to.

#### The macro-economic impact assessment of the new Solvency II Directive

Recently, the European Commission proposed a ground-breaking revision of EU prudential insurance law designed to improve consumer protection, modernise supervision and deepen market integration. Under the new system, insurers will be required to take account of all types of risk to which they are exposed and to manage those risks more effectively. In particular, capital requirements will be influenced by risk exposure and risk measure. FINECON is in charge of evaluating the impact of changing capital requirements for insurance undertakings on the EU macro-economic scenario. In 2007 FINECON developed a model to estimate this impact which consists of two parts: the first focuses on changes in the equity risk premia, assessed via a satellite model; the second uses the Quest model

(developed by the Directorate General for Economic and Financial Affairs (DG ECFIN) and JRC-IPSC) to estimate the impact on the EU economy.

### Post-Trading Activities

The European Commission has been trying to remove the so-called Giovannini Barriers, which prevent the efficient provision of cross-border post-trading services, often referred to as “clearing and settlement”. The “Code of Conduct” proposed by the European Commission demanded from the industry in 2006 to enhance price transparency, ensure rights of access, and provide unbundled services.

In 2007, the Directorate General for Internal Market and Services (DG MARKT) and FINECON have been jointly monitoring and evaluating the progress on the removal of the persisting Giovannini barriers.

### Monitoring sectors activities to enhance the single market functioning

Since the European Commission launched the Internal Market initiative in 1985, the single market has come a long way to achieve the declared aim of free movement of people, goods, services and capital. However, the internal market is still incomplete in several areas, as barriers continue to hinder cross-border activities within the EU. The removal of these barriers is crucial to promote integration and competition within the European economy. In order to identify and eliminate the residual barriers in all sectors and areas of activities, there is a need of accurate monitoring the single market performance.

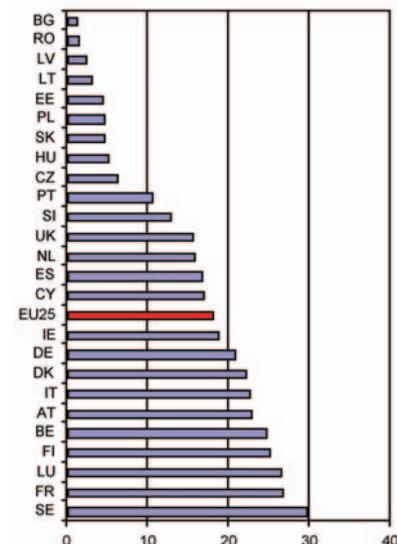
Towards this end, the DG Internal Market requested FINECON cooperation in the creation and population of an indicators’ based monitoring system which will allow exploiting in a systematic and consolidated manner the information already gathered in many areas. In 2007 FINECON worked in close cooperation with DG MARKT’s experts in order to identify all available sources of data and elaborate a monitoring template. The data collected were then processed and compiled in the template, so that it would be possible to identify information gaps and start assessing solutions to fill them in. A general report and 11 individual reports covering the sectors and issues analysed in detail were published.

### Challenges for the future

In 2008 FINECON will continue supporting DG MARKT in the above-mentioned projects. In particular, for the project on deposit protection schemes, FINECON will perform a scenario analysis of the impact of possible financial crises on the current depositors’ safety net. Moreover FINECON will propose some risk-based models to adjust deposit protection premium, which might be later introduced across the EU Member States on a voluntary basis.

For the Solvency II project, FINECON is in charge of delivering during 2008 the results of the quantitative macro-economic impact assessment, which will be part of the final impact assessment needed for the adoption of the Solvency II Directive.

Furthermore, FINECON is developing a methodology to identify and quantify obstacles within and between EU countries which impede the completion of a fully functional market for the retail sector.



*Labour Cost per Employee (Unit Labour Cost) in the Retail trade sector for 2003 (for DG Internal Market).*

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**Pedegree of knowledge**

Assessing the pedigree of knowledge generates insight in the many assumptions and choices that inevitably have to be made during the production process of science-for-policy. It can lead to discerning options for more robust knowledge and to a negotiated management of policy issues characterised by high stakes, value laden positions and disputed knowledge claims.

**b-involved**

The b-involved platform (<http://b-involved.jrc.it>) is a free non-intrusive Internet based platform that allows a small group of people to meet, at a virtual round table and discuss a pre-defined subject or topic. It is particularly useful when public debates take place among participants that live far away from each others.

## Quality of Scientific Information in the EU Policy Processes (QSI)

Policy development in the European Union has to be based on robust knowledge. In particular, when scientific advice is needed, we have to ensure its quality. That is to say, that not only it should be of high scientific quality and reliability but it also has to be robust from the society points of view.

The QSI action develops, tests and deploys guidelines and tools for quality assessment of policy relevant scientific information. The areas of policy where QSI has operated so far are: water governance, climate change, sustainability, health and education. Such guidelines and tools focus on the one hand on the management and expression of uncertainty and, on the other, on the communication of complex and sensitive issues in the context of policy making and societal engagement in policy making. This encompasses the development of tools based on new Information and Communication Technologies (ICT) to foster public dialogue on policy relevant science.



### Major 2007 achievements

**Quality Assurance and Uncertainty Management of Policy relevant Science**  
 QSI has further developed and applied the “pedegree methodology”, a tool for discussing and communicating uncertainty in policy relevant knowledge.

In its programme on integrating social science in nuclear research, the Belgian Nuclear Research Centre (SCK-CEN) used the pedigree methodology to assess external cost studies of nuclear energy.

Based on the concept of pedigree, QSI delivered the protocol for a workshop involving scientists, stakeholders and policymakers, during which crucial assumptions in the calculation chain of external costs were qualified.

The workshop led to insight in how to better communicate external cost results and how to make them more meaningful to stakeholders.

In general, it contributed to conveying a more adequate image about the role that this type of valuation assessment can play in policy discussions.

### Fostering Public Engagement in Policy making

Be Involved! It is just not a slogan for citizenry to get engaged with policy making processes, but also an e-participation tool developed by QSI. The e-participation concept implies the use of ICT that can facilitate the implementation of public engagement in decision and policy making. This platform was launched late in 2007 and since then has gathered enormous attention from researchers around the world. Collaborative tools beyond conversation are currently being developed and will be available during 2008.

### Public Information and Policy Support Portal

This portal has been developed within the ACCENT Network of Excellence, which is a network of atmosphere scientists. During this year the “Urbino Dialogue 07” was set up to discuss what it means to set up a dialogue with society, and to involve different players such as policy-makers and the general public as participants and contributors in ACCENT’s research activities.  
<http://kam.jrc.it/blog/accent>.

### mobGAS™ – Knowing your contribution to Climate Change

In November 2007 QSI launched a new application to support the EC efforts on raising awareness of individual contributions to the emissions of Greenhouse Gases (GHG) and therefore to the broader problematic of climate change. It is called mobGAS™! It is a software application for mobile phones, allowing users to have easy and fast access to their personal GHG at any time of the day. mobGAS™ was received with enthusiasm all over the world, thousands of people using it within a month of its launch supported by notable press coverage. The importance of the individual action to fight climate change is well entrenched in the policies of the EU as, for instance, demonstrated by the setting up of the campaign, “You Control Climate Change” launched by President José Manuel Barroso and Environment Commissioner Stavros Dimas in 2006.

### ICT for Lifelong Learning

QSI participated in the European “Advisory Board of the European Indicator of Language Competence” defining the parameters and instruments needed for carrying out a large-scale survey on Foreign Language skills of pupils in European school education. Emphasis of our contributions was given to investigating the role of computer technologies for skills assessment (“eTesting”) and to explore the potentials of Open Source software tools for such measurements. A survey on existing assessment products was carried out and quality criteria were defined for the selection of tools and the implementation of eTesting activities.

### 2007 key outreach moments

- Strengthening the relations between Serbia and Europe in the area of policy related knowledge was one of the objectives of the 3rd edition of KAM Fall School, which presented state-of-the-art tools and methods to assess policy related knowledge in decision-making processes.
- Communication of Science to Non-Scientists, 2nd edition 3 days course, under the ACCENT Network of Excellence.

### Challenges for the future

QSI will look for research partnerships with several institutions to deploy mobGAS in order to verify how mobGAS type of tools influence behaviours and choices. Moreover, the action will develop collaborative tools for b-involved and will make it available to DG policies. Within a competitive project QSI will work on public perceptions of security as portrayed by the media. Another area of work for the future is the enhancement of the culture of “beyond risk assessments”, demonstrating QSI’s pedigree assessments in emerging technologies.

#### mobGAS™

mobGAS™ [<http://mobgas.jrc.it>] aims to make the connection between daily activities and the emissions of Green House Gases (GHG) and when possible suggest changes to improve individual performances. The project is the result of years of research at the JRC-IPSC and built upon previous experiences such as VGAS© [<http://kam.jrc.it/vgas>].



#### European Indicator of Language Competence

The “European Indicator of Language Competence” dates back to the Barcelona European Council decision of March 2002 to call for the establishment of a linguistic competence indicator. The purpose is to provide hard data for analysis and comparisons which are needed by Member States in order to reflect and (if needed) adjust their approach to foreign language teaching and learning.

# STATIND

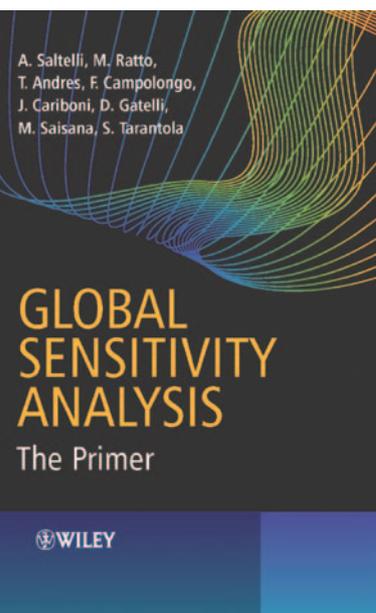
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## Sensitivity Analysis

In June 2007, the JRC-IPSC organized in Budapest, jointly with the Eotvos University, the Fifth Conference on Sensitivity Analysis of Model Output (SAMO). About 70 users of sensitivity analysis in different disciplines of science from all over the world attended the conference. JRC-IPSC staffs presented in total seven papers.

A few months later, the new book on sensitivity analysis by Saltelli, et al. - Global Sensitivity Analysis. The Primer, was published by John Wiley & Sons.



## Indicators and Benchmarks for Education, Innovation and the Knowledge Economy (STATIND)

STATIND action has contributed to the conception, development and assessment of indicators needed to benchmark progresses of Member States in a variety of policy fields connected to the Lisbon agenda, specifically education, innovation and knowledge economy. The action has contributed to this effort with its competencies on statistics, modelling and sensitivity analysis. STATIND is divided into three main lines of activity in:

- indicators,
- sensitivity analysis,
- CRELL (Centre for Research on Education and Life-long Learning).

### Major 2007 achievements

#### Contribution to the i2010 Annual Report of DG INFSO

In support to the Directorate General for Information Society and Media (DG INFSO), an econometric study was performed to investigate for which industrial sectors and for which countries Information Communication Technology (ICT) investments are drivers of productivity growth. The results were published in January 2007.

#### Support to Enterprise and Industry policy

In 2007 STATIND continued the collaboration with the Directorate General for Enterprise and Industry (DG ENTR) by offering its expertise in the development of indicators in the fields of innovation and e-business readiness. In particular:

- Co-authored with the Maastricht Research Economic Institute (MERIT) the 2006 edition of the European Innovation Scoreboard and produced an accompanying report on strengths and weaknesses, which has been used as a memo in the press release to provide a synopsis of the innovation performance of the different Member States.
- Hosted the second INNO-views Workshop on “Metrics to better understand innovation performance: New approaches to measuring innovation” that took place in Ispra on 5th and 6th of July 2007. Around 40 participants from different research institutes specialised in research on innovation have participated in the event. The European institutions were represented by JRC-IPSC, JRC-IPTS, DG ENTR and the European Patent Office.
- Carried out a methodological analysis on the European e-business readiness index, and delivered to DG ENTR a report on the 2007 e-business readiness composite indicators, calculated from the Eurostat Enterprise Survey 2006<sup>1</sup>.

#### Key Figures 2007 on Science, Technology and Innovation

STATIND contributed to the Key Figures 2007 Report of the Directorate General for Research (DG RTD) with the computation and the analysis of high-tech trade indicators for all the industrial sectors in European and BRICK countries (Brazil, Russia, India, China, Korea) in the period 1999-2005. The results show that Europe’s world market exports of high-tech products is stable while US declines. Moreover, Europe is leader of exports in the pharmaceutical sector.

1. <http://ec.europa.eu/enterprise/ict/policy/ebi/ebi-2006-report.doc>

### Knowledge Economy Indicators (KEI)

During the fifth workshop on Knowledge Economy Indicators, organised in Brussels in November 2007, STATIND presented the final results of the KEI project to selected experts from the European Commission and the academia. A composite indicator that measures the European side of the Knowledge Economy was the key achievement of the project. The JRC-IPSC team was invited to disseminate the results of the project to the officials of the Organization for Economic Cooperation and Development (OECD) who are involved in the development and analysis of indicators on Science, Technology and Innovation.

### Support to Education and Culture policy

The Centre for Research on Education and Life-long Learning (CRELL) has developed a composite measure of Active Citizenship for European countries based on 63 indicators organised in 4 pillars: political life, community, values, and civil society. The results of this research project are presented in the EU report "Measuring Active Citizenship in Europe"<sup>2</sup>.

Moreover, CRELL has supported the Bureau of Policy Advisers to the President of the Commission (BEPA) in the preparation of a paper entitled "Investing in youth: an empowerment strategy"<sup>3</sup>.

Finally, CRELL has extensively contributed to the preparation of the Communication from the Commission "A coherent framework of indicators and benchmarks for monitoring progress towards the Lisbon objectives in education and training"<sup>4</sup>, which was adopted on 21 February 2007.

### Cooperation with OECD

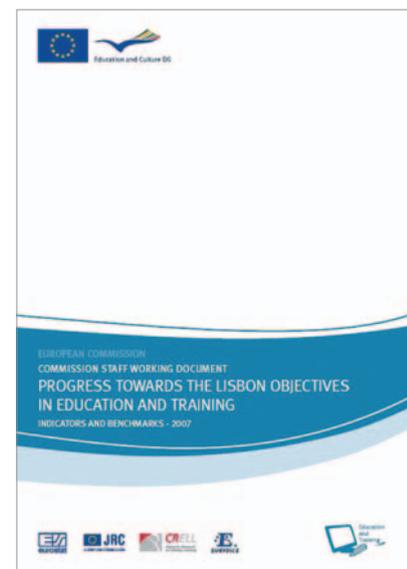
In April 2007, STATIND in cooperation with the OECD, the Bank of Italy and the Centre for Economic and International Studies (CEIS) of the University of Rome Tor Vergata, organised in Rome the conference "Is happiness measurable and what do those measures mean for policy?"<sup>5</sup>.

### Challenges for the future

STATIND will continue its support to the Bureau of European Policy Advisers (BEPA) to the President of the European Commission, to develop the concepts of wellbeing and their measurement, and to produce recommendations for a framework of indicators that could guide policy in the pursuit of wellbeing. STATIND will continue the collaboration with the Directorate General for Employment, Social Affairs and Equal Opportunities (DG EMPL) for the development of indicators of flexicurity (flexibility and security). The inventory of microeconomic reform measures (MICREF) will be updated and suitable indicators will be developed, in collaboration with the Directorate General for Economic and Financial Affairs (DG ECFIN) and the Directorate General for Enterprise and Industry (DG ENTR). Finally, STATIND will continue its scientific contribution in the field of innovation, collaborating with DG ENTR and possibly with the Directorate General for Regional Policy (DG REGIO).

### The 2007 Progress Report on Education and Training

The Centre for Research on Lifelong Learning (CRELL) of JRC-IPSC contributed to the 2007 Progress Report on Education and Training. The report has been prepared in close cooperation with the Directorate General Education and Culture (DG EAC).



2. The report is available on the web-site: [http://crell.jrc.ec.europa.eu/WP/research\\_projects.htm](http://crell.jrc.ec.europa.eu/WP/research_projects.htm)

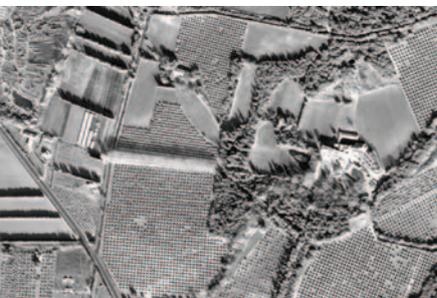
3. The report was published on 25 April 2007 on the EUROPA web-site: [http://ec.europa.eu/dgs/policy\\_advisers](http://ec.europa.eu/dgs/policy_advisers) under the section "Publications"

4. COM(2007) 61 final

5. Presentations, discussion papers and press releases are available at: <http://farmweb.jrc.ec.europa.eu/ci/>

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*FORMOSAT-2 panchromatic 2m data over Mausanne, FR, date 25/03/2007. [Formosat2: © NSPO [2007], Distributed by SPOTImage.*

**Ground European Network for Earth Science Interoperations - Digital Repositories - GENESI-DR**

It is a 2-year FP7 project under the Capacity Programme, totalling 4.4.M € grant, lead by the European Space Agency (ESA). It concerns providing harmonized access to multiple, distributed European Earth Science data repositories and integrating distributed computing infrastructures for science users. JRC-IPSC is contributing to the Project through the CID and the ISFEREA actions.

## Community Image Data Portal (CID)

The competitiveness of the European economy benefits from increased access to harmonised information and interoperable services related to items of community policy relevance. Innovation in a knowledge intensive society includes making this information available in an efficient way and storing it in a secure manner, preserving its long term availability.

The Community Image Data portal (CID) action was created at the start of the 7th Framework Programme. The JRC has for several years been engaged in researching into advanced techniques for extracting and analysing information from satellite sensors. This action is, therefore, the result of the long term experience in image data management and in image data applications built up at the JRC. In this context, CID has the objectives to coordinate efficient image procurement, to provide quality access, efficient preparation and storage of data, and to encourage the use of imagery in new areas. JRC's long term experience will also serve to give input to an efficient collaboration with external partners and towards the Global Monitoring for Environment and Security (GMES) initiative. The action aims to place itself as the centre of gravity of satellite and aerial remote sensing data management within the JRC, the European Institutions Services, and other stakeholders, as a Spatial Data Infrastructure (SDI). It will create and implement an Image Portal consisting of a front/back end providing suitable access and preparation/storage of imagery. This will be done following rules for data harmonisation, metadata, and data specifications defined by, amongst others, INSPIRE<sup>6</sup> standards. It will benchmark new satellite sensors, and provide support to the coordination of the JRC inputs towards GMES.

### Major 2007 achievements

#### The CID Survey

A screening through JRC resulted in that 20 actions from 4 different Institutes (ISD, IPSC, IES, and IHCP) handle satellite and aerial remote sensing data. These actions were interviewed giving an updated situation on the vast image archives of the JRC. A high interest was shown for the provision of a centralized data storage facility with file serving functionality including authentication service, image catalogue services, data visualization and dissemination services. This result now lies as the basis for the CID portal development.

#### The CID portal

Basic authentication, cataloguing, and orthorectification systems have been implemented. The first two are now important building bricks to reach an operational front end to the portal. Back end operations, such as semi-automated orthorectification of High Resolution sensor data, are giving very good results. A reliable IT infrastructure, running under High Availability, is being set up.

6. Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

### Satellite image acquisition

The satellite image acquisition for the EU Common Agricultural Policy (CAP) Control with Remote Sensing programme, was managed successfully. A sub-delegated budget of 6.0 M € from the Directorate General for Agriculture and Rural Development (DG AGRI) was used to programme the selected control zones enabling control of nearly 300,000 farmers in 2007 in the EU27. This is the 5<sup>th</sup> year that the Very High Resolution sensors<sup>7</sup> participate successfully together with the High Resolution sensors<sup>8</sup> to fulfil the programme, with a constant increase in area coverage starting from 12,000 km<sup>2</sup> in 2003, to nearly 160,000 km<sup>2</sup> in 2007.

**Satellite Remote Sensing Data Framework Contracts (FC) and Image data Policy Framework Contracts** (approx. 9 M €/year threshold) were signed in 2006 with 10 different Image providers<sup>9</sup>, in order to obtain efficient data purchasing through the EC Services. All necessary extensions were made in 2007. CID is continuing to harmonise issues of data policy detailing image licensing conditions in these contracts, which in parallel led to a deliverable to GMES on future Image Data Policy, where the perspective of achieving an optimal use of satellite remote sensing data for a GMES user is given.

### Challenges for the Future

The CID portal will be opened to the public with OGC (Open Geospatial Consortium) services implemented. The portal will be operational with discovery, view and download services.

CID will also complete and implement the Satellite Remote Sensing data loading service to the CID portal. The CID archive should then profile itself as a secure long term access and storage facility giving continuity to EU data archives.

Moreover, CID will play an important role in the GENESI DR project (see box on previous page), where CID is one of 10 key digital repositories to be made available for seamless, harmonised data-access and processing to the science user.

Finally, the VHR satellite image acquisition for the CAP Control with Remote Sensing programme will be increased to a requested 180,000 km<sup>2</sup>, which reaches the maximum capacity of presently available VHR sensors.

#### FORMOSAT-2

The satellite FORMOSAT-2 was launched on 21<sup>st</sup> May, 2004. It carries two cameras that deliver imagery of the Earth in the visible and near infrared electromagnetic spectrum.

CID benchmarking has involved 3 test sites, 5 images acquired with various incidence angles, use of 4 different sw suites, and a varying number of ground control points (GCPs). Results successfully extracted accuracy thresholds, and requirements on ancillary data to qualify the FORMOSAT-2 instrument for CAP control purposes.



*WorldView1, panchromatic 0.5m data over Mousanne, FR, date 15/01/2008. This satellite, launched on 18/09/2007, is the highest resolution commercial earth-observation satellite now operating and next in turn for CID benchmarking. WorldView1 "Distributed by EURIMAGE S.p.A. © DIGITALGLOBE [2008]"*

7. Ikonos, Quickbird, Eros, Formosat, and SPOT supermode

8. SPOT, IRS, Landsat, and DMC

9. These contracts cover the sensors SPOT, Landsat, IRS, Radarsat, OrbView (GeoEye1), Ikonos, EROS, Quickbird (WorldView1), Aster, DMC, ERS, Envisat, Terrasar-X, and Rapid-Eye

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## European Centre for Collection and Assessment of Multimodal Transport Safety Data (ECCAIRS)

The overall goal of the ECCAIRS action (European Centre for Collection and Assessment of Multimodal Transport Safety Data) is to provide European policymakers, the three transport agencies of the European Union, Member State authorities and accident investigation bodies tools and services to monitor and evaluate the evolution of transport safety at national and European level.

During the past decade the activity focused on implementing an EU wide network for the harmonised collection of aviation incident data at national level as it was requested in Directive 2003/42/EC on occurrence reporting in civil aviation. This phase has now been successfully completed. In the coming years, in support of new EU regulations adopted in December 2007, this data will be integrated in a single European repository maintained by the JRC-IPSC, from which it can be accessed, using strict security rules, by competent authorities and interested parties. The co-operation with international organisations like the International Civil Aviation Organisation (ICAO) has also led to widespread usage of the JRC-IPSC's tools outside the European Union.

In parallel with developments in the aviation domain, the same tools and methods, using an appropriate optimised taxonomy, will be proposed to the communities of the other transport domains, in particular through co-operations with the European Maritime Safety Agency (EMSA) and the European Railway Agency (ERA).

2007 has been a key year for the ECCAIRS activity. The implementation of the Directive on occurrence reporting in civil aviation had to be completed, while at the same time, the implementation of tools to support the new regulations on integration and dissemination needed to be prepared also. In addition, an outcome was expected from a feasibility study, performed together with EMSA, on the capabilities of the ECCAIRS software to be used in the maritime domain.

### Major 2007 achievements

In the ECCAIRS Steering Committee meeting of October 2007 it became clear that practically all EU Member States are now using ECCAIRS to implement the functional requirements of Directive 2003/42/EC. Backed up by a very successful training programme the ECCAIRS Reporting System (of which a new version was released in November 2007) has obtained an almost complete acceptance level in the EU and is in the course of becoming an internationally accepted standard system for aviation authorities and investigation bodies world-wide.

During 2007 tools and methods for the implementation of the new EU Regulations on data integration and dissemination have been designed and tested. In anticipation of the adoption of these new regulations, France, Germany, Iceland, the JRC-IPSC and the European Aviation Safety Agency (EASA) have been integrating and exchanging data successfully, demonstrating the feasibility and capability of the proposed solution.

At an international level, the JRC-IPSC assisted ICAO in the training of accident investigators by providing ECCAIRS related training material and running ICAO courses and workshops (e.g. a training session in Dakar, Senegal, and a workshop in Tunis, Tunisia). In addition the co-operation with the Chinese Civil Aviation Authority has resulted in a prototype of a bi-directional data-exchange



*Marco Ooms (JRC) together with the students of the ICAO-ECCAIRS training course in Dakar-Senegal.*

facility between China and Europe developed by two Chinese experts detached to the JRC-IPSC for a period of six months.

By providing the European Maritime Safety Agency (EMSA) with a functional prototype of the ECCAIRS Reporting System redesigned to collect maritime accident information, the JRC-IPSC proved the multimodal transport capabilities of the ECCAIRS platform and demonstrated to EMSA the usability of their taxonomy in an ECCAIRS environment. This solution will be evaluated by six Member States and in the beginning of 2008 a decision is expected on a possible adoption of the system by EMSA.

At the end of October 2007 the JRC-IPSC launched the new ECCAIRS website for the user community, the ECCAIRS Portal. Three months later, at the beginning of 2008, 185 users from 119 different organisations had registered themselves. The portal allows for the exchange of documents, the registration of problem reports and change proposals and the distribution of the ECCAIRS software.

### Challenges for the future

The main challenge for 2008 will be to implement the services required by the new EU Regulations 1321/2007 and 1330/2007 regarding the integration and dissemination of aviation safety data at EU level. This will require the further development and maintenance of required tools as well as establishing technical protocols with all of the 27 EU Member States.

In addition a new version of the ECCAIRS Reporting System supporting a multitude of different taxonomies (aviation, maritime and rail to start with) will be developed, released and maintained. This tool will include specific requests of functions related to improving the quality of the data collected and analysing the resulting repositories (e.g. data-entry assistants and risk grading) made by the members of the Occurrence Data Analysis working group in the previous years.

In the case of a positive decision the JRC-IPSC will need to convert the prototype application of the European Marine Casualty Information Platform developed in 2007 into a production release for EMSA. This web based information system will be hosted by the JRC and will need to be complemented by an ECCAIRS maritime portal similar to what is provided for the aviation community.

Having successfully provided services to the aviation and maritime communities the next step will be to also involve the railway community in the ECCAIRS network. In 2008 only the first steps in this direction will be made using an approach similar to that which has been done in the maritime domain i.e. starting with a feasibility study. In the longer term, the challenge is to bring together at an EU level the experts and the expertise from these three domains. By offering a single collection and assessment platform, and thus by speaking a similar language, ECCAIRS will provide a significant contribution to meeting this goal.

### Training

ECCAIRS training courses are provided to all Air Accident Investigation Bureaus/Institutes (AIB/AIIL) and Civil Aviation Authorities (CAA) of the European Union. Participation of other organisations or institutions (such as for instance Air navigation Services providers) is also accepted, provided they are actively involved in or promoting accident prevention. Until the end of 2007 374 participants from 41 countries have attended ECCAIRS courses organised by the JRC-IPSC in co-operation with partner organisations like ICAO.



The Change Proposal Management System implemented in the new ECCAIRS Portal.



Excerpt from a presentation by the Chinese Civil Aviation Authority (CAA) on the joint research carried out by CAA and JRC staff during 2007.

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## Vulnerability Assessment in Transport Distribution Systems (VATDIS)

The VATDIS action focuses on the review and development of methods for the identification, protection and security assessment of European Critical Infrastructures with respect, primarily, to the threat posed by terrorism. These methods include analysis of the threat itself, development of scenarios relating these threats to the vulnerabilities of the infrastructures, assessment of the consequences of the attacks, and development of protection measures. Methodological developments are supported by specific studies related to the threat associated with the surface transport of dangerous substances, how this type of transport can be misused in terrorist actions and the impact of these actions, and how on-board communication and spatial geo-reference equipment can support real-time traceability, alarm management and rapid emergency response.

### Major 2007 achievements

#### Urban vulnerability maps against terrorist attacks using freight vehicles loaded with explosives

Protection against terrorist attacks, in which commercial transport vehicles are misused to bring large quantities of explosive into dense urban areas, can be achieved by creating urban security zones. A method based on the spatial distribution of urban vulnerability was developed to support the identification of these zones. The method determines vulnerability in terms of casualties that would result if a well-defined target was attacked by a certain means of transport. The spatial distribution of all potential targets yields the urban vulnerability map. For a given urban area, only its land-use and a list of possible targets with their spatial locations are required. Each target is classified into a specific target type (e.g. a government building, a school). A target type is characterized by a limited number of parameters that estimates the damage that such type of targets can sustain. The number of victims is estimated using probit equations based on blast strength, either directly if victims are located in the open air, or indirectly, via building collapse. Collateral casualties around targets are also estimated using land-use information. The method was validated against historical events (e.g. Oklahoma City attack and Enschede accident) and demonstrated on an anonymous large-sized European city in a GIS environment.

*Example of an urban vulnerability map against attacks using freight vehicles. The map shows the relative importance in terms of potential damage of individual targets (red dots), a kernel density map, and kernel density isolines. This information is put together with network data and aerial photography to determine security zones (purple and pink dashed lines).*



### Towards the identification of European Critical Infrastructures

VATDIS contributed significantly to the progress made during 2007 on a proposal of a Directive on the “identification and designation of European Critical Infrastructures and the assessment of the need to improve their protection”. It prepared a critical review of existing methodologies to define criticality criteria and analyzed how these criteria have been put in practice in different countries to protect national assets. Particular emphasis was put on the need to capture the interdependencies existing between distributed infrastructures (e.g. between transport, energy and ICT infrastructures). Subsequently VATDIS authored a Commission Non-Paper with a proposal for so-called “Cross Cutting Criteria” to evaluate the impact of the destruction of a critical infrastructure with reference to the potential to cause casualties, economic effect and public effect. This non-paper was discussed at European Council level and became the de facto reference point for the forthcoming technical negotiation with Member States and the Commission for the final definition and adoption of cross-cutting criteria.

### European Root Certification Authority and Laboratory for Interoperability Certification

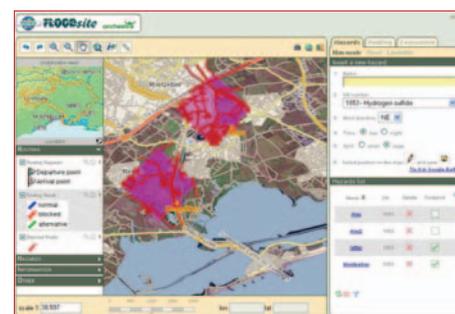
As of 1 May 2006, a new control device for road vehicles, called a digital tachograph, became mandatory on newly registered trucks. The digital tachograph is an electronic recording device used to record and store data on driving times, breaks and rest periods of drivers. The security of the digital tachograph system, and the authenticity and integrity of electronic data recorded and stored, is dependent upon a range of technical, physical and procedural measures to resist attacks. In this respect, VATDIS is managing two major services of the Digital Tachograph (DT): the European Root Certification Authority, which oversees the DT cryptographic key management infrastructure, and the Laboratory for Interoperability Certification (see <http://dte.jrc.it/>). VATDIS also carried out an investigation in the field of the known and theoretical threats to the overall security of the DT system. The report recommended a number of short-term countermeasures to detect and prevent attacks by means of manipulation devices. These recommendations have been incorporated in the preparation of a forthcoming Commission Decision on that specific matter.

### Web service mapping developments

The action is contributing to a number of Integrated Projects, on development of open architecture and preparatory services for risk management for the Global Monitoring for Environment and Security (GMES) initiative. A major deliverable is a pilot web service featuring geo-spatial interoperability in full compliancy with open standards. The pilot web service covers a trans-boundary area covering Italy and France that provides support for the emergency management of different risks: floods, quakes and transport of dangerous goods. The services allow representing the zones impacted by hazards, routing of rescue teams and identifying of near-by civil protection resources.

### Challenges for the future

The definition of the cross-cutting criteria for the identification of European Critical Infrastructures in support of the European Programme on Critical Infrastructure Protection (EPCIP) should be finalised in 2008. This is a critical milestone in view of the adoption of the associated European Directive in 2008 and VATDIS will coordinate the Working Group of national experts working on that matter. An analysis of the basic requirements for a second generation of Digital Tachograph will also start in 2008. The second generation should support spatial localization and improved communication capacity.



*The pilot web service developed jointly in the FLOODSITE, ORCHESTRA and PREVIEW Integrated Projects. Two impact zones (in pink) are represented in an urban area. The right pane allows the specification of impact areas of three different types of hazard. Routing and evacuation web services can be requested for specified impact zones. Main routes for evacuation are represented in red.*

# 2



## Solidarity and the Responsible Management of Resources

Sustainable management of our natural resources and the environment is an ever increasing challenge for the Union. It is a key component of the sustainable development objectives included in the European Union Treaty. Knowledge and technology are essential in this context as they provide potential solutions to the difficult sustainable equation which aims at an equilibrium between economic growth and social and environmental sustainability.

The fields of agriculture and rural development present specific challenges because they are at the core of production, socioeconomic and environmental systems which need to be balanced to the satisfaction of a broad range of stakeholders in a difficult global context. The Agenda proposed by the JRC will focus on an integration of those various dimensions at Community level.

The Fisheries policy, the Marine Strategy and the emerging EU Maritime policy provide the background for the JRC agenda of work in the area of marine ecosystems and resources. The current situation in this sector presents critical sustainable development issues in terms of reconciling production objectives with depletion of resources, social aspects and environmental quality. The JRC provides technical and scientific support to this growing agenda which is likely to significantly evolve during the period covered by the programme.



## 2.1 Rural development, agriculture and fisheries

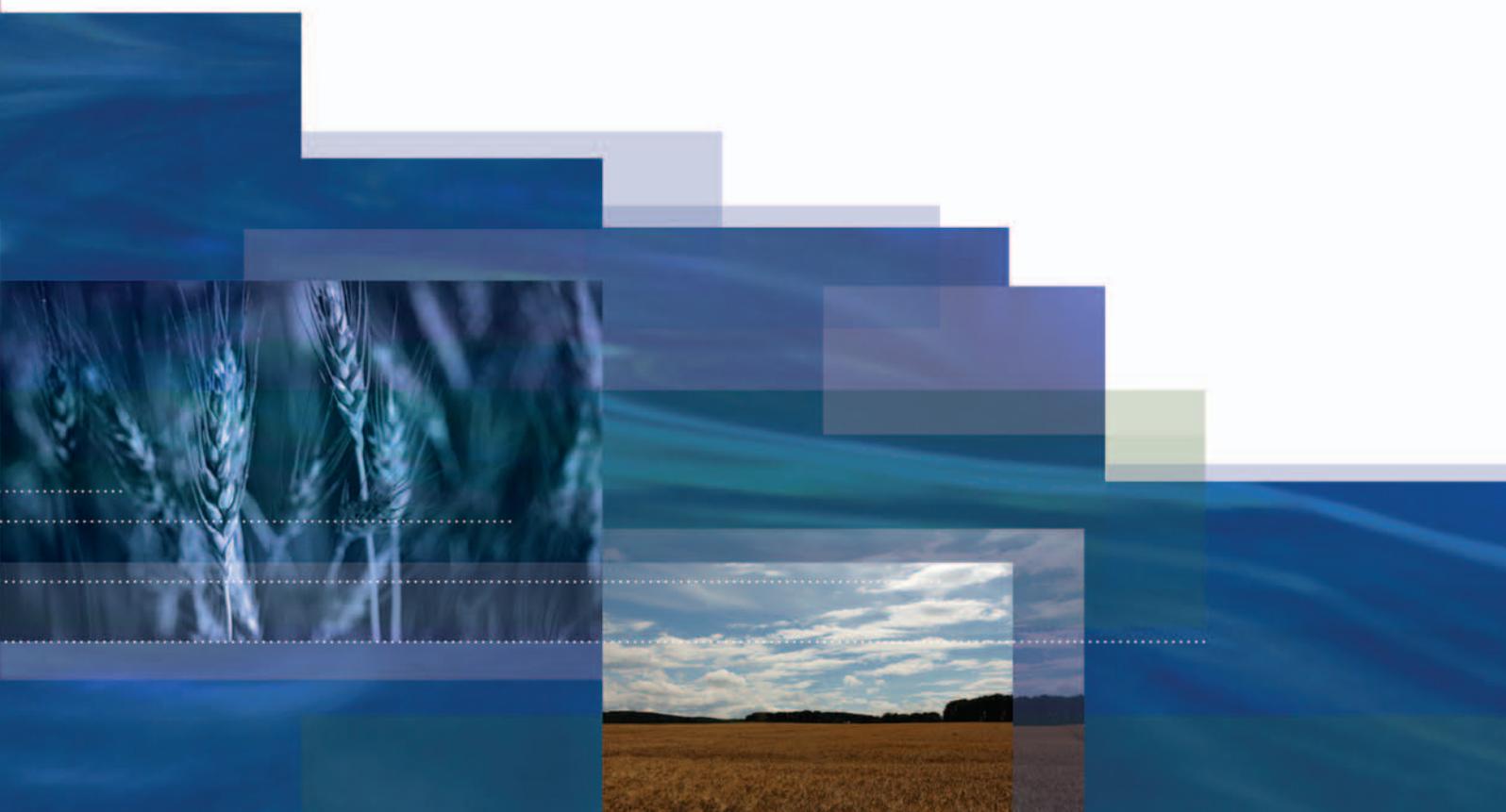
### Agriculture and rural development

Agriculture and rural development has been a central theme in several JRC framework programmes. Actions included in the 2007-2013 multiannual work programme will further develop the capacity to provide technical support to the implementation and control of the Common Agricultural policy (CAP), and to contribute to the development of integrated services for monitoring new requirements resulting from the CAP. In addition to the support to regulatory items (control, monitoring) the objective will be expanded to cover crop forecasts as well as medium/long term commodity market prospects. Strategic techno-economic analyses of production systems at the farming system level will also be developed. Methodological aspects related to implementation of the new EU agricultural statistical system will be studied.

### Fisheries, Maritime policy and Marine environment

The context is provided by the existing fisheries policy, the Marine Strategy and the emerging Maritime Policy. The latter will propose concrete steps towards the integration of Lisbon based objectives and sustainable management of ecosystems. Currently the focus is on monitoring fishery activities and providing support to Marine Conventions and scientific committees. Links also exist with the Security Agenda in terms of monitoring illegal activities taking place at sea. As in other policy agendas the JRC will dedicate specific efforts to the provision of geospatial information tools for better taking into account the diversity of the European geographical situation.

MARS-PAC, MARS-STAT,  
FISHREG, MASURE



# MARS-PAC

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### Percentage of holdings planned to be involved in one-to-one advice yearly

Providing one-to-one advice delivery seems to be considered by Member States as the most common and useful way to provide advice. One-to-one advice is free for farmers in a limited number of Member States, but more often the use of advice services is funded within the framework of the Rural Development policy. Due to its cost the number of holdings that are expected to use one-to-one advice each year rarely goes beyond 5% of the farmers receiving direct payments.

## Geo-Information Management and Control Methods (MARS-PAC)

The Common Agricultural Policy (CAP) is the EU's major policy instrument, impacting agricultural practices, environmental sustainability, and the economic livelihood of rural areas. Aid payments – under either of the two main pillars of the CAP – still make up the largest single component of the EU annual budget. While a major CAP goal is the responsible and sustainable use of rural resources, the correct management and control of these payments is a major task for Member States and Commission services.

The past decade has seen the evolution requirements of CAP legislation for information that is geo-referenced, on-line and supported by extensive and up-to-date national image datasets, consolidated in the Integrated Administration and Control System (IACS).

The geo-referencing of such data has led to the introduction of Geographic Information System (GIS) technology; in some cases exploiting pre-existing reference systems such as cadastral or topographic mapping. The action is regularly requested to respond to ad hoc evaluations linked to co-financed investments by Member (or accession) States, intended to fulfil the infrastructure required for CAP compliance.

Whilst information management is the primary focus for MARS-PAC, control methods for checking CAP claims is an important activity, dominated by two mainstream approaches: Control with Remote Sensing, and Global Positioning System (GPS) parcel measurement. In 2008, a revision of the CAP regulations places both approaches on equal footing, requiring a consolidation of the technical guidance documentation. Both technologies require close monitoring of technology changes (e.g. Galileo, Pleiades) as well as a large degree of technical activity (technical guidelines, quality control programs, missions).

### Major 2007 achievements

#### Assessment of Farm Advisory System implementation

One of the objectives of the action was the assessment and follow-up of the first year of the implementation of the Farm Advisory System (FAS), that each Member State had to set up by the 1st January 2007 in order to advise farmers on land and farm management. The FAS is a core element of the 2003 Common Agricultural Policy reform, expected to increase farmers' awareness on the respect of environmental and other requirements set at European and national levels (so-called cross-compliance); recently its importance has even increased as the participation of a farmer in the FAS can be considered as a lowering risk factor for the selection of on-the-spot checks sample in the controls of financial aids.

Assessment of FAS implementation was carried out through technical visits in Member States, a workshop with all Member States, participation in conferences and a questionnaire survey. Accurate information was collected for all Member States and the main topics were investigated such as the organisation of the system, the operating bodies, targeted farmers' population, communication, funding, ways of providing advice to farmers, farm advisory tools and criteria for the selection of advisers.



Area measurement certification process.

The surveys showed that the first year of FAS implementation was mainly used by the Member States to “fine-tune” their pilot systems. The main concerns raised were the lack of advisers due to the difficulty in recruiting suitably-qualified staff, some problems in reaching small-holdings, insufficient financial resources and a scarcity of farmers’ awareness. Setting up assessment procedures to check the quality and effectiveness of FAS will be a challenging task for the near future.

#### **Area measurement validation**

The measurement of agricultural parcel areas in the context of the control of CAP subsidies requires tools that can be trusted by all interested parties (farmers, administrative bodies, EU Commission, courts).

Building on several years of experience on GPS equipment testing, the MARS-PAC action, in partnership with outside certification bodies, has established a validation approach for the voluntary certification of tools (mainly GPS equipment) for area measurement.

In this process, an advisory body – currently the JRC-IPSC, but stakeholders from the wider community could be incorporated – provides user requirements and guidelines for designing a certification test plan in order to show the correct performance of a piece of equipment under specific conditions.

A certification body will propose a test plan, in accordance with these guidelines; the body will petition the advisory body for recognition of its plan, which, if successful, will be made public via the advisory body’s web site. The certification body will in turn contract with a test laboratory, which will operate under their control and supervision, to undertake tests and produce data through equipment testing. These data will in turn be analysed to produce results, which will, following the review and evaluation by the certification body, lead to Certificate Publication, again on the web.

The first commercial instrument was certified in this manner in November 2007, marking a milestone in this important technological area, which impacts the checks made on about 300,000 farms per year in the EU.

#### **Challenges for the future**

The CAP is entering a phase of stability in 2007, even though a thorough review (the so-called “Health Check”) may identify new priorities and adjustments. However, management of geoinformation must adapt to upcoming directives such as the one establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), and the policy as a whole will need to take into account new needs like improving monitoring of sustainability, particularly in response to related policy demands such as tracking the origins of renewable energy biomass sources.



*Measurement of a maize parcel with the Global Positioning System (GPS) in Bayern, Germany.*

# MARS-STAT

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*A European agricultural landscape.*

**The Remote Sensing Infrastructure**  
 MARS-STAT has developed a pan-European remote sensing infrastructure based on medium to low resolution satellite: MODIS-TERRA (250m), SPOT-VGT, NOAA-AVHRR, METOP – AVHRR (1Km), MSG –SEVERI (5Km). Integrated in the Crop Yield Forecasting System, it provides qualitative independent information every 10 days on the vegetation development. Thanks to the historical data base consolidation from 1981, it is possible to make comparisons at pixel level with reference year and perform scenarios analysis.

Efforts are made to ingest quantitative remote sensing information at the different 3 levels of the yield forecast system: meteo, agro-meteo and yield estimates.

To improve the data analysis and facilitate the image dissemination, two web-based user interfaces were developed: control board and image server.

Further plans are made to acquire high resolution sensors to perform crop surface estimates.

## Crop Production Forecasts/ Estimates and Climate Change Impact on Agriculture (MARS-STAT)

The action focuses on the European Commission Crop Yield Forecasting System aiming at providing accurate and timely crop yield forecasts and crop production biomass. Since 1992 MARS-STAT has been developing and running a Crop Forecasting System at pan-European level. This system monitors crop vegetation growth (cereal, oil seed crops, protein crops, sugar beet, potatoes, pastures, rice) and includes the short-term effects of meteorological events on crop production. The mandate is given through a regulation stating its maintenance, operational run and analysis.

The system is made by remote sensing and meteorological observations, agro-meteorological modelling (Crop Growth Monitoring System, CGMS) and statistical analysis tools.

The rationale behind the crop forecasts at EU level is based on the lack of timely information to take rapid decisions on Common Agricultural Policy (CAP) instruments during the year. In fact statistics are usually provided by Member States to Eurostat and the Directorate General for Agriculture and Rural Development (DG AGRI) several months after harvest. This delay affects decision making in planning tools of the CAP as the European view is missing.

The results are used by analysts from DG AGRI and Eurostat to estimate food balance sheets, for market analyses and decisions on the CAP management of stocks, import/export, market and intervention, set aside decisions and budget preparation.

Along the Seventh Framework Programme (2007-2013) the action will put a clear emphasis on the impact of climate change on agricultural systems. As a consequence, the Crop Yield Forecasting System will be adapted in order to run on climatic scenarios at different levels (from 10 days to 100 years) in order to improve the crop yield forecasts but also to generate climate change impact scenario on farming systems.

MARS-STAT is the repository of techniques developed using remote sensing and area frame sampling at European level to estimate crop areas. This experience has been applied in 2007 to analyse the efficiency and potential use of the Eurostat LUCAS survey (Land Use/Cover Area-frame Survey).

### Major 2007 achievements

MARS-STAT reported extensively on crop conditions and yield forecasts, in total 43 technical reports were released. This comprises full bulletins covering the main crops for EU 27 and neighbouring countries (crop yield forecasts, crop conditions at country level, agro-meteorological analysis), as well as specific bulletins for pastures and rice. The rice bulletin now incorporates also Hungary, Bulgaria and Romania. The reporting is supported by ad-hoc analyses and special reports. This year the action was called to analyse exceptional conditions concerning agriculture production in some Eastern countries of the EU. Reports assessed the impact of heat waves in Spring, which significantly reduced yields expectations for winter cereals and maize in Hungary, Romania and Bulgaria. Particular attention was also given to conditions in the Republic of Moldova where a specific analysis forecasted a reduction of over 86% in the yield of wheat.

The Crop Yield Forecasting System released two new platforms: the Calibration Platform which allows, using optimisation methods, to introduce new crop varieties into the forecasting system as well as to explore crop adaptation within climate change studies. The Sensitivity Platform, which runs sensitivity analysis on the system to better study effects of different variables and parameters on the final crop simulation results. This will be useful also within Climate Change studies to rank the future impacts on crops.

In conformity with the preparation of the enlargement of the Crop Yield Forecasting Systems to other strategic areas of the world collaboration agreements with agricultural bodies in the United States, China and Morocco have been signed, others are in preparation like for Ukraine and Russia, to facilitate the exchange of scientific developments and information. The scientific exchange and training on the Crop Growth Monitoring System was also provided to more than 60 experts from all over the world in a workshop jointly organised with the MARS FOOD action.

### Challenges for the future

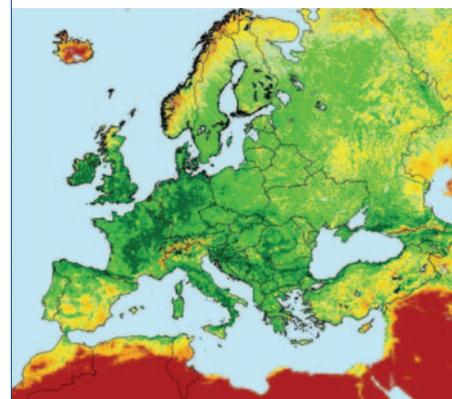
Within the Seventh Framework Programme (FP7) MARS-STAT faces several long term challenges. A new focal point is the assessment of the climate change impact on agriculture exploiting the potential of the agro-meteorological databases maintained in the action and modelling capacities. The experience and data accumulated within European research projects in this field (such as the ENSEMBLES project), together and in co-ordination with the Climate Change Unit of the JRC's Institute for Environment and Sustainability, will be used to study the impact of global warming and how the cropping sector will adapt.

A second long-term challenge will be the enlargement to new crops, including the biofuel crop categories for the area currently covered and to enlarge the application of the agro-meteorological systems to areas such as South America, India, China and Russia. This would help to anticipate the availability or extra demand for food commodities on the global market and their impact on prices.

A third challenge will be to continue the studies on Agriculture Insurances and the possible impact on a future Common Agriculture Policy. Finally, the action will contribute to the development of a European Agro Phenological network.

### Climate change impact on Agriculture

Global Circulation Models simulations estimate changes in climate in terms of an increase of air temperature and more variable rainfall patterns. For both an increase in variability is estimated, in terms of heat/cold waves, and as dry spells. The greatest impact is expected on specialised farming systems, and on areas which are currently marginal for agricultural production. The general concern is that the rate of change of weather patterns will be too fast to be handled by the intrinsic resiliency of agricultural system, hence requiring specific actions supported by institutions. Production is not the only concern; system sustainability (soil organic matter decrease and new diseases and pests) due to patterns in temperature, and environmental risk (pollution due to nitrogen and agrochemicals in ground water, and soil erosion) due to increased frequency and magnitude of rainfall events, demand for ex-ante scenario analysis.



*Vegetation biomass seen from Space over Europe.*

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## Scientific and Technical Support to the Common Fisheries Policy (FISHREG)

The FISHREG action aims at supporting the Common Fisheries Policy (CFP) through basic and applied research and through technical support to the Directorate General for Fisheries and Maritime Affairs (DG FISH). Other customers include national fisheries management authorities under Community authority, Fisheries Monitoring Centres (FMCs) and Regional Fisheries Organisations (RFOs). FISHREG supported the implementation and review of the CFP by addressing a wide range of key issues of importance to fisheries management (e.g. better and more transparent advice, better access to data) and fisheries enforcement (e.g. more effective enforcement of the rules, level-playing field).

### Major 2007 achievements

#### Policy Support

In 2007, FISHREG consolidated experience with its custom-developed Vessel Detection System (VDS) using satellite data (SAR radar images) and successfully applied it over a number of fisheries monitoring campaigns in collaboration with national FMCs. Examples are:

- western Waters VDS and aircraft surveillance campaign with FMC Ireland in March that further highlighted the added value of VDS;
- two Baltic Sea Closed Box Monitoring campaigns, in collaboration with 8 Baltic Sea FMCs in May and June, that demonstrated the feasibility of near-real-time vessel detection;
- redfish fishery area campaign of the North East Atlantic Fisheries Commission (NEAFC) with all major flag state FMCs fishing in this area in May - June that confirmed the fact that more vessels are present in the area compared to what is reported using the Vessel Monitoring System (VMS).
- large campaign in the Mediterranean during the summer to support monitoring of Bluefin Tuna (BFT) fisheries and detect Illegal, Unreported and Unregulated (IUU) activity. The campaign was coordinated with the BFT joint inspection that took place in June and July. Areas of interest for 2007 were: Balearics, South and SW Sardinia; Sicilian Channel; Malta; Libya; Egypt and South Cyprus. During the campaign, FISHREG reported in near-real-time (NRT) to surveillance means the areas with "suspect" targets found in satellite images. The first results indicated that the fishing activity was substantially higher than what was reflected by the EU VMS picture alone, varying from one area to another.

With respect to the scientific advice process, FISHREG assured the Secretariat for the Commission's own Scientific, Technical and Economic Committee for Fisheries (STECF). STECF managed to deliver opinions on all questions within the agreed timeframe. The new web site of STECF, operated by FISHREG, became operational in mid 2007 and proved to be a highly recognized reference source for Commission staff, national authorities and the scientific community.

FISHREG helped Member State services with 4 formal Commission requests for data in the framework of the Data Collection Regulation (DCR), mainly through pre-processing of the data and a modern web-based platform to upload Member State data. Finally, the dedicated data collection web site moved to a more powerful platform.

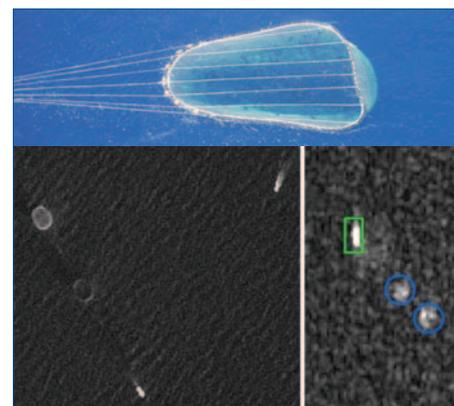
On the policy front, FISHREG supported DG FISH in the conception of the new DCR, which is planned to be implemented in 2009, and in their work towards a seamless merging of DCR data with the data collection programme of the General Fisheries Commission for the Mediterranean of the Food and Agriculture Organization of the United Nations (FAO/GFCM). Furthermore, FISHREG contributed to the collaboration between GFCM and EU by actively taking part of the discussions of the GFCM sub-group on Socio Economics issues (SCESS). Finally FISHREG gave key contributions on the detailed rules for the implementation of Council regulation (EC) No 1966/2006 on electronic recording and reporting of fishing activities and on means of remote sensing.

### Research

In terms of research, FISHREG staff published 13 peer-reviewed papers in scientific journals in 2007 ranging from fisheries management to marine resource economics. FISHREG staff was involved in the FP6 project CEDER (Catch, effort and discard estimates in real time) which aimed at better predictions on catch and quotas. It was a partner in the MARUSE project (Global Navigation Satellite System Introduction in the Maritime Sector) on a study on authentication for fisheries monitoring/assessment of benefits through GALILEO. The FP5 Concerted Action DECLIMS (Detection and Classification of Maritime Traffic from Space), led by JRC-IPSC, was finalised. This project that started with 17 partners and ended with 24 has produced a total of 17 scientific publications, 5 reports, 2 training courses plus several brochures and many oral presentations. It has led to a quantified understanding of present-day capabilities of ship detection and classification in satellite imagery (radar and optical), and the identification of the most pressing problems that need to be addressed for further progress. Finally, FISHREG did research in assessing cost-benefit for fisheries management and fisheries enforcement through FP6 projects CEVIS and COBECOS.

### Challenges for the future

The CFP is undergoing a significant review on its implementation which will have consequences for both the fisheries management and its enforcement. As regards enforcement, it is becoming a political priority for the EU owing to pressures from public opinion and a report by the Court of Auditors. In addition, the Marine Strategy requires that environmental considerations are fully integrated into fisheries management decisions. The requirement for impact assessments made bio-economic considerations mandatory for all fisheries management decisions and management tools are changing with a move to a regional focus, longer-term horizons and ecosystem-based management. All the above challenges will require new types of support to produce good advice and effective enforcement tools.



Top: Photo courtesy of IFREMER.  
Bottom left: Distributed by SpotImage, © CNES [2007]  
Bottom right: Radarsat Data © Canadian Spatial Agency [2007]. All rights reserved

During the summer 2007 JRC-IPSC organized a large Vessel Detection System (VDS) campaign (250 images) in the Mediterranean to support monitoring of Bluefin tuna fisheries in coordination with an EU Joint inspection. The photo shows a tug towing two tuna cages toward the farms, where the tuna that has been catch alive will be fattened for several months. The pictures show a vessel towing two cages: on a SPOT5 (2.5m resolution) Panchromatic image (left) and on a RADARSAT Standard (25m resolution) image (right).

# MASURE

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*The two figures show how ConTraffic can give customs additional information with respect to what is indicated in customs declarations.*

### EGEMP - The group of national experts on satellite monitoring techniques for the detection of oil spills in European waters

To share knowledge and to support a common approach, the Directorate General for the Environment (DG ENV) and JRC-IPSC took the initiative in 2004 to set up a working group of national experts on satellite monitoring techniques for the detection of oil spills in European waters (EGEMP). Since then, EGEMP meets twice a year and, starting in 2007, EGEMP meets jointly with the EMSA Clean-SeaNet User Group.

EGEMP supports present efforts towards an operational use of satellite imagery to detect sea-based oil pollution. EGEMP is now recognized as the permanent network where competent authorities from EU Member States, Candidate Countries (Croatia and Turkey), EEA (Norway and Iceland), Secretariats of relevant Regional Agreements (Helsinki Convention, Bonn Agreement, Barcelona Convention, Bucharest Convention, and Lisbon Agreement) and the European Space Agency (ESA) discuss matters related to satellite monitoring of sea-based oil pollution. JRC-IPSC manages the Secretariat and the website of EGEMP.

## Maritime Surveillance (MASURE)

The action on Maritime Surveillance (MASURE) started in 2007 and covers a number of different activities related to monitoring maritime traffic, maritime pollution, container traffic, and implementation of port security, among others. The boundless nature of the sea requires regional, European and global approaches, not national ones. The tools include emerging space-based technologies of satellite earth observation, communication and global positioning, new developments in Information Technologies, risk assessment methodologies, Geographic Information System (GIS) and sensor systems. MASURE aims to develop and provide the technical and scientific expertise that is essential for the policy makers to put these complex technological tools to their advantage. By nature, the action will touch on all EU pillars, as maritime surveillance implies applications for many Community policies, policing, security and defence. The action clearly fits within the objectives of the Global Monitoring for Environment and Security (GMES) initiative.

The main objectives of the action are:

- to address maritime surveillance using an integrated approach, building a platform where different sources (from satellite data to local data) can be merged and compared and new surveillance technologies and concepts can be tried out, for the benefit of different European-level users.
- to further develop the Contraffic System, a facility developed at JRC-IPSC in collaboration with the European Antifraud Office (OLAF), that provides means for collection and analysis of data related to container movements, primarily for customs intelligence purposes.
- to support the Directorate General for Energy and Transport (DG TREN) in producing guidelines (minimum standards, performance specifications, best practices) for efficient application of the new port security regime<sup>10</sup>.

### Major 2007 achievements

In 2007, MASURE delivered its output in the form of reports, participation to conferences, contribution to joint customs exercises, and advice (ad hoc as well as structured) on technical and scientific matters requested by its partner DGs and Agencies.

Following completion of the “BORTEC report” by the European Agency for the Management of Operational Cooperation at the External Borders (FRONTEX) – which included a significant JRC-IPSC contribution - the European Patrols Network (EPN) project was launched to implement operational coordination of maritime border patrols of the southern EU Member States. MASURE has continued to support this project with technological inputs on maritime surveillance. Likewise, the action has provided inputs to the Commission Communication on EUROSUR (European Border Surveillance System), related in particular to future options for surveillance means such as satellites and Unmanned Aerial Vehicles.

Significant support was provided to the Maritime Policy Task Force of the Directorate General for Fisheries and Maritime Affairs (DG FISH) regarding their actions on integration of maritime surveillance data and dissemination of marine data. Web mapping techniques to publish marine data to a wide audience were tested, and a report was written on the present status of maritime surveillance systems in the EU with special attention to data sharing practices.

10. ISPS Code, Regulation 725/2004

In view of the important role of navies in maritime surveillance also for civilian applications, MASURE has stayed in close contact with the European Defence Agency (EDA) and their PT MARSUR (Project Team Maritime Surveillance) that aims to address prominent shortfalls in maritime surveillance capabilities of EU Navies. In addition, the global dimension of surveillance was addressed by providing support to a project on Illegal, Unreported and Unregulated (IUU) fishing in the Exclusive Economic Zones of the countries in the western Indian Ocean, concentrating on Mauritius.

For what concerns container traffic monitoring and risk analysis, MASURE significantly raised the level of the data quality in its repositories through the successful application of a common codification for container transport events and port locations across different carriers. This made feasible the prototyping of new applications for EU customs, related to the analysis of past container movements. In addition, the action opened new avenues for developing the ConTraffic system through the establishment of a Memorandum of Understanding with the government of Singapore aiming at the security of the Port of Singapore. Finally, in collaboration with OLAF, the action explored the feasibility of introducing governmental data sources for ConTraffic, specifically related to cross-border container traffic along the entire Eastern European border. Development in view of integrating these new customs data with other open-source data is expected to take place in 2008.

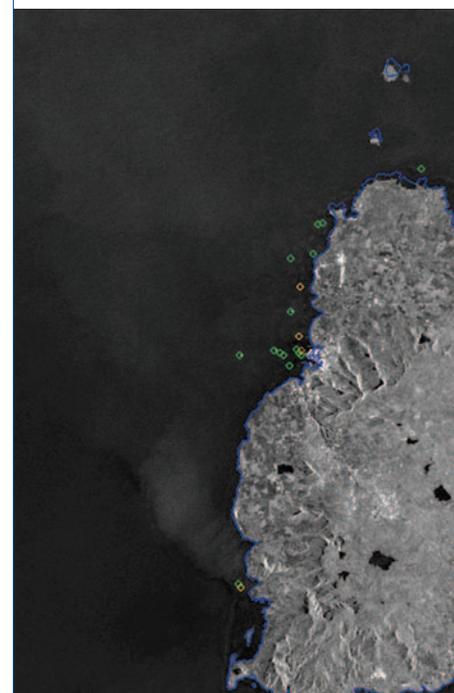
In the process of launching the new action, a key achievement has been the general recognition of the competence and expertise of the MASURE team by policy makers, the industry and academia. The excellent working relation with Commission DGs such as DG TREN and OLAF is also reflected through specific administrative arrangements with these services. Moreover, in 2007 MASURE actively contributed to several externally-financed collaborative research projects, such as LIMES, TANGO, MONRUK, ASPIS, EFFORTS and CORFAT.

### Challenges for the future

In its new integrated maritime policy for the EU, the Commission is advocating further integration of maritime surveillance systems among its priorities. The JRC-IPSC aspires to continue to support that goal by active involvement in the assessment and piloting of surveillance systems at a supra-national level, such as satellite-based systems, and by R&D in interoperability and data fusion. It will do so in the cooperative setting of several FP research projects and in close contact with relevant DGs and Agencies.

#### Collaboration with EMSA

In 2007, the MASURE action established a Service Level Agreement with the European Maritime Safety Agency (EMSA). Using this agreement R&D issues will be tackled by JRC-IPSC, while the Agency is expected to use JRC-IPSC's results to strengthen its operational tasks. MASURE will support EMSA in the areas of: Automatic oil spill detection algorithm for satellite Synthetic Aperture Radar, Feasibility of oil spill detection with satellite optical imagery (MODIS), GIS layers for environmental and shipping data.



*Maritime security is a global issue: security of supply lines and anti-piracy are crucial to the EU also in remote locations. Satellite observation is a very suitable tool to support improved governance and control in remote areas, and JRC is researching its application. The picture shows the west coast of the island of Mauritius in the Indian Ocean as seen by ESA's ENVISAT imaging radar. JRC's software analyses the satellite images for ships: large ships are shown in green, small ones in yellow. ENVISAT image (c) ESA.*

# 3



## Security and Freedom

JRC is expanding its activities to support a broad range of security issues and include protection of the citizen, the territory and the essential functions of society (including economy, food, transport and economy sectors) from a range of threats, primarily: natural hazards, unintentional acts (e.g. accidental), intentional acts (e.g. illegal activities including fraud and organised crime terrorism) as well as geopolitical factors and global challenges which affect Europe both directly and indirectly. This orientation follows new developments associated with the European Security Agenda and European Security Research.

JRC's agenda in this area will be to provide technological and research, capability-driven, support to the development of

- the European area of Freedom, Security and Justice (protection from threats related to terrorism, crime, and fraud, border management, critical infrastructure protection, transport safety and security, security of the supply chain);
- Global Stability and Security (humanitarian aid, development cooperation, Common Foreign and Security Policy, community action for stability, and community action relevant to non-proliferation, and Neighbourhood policies)
- and an improved European capacity to respond to crises and disasters.

The relevant technologies include space observations, information technologies such as web intelligence, data mining, surveillance, detection, tracing and tracking. JRC will also further develop expertise and networks in risk analysis, vulnerability assessment, systems engineering and analysis, forensic profiling of synthetic drugs and statistics including data mining, geospatial analysis, communication and modelling technologies.



### 3.1 Internal Security

The focus of this part of the JRC agenda is to develop and apply information technologies and system analysis approaches to the fight against fraud, organised crime including money laundering, and illicit trafficking. Attention will be devoted to technological and methodological developments as well as analysis studies in support to the protection of critical infrastructure in key sectors at the European level (e.g. information systems, financial systems, industrial plants, public buildings, key sites and monuments, transport and distribution systems and infrastructures such as electricity and gas/oil), to the security of the supply chain, to integrated border management (including migration), to transport safety and security, as well as to the establishment of counterterrorism measures. The agenda will address prevention, preparedness and risk management in several actions where relevant. Provision of support to the EU Crisis room structure (ARGUS) is also foreseen.

BORSEC, ARTTS, ITeST,  
PVACS, EMM, SCNI, SITAFS

### 3.2 Disasters and Response

Actions will be dedicated to the development of better capacity to prevent, forecast and deal with natural and technological disasters. The portfolio includes systems dedicated to early warning, alert, monitoring and damage assessment. Modelling is given specific attention with respect to the occurrence of natural events such as floods and drought, for example in support of the Flood Action Programme. The reporting on and drawing lessons from natural and technological disasters will be maintained as key feature of progress in this area. The Action items are geared towards the provision of direct support to the Community civil protection mechanisms and to interventions by the Solidarity Fund. They are also linked to the development of services of the Global Monitoring for the Environment and Security (GMES) initiative.

MAHB, SAFECONSTRUCTION

### 3.3 Food and Feed Safety and Quality

This agenda focuses on the scientific and technical support to the development, implementation and monitoring of EU policies and legislation on food and feed safety and quality. Of particular importance is Regulation (EC) No 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. It identifies risk analysis as a fundamental component of food safety policy, establishes that the food chain as a whole must be taken into consideration and that products must be traceable at all stages of the food chain.

MonCoTraf

A major part of the work of the JRC in this area will be carried out in support to Regulation (EC) No 882/2004 on official controls performed to ensure the verification of compliance with food and feed law, animal health and animal welfare rules. This regulation integrates controls at all stages of production and emphasises the importance of reference materials and the quality of analytical results. Actions of the JRC will be in line with the Fork to Farm concept which takes into account consumers' demands and their feedback right along the food chain.

# BORSEC

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## Border Security (BORSEC)

Border security plays a key role in the context of the strategy towards a more coherent and efficient security policy across the EU. It is a key part of the central security strategy. In common with other crucial European coordination actions it is of considerable complexity at legal, technical and organisational levels. Progress in this area has, therefore, an important impact both on security within Europe and on the further realisation of Europe's political union.

The Border Security action supported crucial European endeavours by technical advice and support, as well as by conceptual studies to explore new approaches to Integrated Border Management and related issues. For selected areas of high strategic impact, such as biometric testing and electronic identification, BORSEC cooperates with other stakeholders to close existing technological gaps.

### Major 2007 achievements

#### Achievements towards interoperability of electronic passports

In support to the Brussels Interoperability Group, the action organised a number of workshops and meetings to foster interoperability of electronic passports of the EU Member States. The Brussels Interoperability Group is a technical sub group of the Article 6 committee, based on the Council Regulation (EC) No 1683/95, and considers all issues relating to the introduction of e-passports and travel documents by the EU and associated Member States. The Brussels Interoperability Group ensures that Member States achieve interoperability of their electronic passports. It acts as the focal point for resolving all technical issues that arise from the development, implementation and application of the electronic passports, including a Certificate Policy for control of access to the information stored in an e-passport.

In this framework, the Group finalised the specification for so-called "Extended Access Control", the mechanism to protect the confidentiality of the images of the fingerprints of the passport holder which are stored inside the chip of the passport. Based on this specification, a test specification was developed to test different Extended Access Control implementations for their conformity. To contribute to this development, BORSEC implemented its own test suit and participated in a first inter-comparison, in Paris in October 2007.

In an e-passport conformity test the Czech Republic and Italy were supported to test a total of about 50 e-passports. The test included the "Timing and framing tests" and the "RF Protocol and Application test". These tests were carried out according to the technical report of the International Civil Aviation Organisation and according to the ISO/IEC 10373-6:2001 standard.

#### Achievements in collaboration with the European Agency for the Management of Operational Cooperation at the External Borders (FRONTEX)

At FRONTEX's Green Border Workshop in July 2007, BORSEC presented the survey executed on green border surveillance in Austria and Finland. In this workshop, the findings of the report were presented to initiate an exchange between EU Member States' border guards. As a result, a Border Atlas was initiated to map these findings and to extend the study to the Bulgarian border.



*Biometric enrolment to the Misense system at the Heathrow Airport.*

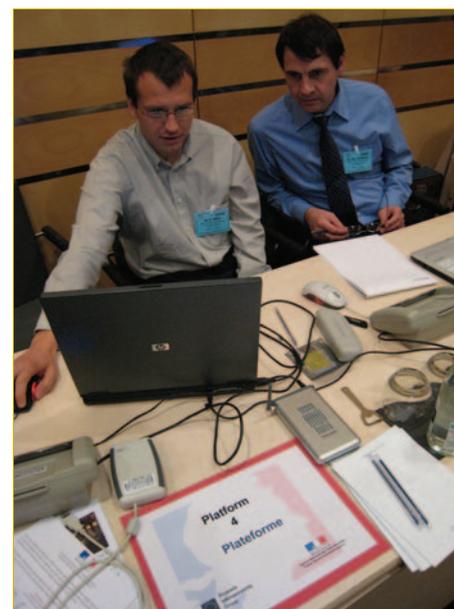
The results of the BIOPASS study, carried out in collaboration between FRONTEX, the BORSEC action and the JRC Security Service on automated biometric border crossing systems for registered passengers at European airports, were presented at a workshop. The study illustrates the use of biometric modalities for automated border crossing systems at the selected airports as a risk-management tool with potential for improving security and convenience of participating travellers. The European pioneers in the area of automated border crossing are: Schiphol Airport in Amsterdam, Frankfurt Airport, Heathrow Airport in London – all three based on iris recognition and Charles de Gaulle Airport in Paris, based on fingerprint recognition.

### Challenges for the future

Electronic Identification technology is likely to become more and more important in government applications, not only for passports but also for visas, ID cards, access control and cross-border judicial cooperation. It is essential that EU authorities are provided with accurate and up to date information on its real capabilities and limitations, including success/failure rates and any risks to security and privacy. Biometric identification using techniques such as fingerprint, iris and face recognition and multimodal biometrics, will be a major topic. JRC-IPSC's Optical and Electronic Laboratories are available for this purpose.

Encryption is the main means of protecting the citizen against breach of information privacy so cryptography is expected to be an important topic in the action. Privacy and identity management within large-scale IT systems across the EU is equally important and is a major challenge. Expertise derived from the project "Privacy and Identity Management for Europe" (PRIME) will allow the action to undertake analytical studies on this topic.

Border surveillance is another area of increasing concern, since EU enlargement has created a much longer land border. We envisage that optical and radar expertise within the JRC-IPSC will be applied to study emerging border surveillance technology, once again with FRONTEX as the main customer.



*BorSec staff testing e-passports at the cross-over and conformity test event of the Brussels Interoperability Group in Paris.*

## ARTTS

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*First responders need interoperable radios to communicate in a crisis situation.*

## Advanced Radar and Telecommunication Techniques for Security (ARTTS)

The action Advanced Radar and Telecommunications Techniques for Security (ARTTS) is a new action which started in 2007.

The action builds on a solid and well-recognized scientific background in Radio Frequency and Microwave measurements to provide independent expertise in radar and wireless communication technologies. The focus is to respond to new threats and improve the management of risks.

Particular emphasis is given to the investigation of emerging technologies and their technology performance and feasibility assessment against real and rapidly changing scenarios defined through a constant relationship with end-users and a systematic collection and analysis of their needs.

A key element of the action's activities is the operation of relevant and unique experimental facilities, which enables the design and execution of reference Test and Evaluation to support the policy making process, standardizing bodies, regulators, industrial partners as well as the scientific community.

### Major 2007 achievements

#### Experimental activity on radio interference measurements

The experimental activity on radio interference measurements has been significantly consolidated during the course of 2007. In this context, as a result of a series of reference measurements carried out by the JRC-IPSC, the Commission adopted the Decision 2007/131/EC on "allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community".

This Decision is based on the technical studies undertaken by the European Conference of Postal and Telecommunications Administrations (CEPT), which are included in the CEPT Report 017. The report uses the results of the screening attenuation measurements performed in the JRC-IPSC's European Microwave Signature Laboratory (EMSL).

The present activities are focused on the performance of reference interference measurements between radio services sharing the same frequency band in Europe, which are needed to assess the impact of the introduction of new services in the EU.

#### Standardization and Certification of Software Radio

Nowadays, security forces (police, fire brigades, Red Cross, etc.) use different and incompatible communication systems that hamper the exchange of information among different services and reduce the effectiveness of their work. The problem can be even bigger when services from different countries collaborate in the same operation.

Software Defined Radio (SDR) is considered one of the most promising technologies to overcome the problem of incompatible Radio Communication Systems. During the past year the JRC-IPSC has further developed its expertise in the field by developing Waveforms for SDR platforms capable of interoperate with presently used (legacy) radio communication systems such as Public Mobile Radio (PMR), in the 400 MHz band and DECT, in the 1800 MHz band.

The JRC-IPSC also supported the Project Team on SDR established by the European Defence Agency (EDA); in this framework the JRC-IPSC promoted the creation of a specific Sub-Group responsible to prepare a Strategy Document on Standardization and Certification.

In the area of SDR, the JRC-IPSC also carried out specific activity on standardization and certification in the framework of the project “Wireless Interoperability for Security” (WINTSEC) and within the EDA project SCORED.

The JRC also supported the European Telecommunications Standards Institute (ETSI) in the preparatory activity to start up a Technical Committee on Reconfigurable Radio System.

### Support to the emergency in Stromboli volcano activity

Also during 2007, and after the Stromboli Volcano eruption occurred on 27 February 2007, JRC-IPSC, in collaboration with the Earth Science Department of the University of Florence and the JRC’s spin-off company LisaLAB, has been responsible of the provision of displacement maps of the volcano with the LISA (Linear Synthetic Aperture high-resolution radar) equipment deployed in Stromboli.

On March 3rd at 14:00 GMT, as a result of the displacements maps produced, it was possible to forecast the creation of a new effusive vent on the north western flank. This event produced major morphological changes to the topography of the volcano, and in particular to the craters. The availability of the LISA imagery has been instrumental in the management of the crisis by the Italian Civil Protection Department.

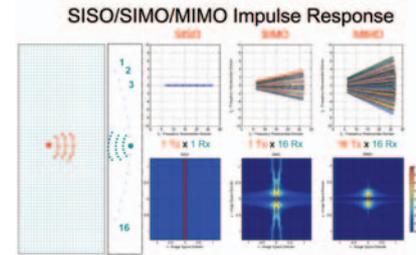
The LISA instrument is the core sensor of the monitoring network on the volcano since the beginning of 2003. Displacement maps of the area with sub-millimetre accuracy are delivered in real time to the Italian Civil Protection Department in Rome, updated every 10 minutes.

### Challenges for the future

The action will constantly strive to position itself as a recognized, independent and competent provider of scientific advice and reference data for the stakeholder’s community in wireless communications related topics.

This will respond to a specific demand of the relevant policy DGs which identified a specific role for the JRC-IPSC in the performance of reference interference measurements prior to the introduction of new radio services in the EU. Particular efforts will be devoted to the investigation of related topics, such as the identification of appropriate test and measurement procedures, interferences modelling and advanced techniques for spectrum occupancy monitoring. Specific research activities will be also initiated to deal with the challenging topic of extending the measurement capabilities to mm-wave (e.g. 60 GHz), where a number of new applications are currently being explored.

In parallel the investigation of innovative applications in the security domain of radio systems will continue exploring synergies and convergences of radar, communication and navigation (high precision positioning) technologies.



Example of resolution improvement in bidimensional imaging radar.1.

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## Integration and Testing of Supply Chain Security Technologies (ITeST)

The main focus of this action is to validate approaches for integrating security in supply chains in general (commercial containers; transport of small arms, weapons and explosives; people's mobility) and to test technological solutions with respect to interoperability, performance and conformance to standards.

By extending the use of solutions developed for nuclear applications and integrating them with the now broadly used techniques, such as RFID (Radio Frequency Identification) and GSM/GPRS (Global System for Mobile Communication/General Packet Radio Service), we can increase the traceability and security of goods and people, improve transport security, facilitate the detection of tampering/manipulation and of smuggling attempts, and reduce the threats of proliferation of small arms, weapons and explosives.

A promising solution is the RFID-based seal that embeds a programmable transponder storing information (e.g. on the container's itinerary, on events occurred, on people's positions or on the surrounding environment).

ITeST is developing different applications integrating intelligent seals (based on active and passive transponder technology) and other sensors in order to implement a fully intelligent system able to monitor and track over the Internet or GSM network the status and the position of containers, but also of objects and people.

### Major 2007 achievements

#### Container Security

Recent terrorist attacks significantly increased awareness of the need to improve transport security and to reduce the risk that containers are used as tools to smuggle weapons. The initiatives undertaken by the United States are of great relevance, followed by similar actions by the European Union, the G8 and international organisations that regulate the maritime industry – the International Maritime Organisation, the World Customs Organisation and the International Labour Organisation.

Smart seals based on passive and active transponders used to secure the container main door were developed and tested focusing on an analysis of the cost range and the false alarm rate.

An Integrated Alarm System, checking the internal volume of the container, was developed and is under testing. The alarm does not require any infrastructure for communication: it uses the commercial GSM and GPS networks. The integration with smart seals based on active transponders is under study. This will avoid the costly infrastructure dedicated to reading the seals.

#### Identification and tracking of small arms, light weapons (SALW)

JRC-IPSC participated in establishing a Network of Excellence of Experts on Conventional Weapons to which Commission services can turn to for advice and that would be the cornerstone for a JRC-based capacity for highly specialised work (e.g. technical assessment, technological solutions...) in the field of arms control, disarmament and non-proliferation.

In order to control and contain illicit trafficking of small arms and light weapons ITeST discussed with the concerned industry the technologies under development at JRC-IPSC, establishing also a cooperation with European major weapon



*Passive electronic seal with three transponders on a container.*



*Ultrasonic identification of small arms & weapons.*

industries in order to concretely demonstrate the feasibility of tracing and marking techniques tested in the laboratory on real weapons.

#### Identification and tracking of explosives and detonators

Explosives have played a deadly role in terrorist attacks in Europe and elsewhere and the Commission is currently launching several initiatives to enhance the security of the EU against this threat. Upon request from the Directorate General for External Relations (DG RELEX) the Directorate General for Justice, Freedom and Security (DG JLS) and the Directorate General for Enterprise and Industry (DG ENTR) the following activities were carried out:

- detection of explosives in plastic casings;
- exploiting ultrasonic, RX & RFID techniques and methods for identification, tracking and detection of detonators and explosives.

#### Innovative technologies for assisting disabled people

By applying the RFID technology used for container security and traceability of weapons, ITeST developed an innovative system to guide visually impaired people and improve their security/mobility. This system, patent pending, is called Sesamonet (Safe and Secure Mobility Network).

RFID passive transponders are placed in the pavement to create a path. A walking cane, with an antenna on the tip and reading system, detects and reads the signal sent by the RFID, through a bluetooth channel, to a smart phone. The smart phone equipped with a database retrieves the information on the location, elaborates the signal and communicates to the visually impaired the information on the path. The system can operate any electromechanical device which can be linked to a serial port, such as a traffic light, by reading the transponder close to it. Sesamonet is powerful: it allows a person to be guided along the electronic path automatically inverting the navigation's logic when the user changes direction and to enter the path from any generic position.

A first demo was realized inside the JRC's site in Ispra (Italy) in 2006. On 19 October 2007 in the city of Laveno (Varese, Italy) a full scale test trial was officially opened in the presence of the Vice President of the European Parliament (Mr M. Mauro), the Italian authorities and the Italian and European blind associations' representatives. The Laveno test trial gave visually impaired users the opportunity to test all the features of the system. A second demonstration was done in December in the park of Prealpi Giulie (Udine, Italy). Several public administrations have expressed real interest for Sesamonet and are willing to create real scale Sesamonet paths in central walking areas.

#### Challenges for the Future

The Commission has launched a strengthened co-operation on supply chain security with China by agreeing on a pilot project on smart and secure trade lanes. The pilot cooperation involves the customs of China, the United Kingdom and the Netherlands, as well as the Directorate General for Taxation and Customs Union (DG TAXUD) as coordinator and started with container movements in November 2007. DG TAXUD showed interest in the work developed at JRC-IPSC both on development-testing and on vulnerability analysis on seals in general and electronic seals for container security and in 2008 an administrative arrangement will be signed to formalize the request for collaborating on the pilot project and participating in the definition of standards.

DG JLS will sign an administrative agreement to continue the task on explosive security. The techniques under development at JRC-IPSC will be fine-tuned and presented to the industry and the Member States. A further effort will be required to test the newest ultrasonic, RX and RFID equipment available on the market.



*Vice President of the European Parliament Mario Mauro at the SESAMONET opening in Laveno.*

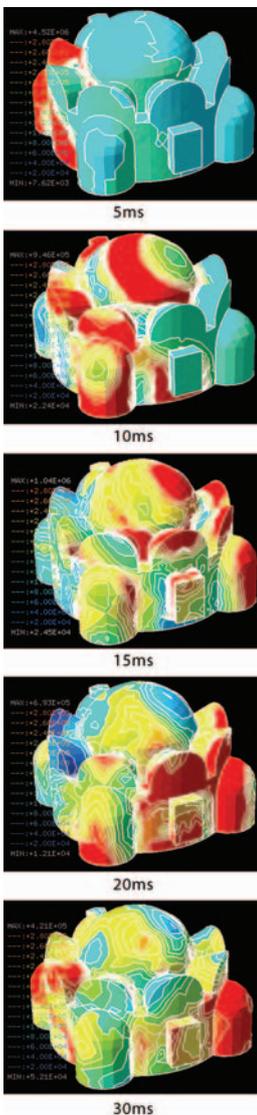


*SESAMONET: the walking cane, the transponder.*

# PVACS

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*Simulation with Europlexus of the evolution of the pressure distribution on the interior walls for a bomb explosion inside the closed space of a small, church-like structure; a multitude of reflections is clearly seen.*

## Physical Vulnerability Assessment of Critical Structures (PVACS)

This action deals with the risk mitigation of terrorist acts involving explosives, through the development of vulnerability assessment methodologies of their effects on structures and their occupants. The rationale is that if all precautionary measures fail to prevent such events, it will be the physical structure itself, in terms of mechanical resistance, integrity and robustness, to bear the first consequences. If adequate provisions against abnormal loads, such as blast, explosion and impact, have been taken in the design, it is possible that catastrophic consequences will be contained and major disasters avoided. The approach followed is based mainly on computational structural mechanics and is aided by laboratory experiments.

### Major 2007 achievements

#### Simulation techniques

Development of numerical simulation techniques for the assessment of the structural vulnerability of several construction types has been extensively pursued. All activities have been carried out within the code EUROPLEXUS. This is a structural analysis programme based on an explicit finite element formulation, and it is suitable for studying fast dynamic responses of structures (explosions, impacts, crashes, etc.), with special capabilities for modelling fluid-structure interaction phenomena. It has been co-developed by the JRC-IPSC and the French Commissariat à l'Énergie Atomique (CEA).

Efforts have been focused into simulating both open-air blasts, with geometries representative of urban environment, and explosions in closed spaces. The complex pressure wave propagation patterns, due to multiple reflections and tunnelling effects, have been efficiently and reliably obtained in each case. Areas of high risk for the occupants, with respect to injuries potentially induced to humans due to blast wave effects and flying debris, have been identified for several explosion scenarios.

In this context, models for the debris generation and projection, based on element erosion techniques, have also been developed and implemented in the code. The efficiency of Europlexus to simulate the process of detonation of a solid TNT explosive has also been tested and validated using the Jones-Wilkins-Lee equation of state for the explosive. However, for reducing computational effort and costs, other approaches, like the compressed air-bubble and the load-time function models, have been explored and implemented in the code.

#### Experimental activity

Reliable structural predictions require realistic material models in the simulation codes, and the need naturally arises to characterize the construction materials under the actual conditions of their employment (higher strain-rates, temperature, fatigue etc.).

In the past year the experimental activity has been focused on investigating the dynamic compression properties of concrete under lateral confinement. This least understood aspect of this widely used material is crucial for modelling the penetration of thick concrete walls by missiles and projectiles, or for contact detonations. The investigation has been successfully conducted, in collaboration with the Délégation Générale pour l'Armement (DGA, French Ministry of Defence).

The testing has been challenging and particularly demanding due to the very high dynamic pulses required. It was carried out at the Large Hopkinson Bar of the JRC-IPSC, which was properly configured for this purpose. Several concrete mixes were tested, while confinement was provided by a steel jacket, inside which the specimen was fixed. The dramatic change of the compressive behaviour of concrete due to such confinement, which reached almost 0.2GPa, was clearly observed.

### The RAILPROTECT project

Its full name is “Innovative Technologies for Safer and More Secure Land Mass Transport Infrastructures under Terrorist Attacks”. The project started in late 2006 in support of the transport security policies of the Directorate General for Energy and Transport (DG TREN). It deals with the physical protection and mitigation of the bombing attacks risk in the rail transport sector. It is expected to contribute to alleviating the vulnerability of Europe’s passenger land transport infrastructures, and it will provide assurances to the European public that the level of security and safety in the land mass transport has been upgraded (as in the air and maritime transport). Both station infrastructures and rolling stock fall within its scope.

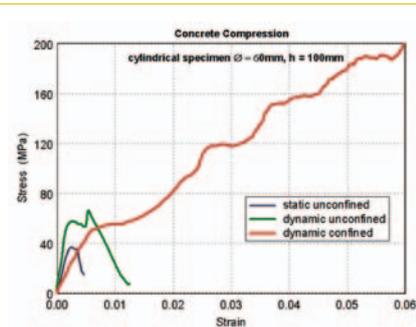
Proceeding with the project, besides the blast analysis treatment itself, the upfront problem of the non-availability of the geometry of the structures, especially of the older stations, had to be solved. In collaboration with the project partners, a field intervention at the Gare de Lyon in Paris was made in September 2007. Two areas of the station and a subway coach were successfully mapped using the 3D laser scanning technique “RECONSTRUCTOR”, developed by the JRC-IPSC. These geometric data are currently being elaborated and adapted for use in Europlexus for the numerical simulations of bomb explosion effects. A major milestone of the project has thus been accomplished.

### Further activities

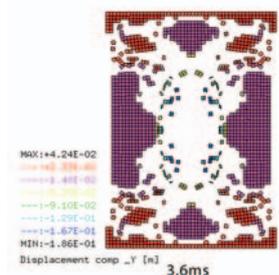
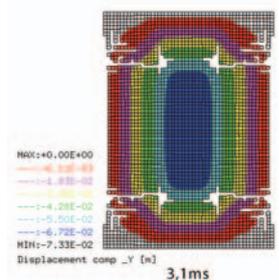
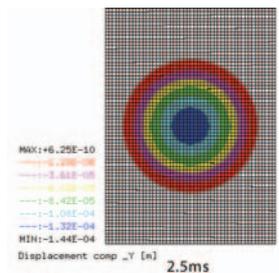
The objectives of PVACS include also the development of mathematical methods for the vulnerability analysis of networked critical infrastructures, whose nodes represent physical structures subject to threat and damage. Flanking this work, a new FP6 competitive project started in 2007 in this area: MANMADE “Diagnosing vulnerability, emergent phenomena, and volatility in man-made networks”. Concerning standardization, contacts with the European Committee for Standardization (CEN) have been maintained through the Expert Group “Critical Infrastructure - Building and Civil Engineering Works” within CEN/BT/WG161 “Protection and Security of the Citizen”.

### Challenges for the future

The major challenges lying ahead for 2008 are (a) the successful conduction and completion of the RAILPROTECT project, where an urgent, real problem and many external collaborators are involved, and (b) the upgrade of the Large Hopkinson Bar facility. Both will be critical for the future development of the activity.



Concrete behaviour for different loading conditions: the strength is almost doubled from static to dynamic loading, and it is increased many times under dynamic confined conditions.



Simulation with Europlexus of the evolution of the displacement distribution, failure and formation of projectiles (shards) for an annealed glass panel of dimensions  $1\text{m} \times 1.4\text{m} \times 0.001\text{m}$ , subjected to blast due to 3kg of TNT at 3.5m distance.

## EMM

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## Web Mining and Intelligence (EMM)

The main objective of this action is to support the European Commission in its policies for public health, security, crisis management and communication. This is achieved through the development and maintenance of a number of systems and services, all having Open Source Information as a common input. This information is gathered in real time and transformed using a range of techniques such as classification, text mining, automated machine learning and statistical analysis, all of which form the scientific backbone of this action.

One of the main products of this action, which has been enhanced significantly in 2007, is the Europe Media Monitor (EMM). This system monitors news media sources on the World Wide Web from all around the world in multiple languages, classifies the news, analyses the news using information extraction techniques, aggregates the information, provides notifications depending on their content and provides visual presentation of the information found. The fact that this system monitors, in real time, 40.000 new news articles per day from 1500 news web-sites world-wide in 35 different languages, makes the system unique.

### Major 2007 achievements

#### Multilingual Media Monitoring as an expanding set of Integrated Processes

At the start of 2007 EMM could automatically classify new articles according to its content and categorised by some 600 alerts. The first new development in 2007 made it possible for the system to automatically group articles by subject, based on content analysis. This clustering system analyses the last 4-8 hours worth of news articles every 10 minutes to determine the main stories in the news. A story tracker module analyses the differences between subsequent executions to effectively track the development of a story in time. A new module added this year identifies known people and organisations in the text by matching it with a machine-generated database containing millions of entries. In a similar fashion, another new module determines the geographical locations mentioned. The result of these modules is used in the clustering process to determine the best geographical position based on the location of all the articles in the group, which can then be visualised on interactive maps like Google World<sup>11</sup>.

#### Near Real Time Violent Event and Disaster Detection

Another notable development allows the near real time detection of events and natural disasters. An event extraction engine detects violent event or disaster information such as the actors, the actions, the means (weapons for violent events and phenomena for natural disasters), victims and casualties. The event information is then updated every 10 minutes and displayed on a world map. The system currently only processes articles in English, but it has been designed to support almost any language.

Thanks to the promising results of these operational systems, the African Union's Continental Early Warning system will deploy and exploit these systems directly.

#### EMM-Labs

EMM-Labs demonstrates a number of products showcasing other techniques, for instance, Country and Theme information sheets that gather and display statistics about the co-occurrence in texts of countries and certain alerts (i.e. categories). Another product is a Social Network Browser that allows the visualisation of relations like meeting, support, criticism and family relationships, which are automatically extracted from the news articles. A media impact tool was created that determines who is talking about what and where. Moreover, a



11. <http://press.jrc.it/geo?type=cluster&format=ref&language=all>. Other results of this process are available to the general public free of charge on the EMM website (<http://emm.jrc.it/overview.html>).

media-network browser was developed, showing the relations between real-time news clusters, countries and alerts.

### **Open Source Intelligence (OSINT) Suite**

A new and improved version of the OSINT Suite desktop software was released. The OSINT Suite incorporates language technology tools into an easy to use package. The software is used by analysts of law-enforcement agencies in EU Member States to retrieve and analyse documents from the internet quicker and with better results. A new graphical component visualises the relationships of persons and organisations found during analysis.

### **Medical Information Aggregation and Health Early Warning**

The Medical Information System MedISys is a concrete example of the application of EMM technology to rapidly identify threats to public health using information from the internet. In addition to the news feeds from EMM, MedISys monitors some 150 dedicated medical sites and can provide alerts on threats like communicable diseases, risks related to chemical, biological and nuclear accidents.

MedISys organises articles into specific categories that are defined by keyword combinations and maintains statistics for each occurrence so that breaking news can be identified. This means that it is able to suppress news “noise” and provide health alerts for early warning. As MedISys aggregates information from multiple countries in different languages users may be warned about relevant health threats even before they are reported in their own languages.

### **Rapid News System (RNS)**

RNS is an editorial system that allows the manual selection of articles harvested and classified by EMM in order to produce a news brief or to notify interested parties by e-mail or sms. The news brief can then be published on-line or as a pdf document and sent by e-mail. The system is in daily use by the Directorate General for Communication (DG COMM) to produce EMM Panorama, and by the Directorate General for Agriculture and Rural Development (DG AGRI) and the Directorate General for Energy and Transport (DG TREN) to produce in-house newsletters. A major development in 2007 has been the integration of the production of the EMM Review, the press cuttings product of DG COMM. This now allows DG COMM to produce their main products using one single programme, and will allow further integration of EMM Review and EMM Panorama in the future.

### **Challenges for the future**

Challenges for 2008 will include the extension of the event extraction system to deal with languages other than English. A Blog Monitoring system will be developed for both political analysis and support to the OSINT development. This will be linked with research on automatic sentiment detection. The MedISys system will be interfaced to a large medical term taxonomy (MESH) to provide high quality medical classification of articles. Research will be carried out in the area of the automatic generation of summaries from multiple documents, and into the operational applicability of the current state of the art in speech to text software.

#### **EMM NewsBrief facts 2007**

- 24/7 coverage of 1500 news web sites world wide
- 40.000 new articles/day
- 30.000 distinct visitors/day on press.jrc.it
- 1.000.000 hits/day on press.jrc.it
- 12.000 e-mails sent/day to subscribers
- on-line since July 2002

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## Security of Critical Networked Infrastructures (SCNI)

During 2007 the action Security of Critical Networked Infrastructures (SCNI) has conducted research and produced policy support concerning the subject of vulnerabilities of information and communication systems and power systems. The policy context is given by the initiative regarding the European Programme for Critical Infrastructure Protection. The protection of telecommunications and energy infrastructural systems is recognised as an urgent priority. The work carried out by SCNI aims at:

- developing and applying security assessment methods, including the modelling security features and events (such as vulnerabilities and attacks);
- implementing tools and platforms for the simulation of security events;
- studying and putting into practice mechanisms for the exchange of sensitive security data among public and private actors;
- analysing the evolution of technologies with reference to R&D roadmaps and standardization needs.

### Major 2007 achievements

#### Completion of the tool INSAW

In 2007, SCNI completed the theoretical developments and the software implementation of the Industrial Security Assessment Workbench (INSAW), a framework for the identification and analysis of the security of Information and Communication Technologies (ICT) systems in industrial settings.

The tool has been applied, with the help of industry, to realistic cases, validating its performance and potential value. It is worth noting the need by industry to analyse their systems, and the scarcity of mature assessment tools.

The tool has been completed with libraries that describe the most common devices in use in the power sector, and will be distributed in 2008 to interested users.

#### Implementation of the SCADA Cybersecurity Laboratory

During 2007, SCNI collaborated with the power company ENEL S.p.A. (Italy) in the development of a cybersecurity laboratory dedicated to the industrial control systems (a.k.a. SCADA – Supervisory Control and Data Acquisition systems) of power stations.

This is a unique, one-of-a-kind facility, which is intended to support experimental security activities in Europe in the next years.

The laboratory is situated at the ENEL Research premises in Livorno (Italy), where the project took advantage of the availability of the existing Idrolab facility for the simulation of the thermodynamic cycle of thermal power plants, with the associated three SCADA systems and a control room.

JRC-IPSC was in charge of the design, development and deployment of the testing platform.

The platform was used for the verification of potential attacks, and the results were presented to the satisfaction of operators, engineers and industrial sponsors.



Facility "IdroLab" for the simulation of cyberattacks to power stations (© ENEL).

### Development of malicious software (malware) simulation tools

One of the most important problems related to the simulation of attacks against critical infrastructures is the lack of adequate tools for the simulation of malicious software (malware). Malware attacks are the most frequent in the Internet and they pose a serious threat against critical networked infrastructures. For this reason, SCNI has produced the tool MalSim (Mobile Agent Malware Simulator of malware), a framework implemented as a software toolkit for emulating the behaviour of malicious software in computer networks. MalSim can be used for impersonating malware (worms, viruses, malicious mobile code etc.) in security testing platforms, making reference to well-known malware (e.g. Code Red, Nimda, SQL Slammer), to generic malicious behaviours (e.g. rootkits, backdoors), or to hypothetical new malicious codes (e.g. targeted threats).

### A platform of the exchange of sensitive security data

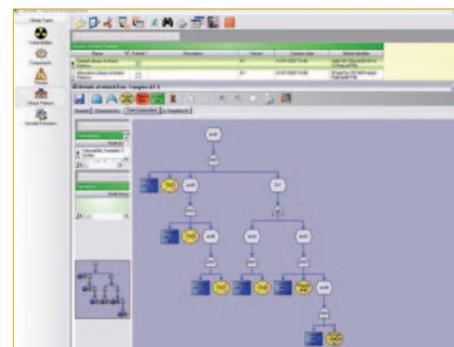
SCNI is developing the project SecNet, for the development of a platform for information exchange on the SECurity of critical NETworked Infrastructures. In 2007 the work has concentrated on the exploration of theoretical concepts, the needs and challenges involved in the implementation of an electronic communication system, and the development of first prototypes. The objective is to enable the sharing of security related information among private and public stakeholders. The project aims at implementing the Traffic Light Protocol (TLP), and existing communication protocol for face-to-face meetings, in use in some EU countries. Currently the application of the TLP is limited to physical meetings and - to some extent and with difficulties - to e-mail communications. Europe might greatly benefit from a system permitting the direct connection among geographically distributed stakeholders.

### Challenges for the future

One of the most important challenges that our society confront is the protection of critical infrastructures. This implies demanding decisions by the companies operating those systems and by the national authorities. These decisions should be based on the best possible data and evidence. It is nowadays generally understood that those data and evidence – as in other scientific and technological fields – should be obtained following rigorous, systematic methods and making use of appropriate testing settings.

SCNI will expand in the next years R&D in the field of experimental security, including the development of systematic approaches, the extension of the simulation tools, and the study of the feasibility of networking with other similar undertakings in Europe and worldwide.

In parallel, as those data should be shared by all interested parties but should be distributed following the strictest conditions due to its sensitive nature, SCNI will continue its studies on the exchange of security information. It is planned to deploy during 2008 a first prototype that will be validated with industrial and governmental actors.



*Modelling attacks with the tool INSAW.*

## SITAFS

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## Statistics and Information Technologies for Anti-Fraud and Security (SITAFS)

The action Statistics and Information Technology for Anti-Fraud and Security (SITAFS) is a new action that brings together two pools of expertise in Statistics and Computer Science applied on a variety of problems of interest to the European Anti-fraud Office (OLAF): enlargement, agriculture, customs, external aid, and the non-profit sector. Although the primary customer of the action is OLAF, the problems addressed by the action, such as the misuse of aid funds and the vulnerability of the non-profit sector to organised crime and terrorist financing, are also of particular interest to the Directorate General for Justice, Freedom and Security (DG JLS), the Humanitarian Aid Office (ECHO) and the Europe Aid Office (AIDCO).

In 2007, the activities of the action comprised:

- the formulation of fraud control problems as patterns to be detected in appropriate datasets and the development of innovative statistical methods to detect the patterns;
- packaging of the statistical methods above and accessing them with graphical user interfaces for making the methods easily accessible by end-users - the user friendly anti-fraud software “ARIADNE”
- the dissemination of results to an expanding community of end-users in the Commission and in the Member States through the action’s website “THESEUS”.

The exploitation of results produced by the work above has been supported by the execution of a sequence of administrative agreements with OLAF on the Automated Monitoring Tool for External Trade.

The action further advanced the project “Transparent Aid” (TR-AID), a system that automatically gathers data on development and humanitarian aid primarily from open sources. TR-AID is currently assisting OLAF in enhancing Community monitoring and control capacities for aid funds to prevent their misuse for criminal activities including fraud.

In addition, the action, in consortium with other industrial and academic partners, contributed to the project Next Generation of Anti-terrorist Financing Methods (GATE).<sup>12</sup>

### Major 2007 achievements

The new pattern of downward spikes, i.e. unexpected strong decreases in trade between two countries of a product, has been related to the detection of deflection of trade. The pattern detection was implemented and presented to subject matter experts and analysts in the Workshop for the Dissemination of Statistical Methods and Tools for the Protection of the Budget of the European Community, organised in Ispra on 29-30 November 2007. This pattern has thus been added to the list of upward spikes, outliers in trade and systematic underpricing. The patterns, detected in a multitude of datasets, give rise to signals or “alerts” that, depending on the trade dataset explored, indicate possible instances of a wide range of fraud control problems such as stockpiling before EU enlargements, fraud in payment of export refunds, deflection of trade to evade import duties or quotas in force for imports into the EU, trade based money laundering, etc. SITAFS has thus enriched the matrix of patterns and fraud control problems [Figure 1].

	↑ spikes	outliers	↓ spikes	systematic underpricing
Stockpiling	*			
Fraud in Export Refunds	*			
Evasion of anti-dumping or import duties		→ (low price outliers)		*
Deflection of Trade	←, partly		←, partly	
M.A. trade based		→ (high and low price outliers)		

Figure 1: Fraud control problems and patterns matrix

12. GATE: <http://www.exodus.gr/gate>

A new approach, the forward search, was applied and developed in collaboration with the University of Parma for the detection of outliers in trade data. Results were presented in two international events: the annual conference of the Classification and Data Analysis Group (CLADAG), Macerata Italy, 12-14 September 2007 and the JRC/NATO workshop on Mining Massive Data Sets for Security, Gazzada, Italy, 10-21 September 2007.

The restricted area of the action website THESEUS (<http://theseus.jrc.ec.europa.eu>) was enriched with a variety of options for sorting, filtering, rolling-over graphs, and links to open sources. These add-ons, together with the continuous enrichment of the website content have expanded the end-user community of the website and intensified its use. The website is being actively used by 25 users in the EU Member States. In 2007, more than 6000 data items (reports, tables of signals, graphs) were retrieved through the THESEUS website by its user community (excluding the JRC).

2007 was the first year in which some modules of the ARIADNE user friendly anti-fraud software developed by SITAFS were used successfully at the premises of action's primary customer. OLAF proposed to operationally use ARIADNE to produce anti-fraud relevant signals after EU Member State requests, on appropriate datasets.

### Challenges for the future

With regard to modelling and development of methods, the prime objective and challenge of the action is to extend the fraud control problems and patterns matrix in rows (for fraud problems), columns (for patterns) and cells (relevance of patterns to fraud problems) and develop new statistical procedures for the detection of the patterns therein.

With regard to applications, customs agencies in three EU Member States have agreed to provide in 2008 anonymised dis-aggregated import/export data for a systematic scanning for statistically significant high or low prices reported by importers and exporters. After being contacted by the Directorate General for Internal Market and Services (DG MARKT), the Financial Intelligence Units (FIU) in two of the Member States have agreed to examine the results obtained and evaluate the usefulness of the methodology to be applied for the detection of trade-based money laundering. It is expected that this project will be the first of its kind to apply a rigorous statistical method to detect price outliers on imports/exports data and submit results to both customs services and the FIUs for jointly protecting against losses of revenues to the budget of EU Member States and against trade-based money laundering.

In 2008, the TR-AID system will produce a consistent data repository that is richer in content, and that can be queried and analysed by a variety of users ranging from fraud investigators to managers of aid funds or those looking for an overview of how aid is spent round the world.

## CONTACT

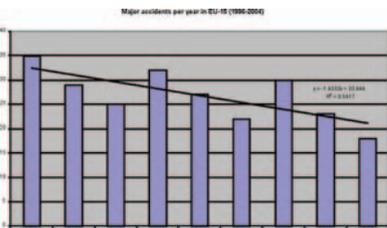
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## MAHB

The Major Accident Hazards Bureau (MAHB) provides research-based scientific support to the European Community on the formulation, implementation and monitoring of EU policies for the control of major accident hazards, chiefly the Seveso II Directive. DG ENV and the Seveso Competent Authorities rely on MAHB for receiving guidance for the implementation of the legislation. MAHB has also an instrumental role in managing the European accidents database, analysing trends in accident occurrence, and identifying and disseminating lessons learnt in order to prevent recurrence of similar events.



Search Accidents web  
 (Choose one or more items)  
 Accident number (EU-registered) [ ] and [ ]  
 between [ ] and [ ]  
 Event Type [ ] Industry Type [ ]  
 Accident Type [ ] Environmental Category (Seveso II) [ ] Seveso Category [ ] Seveso Directive [ ]  
 Occurrence status [ ] Occurrence type (Seveso II) [ ] Occurrence type (Seveso I) [ ]  
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 Full text search: [ ]



*The e-MARS system for identification and dissemination of lessons learned from past accidents. Trends in major accident occurrences in Europe.*

## Risk Analysis for Industrial Accidents and Natural Disasters (MAHB)

This action deals with the safety and security of industrial installations, addressing the protection of the citizen from accidental and intentional threats related to the operation of chemical industrial facilities.

### Major 2007 achievements

#### The Major Accident Reporting System

A number of obligations put on the Commission by the Seveso Directive<sup>13</sup> are being fulfilled through activities entrusted to MAHB. Such key activities are the Major Accident Reporting System (MARS) and the Seveso Plants Information Retrieval System (SPIRS), which are both maintained and managed by MAHB. MARS is the reference major accidents database worldwide. It contains the accident reports submitted by the EU Member States in the context of the Seveso Directive and from countries belonging to the Organization for Economic Cooperation and Development (OECD) according to a voluntary scheme. In 2007 the e-MARS internet-based tool (<http://mahb-srv.jrc.it>) has been developed and became available to the authorities, the industry and the general public, allowing through simple searches full access to the accident reports for the identification of lessons learned, causes and consequences of the major accidents. Moreover, a number of analyses on selected safety topics were performed, trend analyses and lessons learnt were disseminated, while a workshop, jointly organised with the European Safety, Reliability & Data Association (ESReDA), examined the “Challenges in Accident Investigations”. In parallel, the SPIRS system, presently containing data on about 8500 establishments from the EU and EEA countries, was successfully managed, providing the Commission and the Member States with useful insights on the profile of industrial hazards.

#### Guidelines and databases

The consistent and efficient implementation of the legislation is ensured through guidelines and common databases, which are developed by MAHB in close collaboration with the Member States and the industry. In June 2007 the Commission Decision C(2007)2371 approved the Guidance documents developed by MAHB in response to the request of the Parliament and the Amendment Directive<sup>14</sup>, namely:

- guidelines for the preparation of a Safety Report;
- guidelines for Land-Use Planning in the context of major accident hazards;
- a technical database with risk data and scenarios to be used in the underlying risk assessments evaluating the compatibility between Seveso plants and residential areas. This database is a big step forward for more transparent and consistent land-use planning decisions.

#### Support to the network of inspectors

MAHB, in agreement with the Directorate General for the Environment (DG ENV), has established and manages a network of inspectors from the Member States, who jointly analyse case studies, exchange experience and good practices and define recommendations on crucial issues of the inspection policies. In 2007, MAHB organised two such case-studies/visits in Poland and Romania, it launched a dedicated web site for the Seveso inspectors and published two recommendation documents on “Necessary Measures for Preventing Major Accidents at Petroleum Storage Depots” and on “Improving Major Hazard Control at Petroleum Oil Refineries”.

13. Directive 96/82/EC on the control of major accident hazards involving dangerous substances, OJ L 10, 14.1.97.

14. Directive 2003/105/EC, OJ L 345, 31.12.2003, pp.97-105.

### Protection of Seveso plants

Due to the presence of dangerous substances and their importance for the national economy, Seveso plants are often considered as critical installations and need to be protected not only from accidental but also from intentional causes of accidents, including terrorist acts. MAHB participated in the SECURE-SITE research project, funded by the Directorate General for Justice, Freedom and Security (DG JLS), focusing on the analysis of methodologies, regulatory framework and protection measures for the security of those Seveso plants regarded as Critical Installations.

### Natech disasters (Natural event triggered technological disasters)

The research of MAHB in this area focuses on the development of methodologies for assessment and management of natech risks and the development of a database of past natech events for analysing these disasters and drawing lessons on how initiating natural events escalate into accidents. Highlights of 2007 include the development of a rapid natech risk assessment method that was validated in an experts' workshop in September, the assessment of impact of floods and forest fires on industrial facilities, and the preparation of a Special Issue of the Natural Hazards Journal devoted to natech risks.

### Coping with Disasters

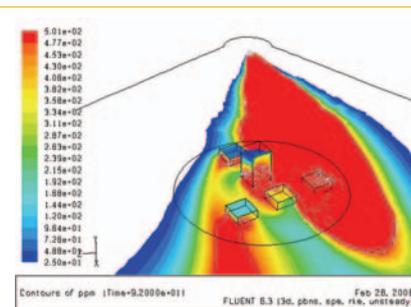
Motivated by the urgent need to think beyond short-term disaster management goals, the action, in collaboration with the International Institute for Advanced System Analysis (IIASA) and the University of Kyoto, organised an international Conference on "Coping with Disasters: Global Challenges for the 21<sup>st</sup> Century and Beyond", where more than 160 experts from all over the world analysed the challenges that lie ahead in an ever increasingly populated, urbanized, and complex world. In this context, MAHB is involved in the Disaster Reduction Hyperbase initiative, aiming at identifying and evaluating disaster risk reduction measures and technologies applicable in developing countries. Moreover, the Natural and Environmental Disasters Information Exchange System (NEDIES - <http://nedies.jrc.it/>) contains a rich collection of disaster management reports, lessons learnt and practices for prevention, preparedness and response to disasters, valuable to civil protection.

### Integration and Enlargement activities

The action has been very active in Integration and Enlargement activities, assisting the New Member States and Candidate Countries (NMS&CC) to achieve the *acquis communautaire*. In this context, a series of training workshops on safety management issues were organised and research/dissemination projects were carried out in collaboration with institutions from NMS&CC, focusing on uncertainties in risk assessment and Multi-hazard risk mapping.

### Challenges for the future

Future challenges include the assessment of major accident potential of industrial substances and activities, the development of a complete suite for assessment and management of all hazards (natural, accidental, intentional), improvement of consistency in risk assessments, and use of lessons learnt from past accidents for building resilience in chemical facilities.



*Use of CFD (Computational Fluid Dynamics) codes for modelling the dispersion of toxic releases in a complex environment.*

### What are Natech disasters?

Natural disasters can trigger technological accidents with severe consequences to the population and/or the environment, due to the release of hazardous materials processed or stored on site. These so-called Natech disasters deserve particular attention, as they can cause multiple hazardous-material releases.

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## Research in Support of Risk Analysis in Construction and Construction Products (SAFECONSTRUCTION)

The JRC-IPSC has been strongly involved in research work in support of the Eurocodes - the European Standards providing methods for the design of structures (buildings and civil engineering works) and structural products. SAFECONSTRUCTION is now contributing to their implementation and further development.

The experience, expertise and research facilities of the JRC-IPSC are unique in Europe and are now pooled for a more ambitious objective of development of advanced European standards and design guidelines, which should serve as a major instrument to increase competitiveness of the EU construction industry in the internal and the global markets and to contribute to the effective implementation of other construction related policies (e.g. safety, security, sustainability).

SAFECONSTRUCTION addresses also technical and scientific aspects related to vulnerability assessment of existing constructions, especially under earthquake loading and develops/calibrates new design methods and risk mitigation strategies, including innovative technologies for retrofitting of vulnerable constructions. The action also fosters co-operation amongst the major European laboratories in earthquake engineering and structural dynamics through IT based networking and will provide support to standardisation for enhanced earthquake protection.

### Major 2007 achievements

#### Support to implementation and further development of the Eurocodes

SAFECONSTRUCTION, in collaboration with the for Enterprise and Industry (DG ENTR), the European Committee for Standardisation CEN/TC250 and European experts, achieved a road map for further expansion of the Eurocodes to tackle the different dimensions of sustainable development in construction and the need to respond to recent and foreseeable market developments. Future needs for pre-normative research in support of the European standards and codes have been justified, in particular concerning the improved fire protection and the use of emerging technologies and materials (e.g. glass) in the construction sector.

Many Member States subscribed to the Database for the Nationally Determined Parameters (NDPs), and started uploading national annexes to the European Standards as a means of notification for the national implementation and as a fundamental source of data for the further harmonisation of the Eurocodes. Moreover, substantial progress was achieved in the development of related informatics tools, namely:

- the Centralised Helpdesk, which is a platform for the maintenance of the Eurocodes linking National Standardisation bodies, National Authorities, CEN TC250 and the European Commission
- the Database for background documents on the Eurocodes which is a unique source of information on the theoretical justification of the Eurocodes technical rules, on the recommendations for the NDPs and on the national decisions about the choice of the NDPs.

#### “Dissemination of information for training” workshop

The major European training event on the Eurocodes was organised by the European Commission (DG ENTR) and the JRC-IPSC with the support of CEN/TC250, CEN Management Centre, EU and EFTA Member States on 18-20 February 2008.

The workshop aimed at enhancing the training potential of the Member States by provision of state-of-the-art knowledge, training material and background information on the Eurocodes. <http://eurocodes.jrc.ec.europa.eu/>



### Technical and Scientific Field Mission to Peru

The JRC-IPSC carried out a field mission during the week of 5-12 September 2007 in the areas affected by the 2007 August 15 Magnitude 7.9 Earthquake near the coast of Central Peru. The main objectives of the mission were to collect data and make observations leading to improvements in design methods and techniques for strengthening and retrofit, and to assist the phase of reconstruction. The mission focused on the behaviour of non-engineered structures, in particular those of adobe construction, which caused 519 deaths and 1844 injuries after the collapse of more than 70,000 houses.

The field mission consisted of surveying the damaged areas of the Province of Ica, in particular the cities of Pisco, Ica and Chincha Alta. Special attention was given to surveying the rural mountain areas up the valley of the Cañete river.

### Reference tests carried out at the European Laboratory for Structural Assessment (ELSA)

The competitive project ESECMaSE (Enhanced Safety and Efficient Construction of Masonry Structures in Europe) aims at an improvement of knowledge in the seismic design of masonry in order to enhance harmonised European design standards (Eurocodes 6 and 8). The final experimental task of the project consisted of a series of pseudo-dynamic tests on a selected full-scale masonry building model, a 2-storey terraced house, in order to assess its earthquake performance and also to verify the theoretical, numerical and experimental findings obtained within the other tasks of the project. [Figure 1]

### Safety and Security of Nuclear Power Plants

SACONSTRUCTION has collaborated with the International Atomic Energy Agency (IAEA) in the area of the protection and security of the citizens against the consequences of strong earthquakes on Nuclear Power Plants (NPPs) and other nuclear facilities.

The JRC-IPSC contributed to the organisation and management of the IAEA Coordinated Research Project (CRP) investigating the “Safety Significance of the Near Field Earthquakes for NPPs and other nuclear facilities”, which provided the basis for the relevant IAEA Technical Document. In the framework of the new IAEA Extra Budgetary Project “Seismic Safety of existing Nuclear Power Plants”, development and implementation of a “Database on Earthquake Experience” was agreed. This database is intended as a key element for the reassessment of the seismic safety of existing NPPs.

### Challenges for the future

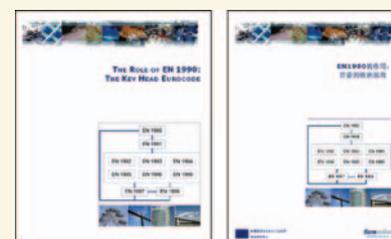
Although remaining the standards for structural design, the Eurocodes should take into account all aspects of sustainability, including protection of the environment, resources, economy, energy saving, healthy conditions and security. In this context, further research will be undertaken to examine the feasibility of a future expansion (new codes, new parts and/or amendments) of the Eurocodes and associated EN standards for methods and products to all six Essential Requirements of the Construction Products Directive (CD 89/106/EEC).

In 2008, SAFECONSTRUCTION will also concentrate efforts on the preparation of an integrated infrastructure project, which is designed to reinforce cooperation between world-class European research infrastructures in earthquake engineering and structural dynamics.



Figure 1: Masonry house specimen tested at the ELSA laboratory in the framework of the competitive project ESECMaSE: a series of pseudo-dynamic tests representing earthquakes of increasing intensity has been carried out up to the onset of collapse characterised by large stepwise cracks and/or joint slidings in most walls.

**Awareness Material on the Eurocodes**  
JRC-IPSC produces a series of leaflets and booklets on the Eurocodes (Example of the booklet on EN1990 in English and corresponding translation in Chinese available at the EU-China Workshop in Beijing).



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**Animal welfare in long journeys**  
 Regulation 1/2005 on animal welfare in long journeys establishes that in all new trucks in operation from 1.1.2007 a Navigation System has to be installed. The System must register all relevant data concerning the location of the vehicle and the conditions of transportation (temperatures of transportation, etc.).

## Monitoring, Control and Traceability in the Food Chain (MonCoTraF)

The key task of MonCoTraF is to ensure customers (Commission Directorates, EU Member States official authorities, farming industry, food processing industry, RFID manufacturers) with technical advice in order to improve the establishment of Radio Frequency Identification (RFID) to explore further solutions for the traceability of livestock and products.

Traceability of livestock and animal products are all aspects linked together to prevent sanitary frauds and to ensure food safety. The crises on Transmissible spongiform encephalopathies (TSEs) and Foot and Mouth Disease in Europe have demonstrated that, in order to ensure safe food, a reliable traceability system is the key point to be developed. One of the most common weaknesses in the EU Member States where such crises have developed was, in fact, the absence of safe instruments to trace in due time animals and products possibly contaminated, with the immediate consequence that consumer protection was not ensured. In this context, JRC-IPSC has developed research projects in close collaboration with Member States, which confirmed new traceability technologies to be a tool delivering safe information about the origin, the processing and storage of meat.

In addition, JRC-IPSC provides also a RFID test laboratory for the assessment of RFID devices, and for standardising test procedures. The laboratory is being accredited according to ISO 17025 standard (foreseen in Spring 2008). It is officially recognized as an ICAR (International Committee for Animal Recording) test centre and it is playing a key role in the ISO working groups concerning the technical aspects of animal electronic identification.

### Major 2007 achievements

#### Monitoring of Animal Welfare Conditions over Long Journeys

In the context of the technical collaboration with the Health and Consumer Protection (DG SANCO) a study was completed for the smooth implementation of Council Regulation 1/2005 (Animal welfare over long journeys). The study was aimed at providing the EU Member States with an implementing measure (Navigation System) able to constantly monitor the traceability of transported animals and the animal welfare conditions over long journeys. The study enabled the JRC-IPSC to finalise the Navigation System Technical Specifications, which are in the process of being transformed into a Commission Regulation. The Navigation System prototype –tested under real life conditions in 2007- demonstrated the possibility to transmit data to a dedicated website, enabling the responsible bodies to take appropriate actions, if necessary.

#### Pig identification

In 2007 the feasibility study concerning the extension of RFID to live piglets confirmed that JRC-IPSC's approach (tagging procedure/location of transponder) is appropriate and it allows the best retention rate and reading. MonCoTraF launched a collaboration with the Parma Ham Consortium, in order to move to a larger scale project, where the final aim is to identify a model which would cover the traceability of both live animals and pig products (ham). The large scale project will allow a safe identification of the animals and a robust internal traceability model to be established.

### Technical Support to the EU Member States authorities in the field of electronic identification of small ruminants

In 2007 several RFID studies were successfully carried out in EU Member States:

- An articulated field test in Italy where the full implementation of the Regulation 21/2004 was tested for all components (devices procurement, staff training, monitoring of the functioning, integration of the Electronic Identification – EID - into the national database);
- A technical collaboration with the United Kingdom, which aimed at verifying the compatibility of the modern available RFID technology with the peculiar structure of the UK farming industry. The collaboration included environmental data collection in the sites where the JRC-IPSC/UK trial was launched (farms, auction animal markets, and slaughterhouses) and performance tests of the RFID equipments in the heavily contaminated environments.
- A scientific project with the Ministry of Agriculture of Cyprus with a multi-faceted study aimed to integrate EID into a JRC-IPSC's prototype of automated selection system to prevent infected animals to enter the food chain.

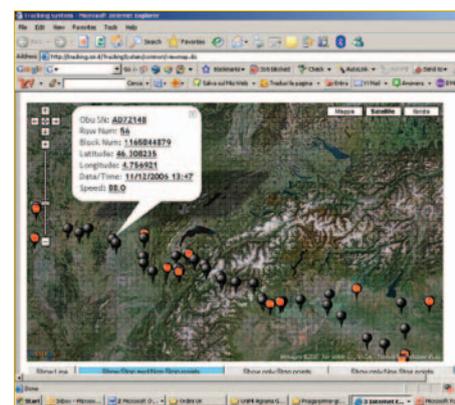
### Accreditation of the RFID Laboratory

According to the JRC RFID assessment Technical Guidelines and the adopted Commission Regulation and Decisions, JRC-IPSC initiated the procedure to ensure laboratory accreditation according to ISO 17025. The accreditation, expected for Spring 2008, will allow the laboratory to play the role of Community Reference Centre and to provide the other RFID laboratories of the EU Member States with a technical support service. In the meantime, manufacturers have already requested that their equipment be tested according to the new testing procedure, and some member states have informally requested JRC to consider the possibility to play the role of national reference laboratory for them.

### Challenges for the future

Concerning animal welfare, one of the challenges will be the integration of additional information into the data flow from the Navigation systems established by Regulation 1/2005. The integration will enhance the monitoring of the animal transportation by the Navigation System. In addition, as agreed with other partners in the Member States, the integration of the Navigation System into a Geographical Information System will be explored, in order to provide the end user with a complete solution of transportation monitoring integrated into other animal health information layers (farms location, outbreak notification, etc.).

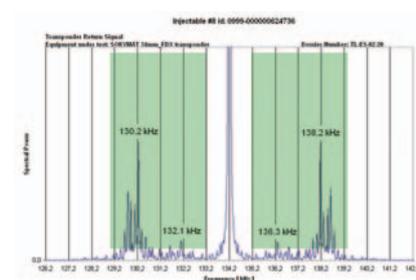
Concerning the livestock and animal product traceability, a major effort will be put in the possibility to transfer the RFID code(s) into the second part of the food chain (with particular reference to meat), in order to ensure a safe connection between animal and product identification in the context of the industrial food production. In addition, the establishment of the project on DNA/EID in the food processing chain will open totally new scenarios in the traceability of animal and animal products.



Screenshot of the tracking system at a web application visualizing the data transmitted from a truck transporting animals (each point represents a data block transmitted during the journey).



Reading of electronically identified sheep in an auction market with a high animal throughput.



Results of a compliance test on a RFID transponder.

# 4



## Europe as a World Partner

The JRC portfolio of Actions under this policy theme aims at providing support to two policy areas in the external relations of the Union: global security and development cooperation. The first area of work concerns the development of systems and technologies which provide information, analyses, management tools and data sets in the context of crisis management and security.

The second area of work concerns development cooperation where the JRC will provide information and tools for planning, monitoring and assessing development programmes. The focus will be on the establishment of satellite based monitoring systems which will maintain an intelligent watch on the conditions of resources and environment under growing human pressure.

Furthermore, common elements of the JRC actions foreseen in the Agendas 4.1 and 4.2 will contribute to the Africa Caribbean and Pacific ACP Observatory for Sustainable Development. The purpose of the Observatory is to provide relevant, reliable, ready-to-use and updated information to the EC services and to the beneficiary countries and regions in order to improve the decisionmaking processes. Whilst addressing all ACP countries, the African continent will be the focus in the initial phase. The ACP Observatory will support three main domains: sustainable management of natural resources, food security and crisis response/monitoring for security.

## 4.1 Global Security

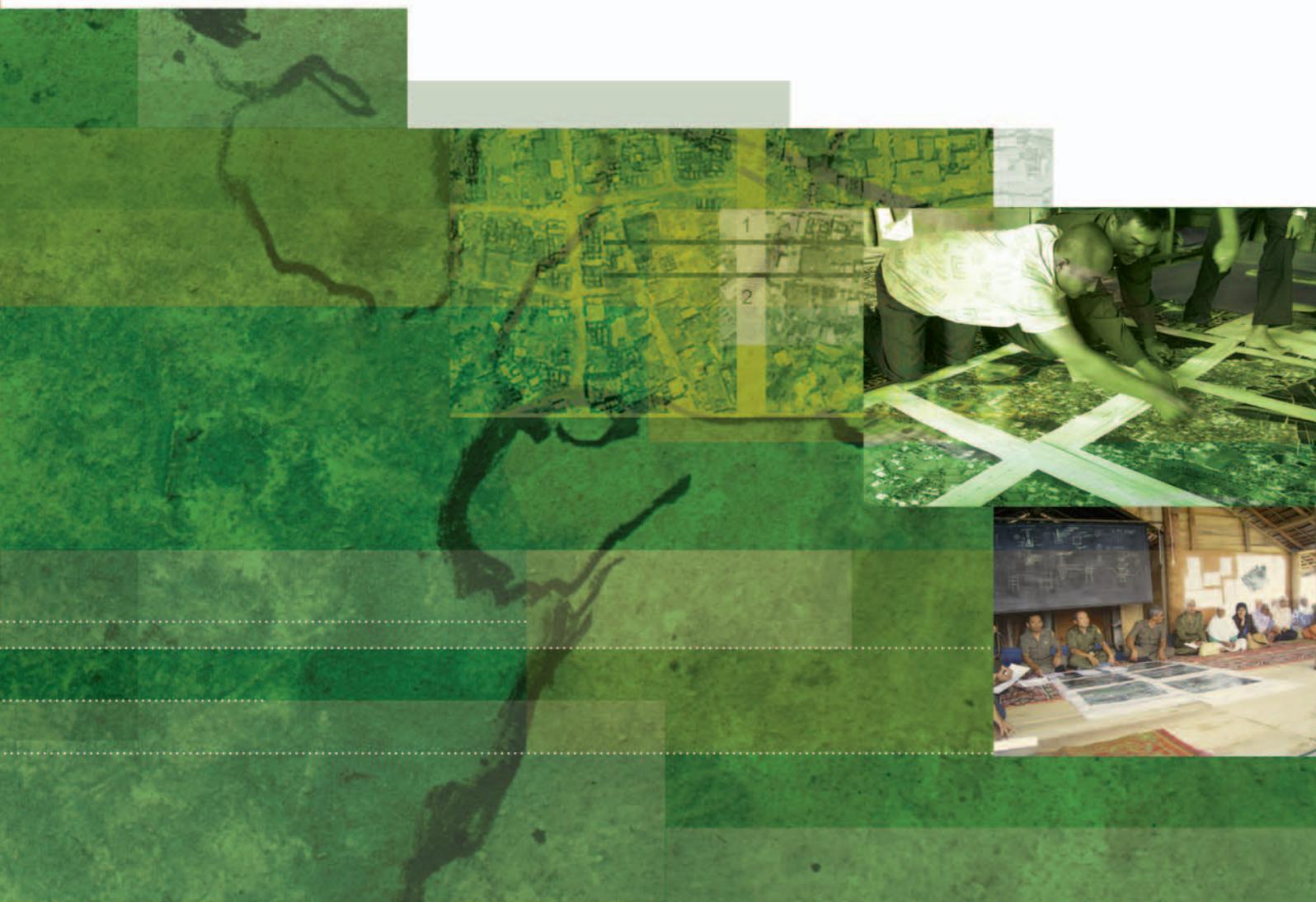
The focus of this part of the JRC agenda is to develop and apply information technologies, Geospatial (including remote sensing) analysis techniques, and system analysis approaches to provide support to policies and actions in which the Community has competence and fully participates, particularly in: crisis management, conflict prevention, international disaster response, common foreign and security policy, in addressing the root causes of migration, and in tackling global challenges such as non-proliferation, terrorism, and illicit trafficking. Some activities will be developed in support to the development of services under the Global Monitoring for Environment and Security (GMES) initiative, in particular in the fields of emergency response and security.

CriTech, ISFEREA

## 4.2 Development Cooperation

Actions in this Agenda aim at developing products usable by partner countries, which will be involved in the definition of Specific requirements. Links will be maintained with other EC funded activities and international programmes.

MARS-FOOD



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## Crisis Monitoring and Response Technologies (CriTech)

The aim of the CriTech action is to enhance the EU's crisis preparedness and response capacity, in the fields of global crises management, humanitarian aid and public health emergencies, by means of fostering a better capacity for early warning, alerting, situational awareness and monitoring, and impact assessment. The action provides scientific/technical support to relevant Commission's Directorate Generals, particularly those with crisis rooms<sup>15</sup>. The action also collaborates with the European Commission's partners including the Council Secretariat's Joint EU SitCen, the European Centre for Diseases Control (ECDC) and the United Nations agencies (e.g. the United Nations Office for the Coordination of Humanitarian Affairs – UNOCHA and the United Nations Department of Peacekeeping Operations - UNDPKO).

CriTech is mainly dedicated to the development of early warning/alerting models/systems and web-based solutions for the collection, integration, analysis, visualisation and dissemination of crises related information. In 2007, advances were made in numerical modelling, information technologies and Geographic Information System (GIS) in order to provide novel solutions for collaborative crisis management, tsunami early warning, global flood detection, and evaluating the consequences of crises such as those related to communicable diseases and natural disasters.

### Major 2007 achievements

#### Public health emergencies and disease outbreaks

At the request of the Directorate General for Health and Consumer Protection (DG SANCO), CriTech performed a detailed analysis of the first self-sustaining outbreak of Chikungunya fever CHIK in Europe (in Italy) with 217 confirmed cases.

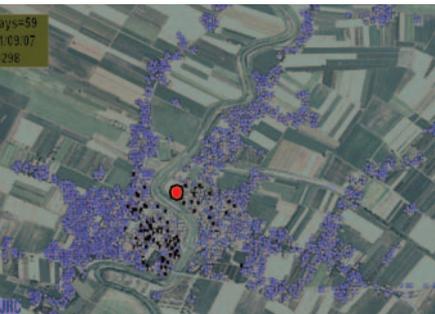
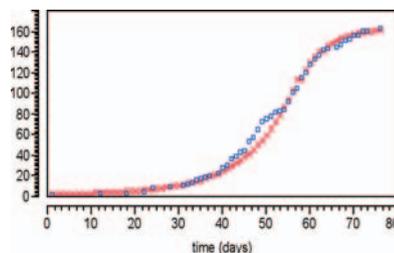
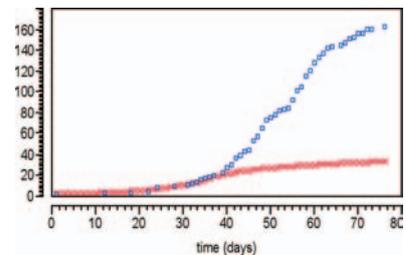


Figure 1: Spatial distribution of the infections calculated with an Agent Based model.



Modelling results for the Chikungunya: comparison of real cases (blue) with model predictions (red).



Results of the simulation showing the effect when control measures are applied at day 36.

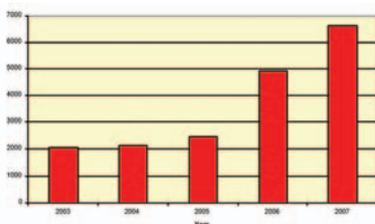


Figure 2: The number of registered users to the Global Disasters Alert and Coordination System (GDACS) is constantly increasing with a current rate of more than 1700 new users in 2007 alone. The users receive GDACS alerts by email, fax or SMS.

After an analysis of the most striking epidemiological features of the outbreak, including its clinical characteristics, a deterministic compartmental modelling and an agent-based model approach were tested. The deterministic model showed that the early application of containment measures strongly reduces the number of cases. The agent-based model showed that it is possible to describe the spatial component distribution of the cases. It was shown that the location of the first case (index case) may play an important role which, in some cases, can lead to a self-containment of the outbreak [Figure 1].

With respect to the current global public health threat of an influenza pandemic, CriTech showed in an ecologic immunology study that it is unlikely that wild birds can spread the virus along established long-distance migration pathways<sup>16</sup>.

15. including the Secretariat General, the Directorate General for Health and Consumer Protection – DG SANCO, the Directorate General for Humanitarian Aid - ECHO, the Directorate General for External Relations – DG RELEX, the Directorate General for Justice, Freedom and Security – DG JLS, and the Directorate General for Environment – DG ENV  
 16. Weber & Stilianakis, *Emerg. Infect. Dis.*, 2007, 13:1139-1143

### Tsunami Assessment System

The JRC-IPSC's Tsunami Assessment System is part of the Global Disasters Alerts and Coordination System (GDACS), a joint United Nations and Commission system. GDACS aims at controlling the information flow after the disaster, including fast alerts, updated news, satellite maps and needs and relief related information. It is widely adopted and its success is shown by a growing number of users [Figure 2].

For under-water earthquakes the JRC-IPSC's Tsunami Assessment System identifies the potentially affected coastlines. The system models the height of the tsunami wave in addition to the travel time. In 2007, this model was integrated in the GDACS system. It correctly predicted all the major events which occurred in 2007 (Solomon Island, 1/4/2007 [Figure 3], Peru 15/8/2007).

In August 2007, CriTech started pre-calculating most possible Tsunami scenarios in order to produce a database which allows immediate access to preliminary Tsunami height and travel time calculations. This activity will be completed before the end of 2008 [Figure 4].

### Global Flood Detection System

Nowadays, most natural hazard types are monitored through international networks. However, the most damaging and killing natural hazard - floods - is not monitored this way. With experience in satellite technology and early warning, CriTech developed – in collaboration with the US Dartmouth Flood Observatory – a methodology to detect major floods anywhere in the world on a systematic basis. The methodology is based on passive microwave satellite imagery, which is able to provide daily coverage of the globe independent of cloud cover or other atmospheric disturbances.

CriTech implemented this methodology into a system that provides daily measures of the flow status of over 2500 sites on major rivers. These measures are compared with average flow levels and flood alerts are generated when extreme values occur. The system has contributed to the European Commission disaster management of the Bolivia floods (January/February 2007) and the African floods (August/September 2007) by providing rapid information on affected areas.

### Crisis Information Management Systems

Web-based crisis information management systems are becoming increasingly important in enhancing collaborative crisis management by means of allowing remote and distributed access to relevant information and tools.

CriTech developed several systems:

- the Health Emergency and Diseases Information System (HEDIS), which DG SANCO uses to exchange information with public health authorities in the EU Member States and the European Centre for Disease Control
- the KREIOS situation centres portal, which integrates collaborative technologies (such as discussion fora, wiki mapping and request for information), supports the development of a collaborative crisis management environment between Commission Services (mainly DG RELEX), Council EU Joint Situation Centre, UN Peace Keeping Operation Situation Centre and NATO.

### Challenges for the future

In 2008, CriTech will focus on further developing and testing new models and systems to support decision making and coordination related to global crises management, humanitarian aid and public health emergencies. New systems include: geo-visual and field gathering tools, a new ground-based device for Tsunami alerting, advances in real time modelling of infectious diseases and better global flood monitoring and mapping systems.

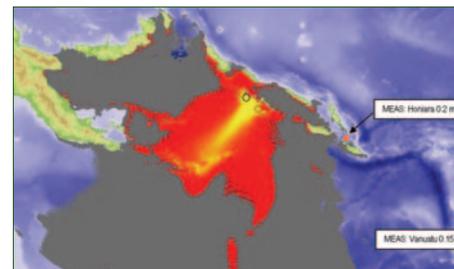


Figure 3: On Sunday 1 April 2007, an earthquake of magnitude 8.1 caused a tsunami of several meters to hit the Solomon Islands. More than 10 people were reported dead and thousands affected or injured. JRC-IPSC systems detected the event 16 minutes after its occurrence, i.e. as soon as it was published by the United States Geological Survey. The event was evaluated to be a Red Alert and over 3000 alerts were sent out. The JRC-IPSC Tsunami calculations were available after 17 minutes and predicted a wave of 3.3 m in Kunji, where most of the fatalities occurred.

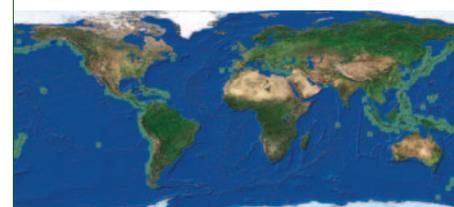


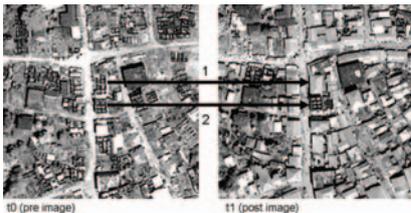
Figure 4: A calculation grid was defined using the NOAA NGDC Tsunami Database of Historical Tsunami sources locations. It has been obtained building a regular grid (10x10) around each data point, thus obtaining 10185 points. For each location each magnitude between 6.5 and 9.5 every 0.25 is calculated, and determining an overall number of Tsunami calculations of 132405. The completion status in December 2007 is about 50%. The calculations should be completed by mid 2008.



Overview of ongoing floods detected by the Global Flood Detection System (<http://www.gdacs.org/floods>).

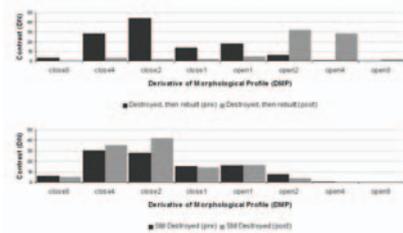
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1: destroyed, then rebuilt structure  
 2: still destroyed structure

Morphological profiles:



The figure shows the use of the decomposition of the image by the derivative of the morphological profile (DMP) for post-conflict automatic image recognition tasks, in this case the discrimination between built-up structures destroyed by a conflict event and then rebuilt and built-up structures still destroyed in a village in Africa. The histograms at the bottom show the signal recorded by the DMP for the two classes "rebuilt" and "still destroyed". Note the similar behaviour of the DMP for "destroyed" built-up structures in the t0 and t1 images, while the DMP of the "rebuilt" structure at time t1 is clearly distinct as unbalanced on the right side of the graph. This kind of information is used for the automatic discrimination between the two classes. While radiometric discrimination is not possible because of the important number of not-relevant radiometric changes in the image (such as the change in the colour of the roof because of metal oxidation), the structural description recorded by the DMP has been demonstrated to be more stable and allows for more robust automatic discrimination.

## Information Support for Effective and Rapid External Action (ISFEREA)

The ISFEREA action aims to support EU external policies concerned primarily with security and global stability, development, and humanitarian assistance. ISFEREA specifically focuses on disaster reduction, crisis response and support to post-crisis rehabilitation and reconstruction, conflict prevention, and monitoring for security. The action provides scientific/technical support to the services of the Commission's Directorate Generals dealing with external relations and their partners (including the United Nations agencies) by means of developing, validating and applying techniques and system analysis approaches for the processing, interpretation, and analysis of geo-spatial data as well as other relevant data including socio-economic and political.

### Major 2007 achievements

#### Earth observation and geospatial analysis for crisis response and monitoring for security

**Crisis response.** The support to crisis response focuses on integrating technologies and establishing procedures for rapidly collecting and processing geo-spatial data over crisis areas outside the EU. The activity is based on earth observation (EO) and investigates closely complementary technologies of field data collection to complement information from EO. In 2007, methodological innovation centred on supporting the efficiency and consistency of visual image interpretation and on testing newly-defined automatic and semi-automatic image feature or pattern recognition procedures, automatic change detection algorithms, and analysis of volumetric data extracted from stereo images by improved automatic image matching procedures.

**Global Atlas.** ISFEREA has further enriched the Global Crisis Atlas through extending the underpinning geo-spatial data infra-structure, processing and standardisation of new global continental and regional datasets within a Geographic Information System framework. The Global Crisis Atlas supports EU decision-making during peace times and during crisis preparedness and response. Today, the Atlas comprises several hundreds of user driven map products (based on earth observation and topographic data) for more than 40 countries outside the EU.

#### Support to conflict prevention

**Conflict resources.** ISFEREA is developing image analysis algorithms for identifying and monitoring conflict resources such as illegal exploitation of mineral resources (e.g. diamonds) and illicit crops. With regard to mineral resources such as diamonds, the information extracted from EO is combined with open source and other geo-spatial information to monitor regularly the compliance requirements of the Kimberley Process. The methodological focus is on object-based multi-criteria and multi-temporal processing of very high resolution (VHR) satellite optical data, in both 2D and 3D for estimating excavated volumes in case of mineral resources exploitation.

**Assessment of urban environments in developing countries.** On the basis of EO and geospatial analysis, ISFEREA has been developing information layers of built-up areas in support of identifying fragile and vulnerable communities in urban environments. Current and new VHR EO missions for both optical and radar imagery were tested in 2007. The information extraction on built-up areas, highly relevant for organisations such as the United Nations Human Settlements Programme (UN-Habitat) and the World Bank, was carried out in cooperation

with relevant Commission services and delegations. Concerning the detection of settlement patterns valid at continental level, the methodology focuses on newly-defined procedures based on textural and morphological processing, the multi-temporal description by multi-source comparison. The related general security impact assessment is done using a fuzzy multi-criteria spatial decision support system.

**Analysis of root causes for violent conflict and specific risk & situation assessments.** In 2007, ISFEREA developed and tested a global risk assessment model for armed conflict based on structural and dynamic indicators. In parallel, ISFEREA investigated root causes of insecurity in specific regions and for specific themes. The action also monitored active conflict areas using EO and other data and provided situation assessments (e.g. monitoring the evolution of the security barrier and settlements in the West Bank).

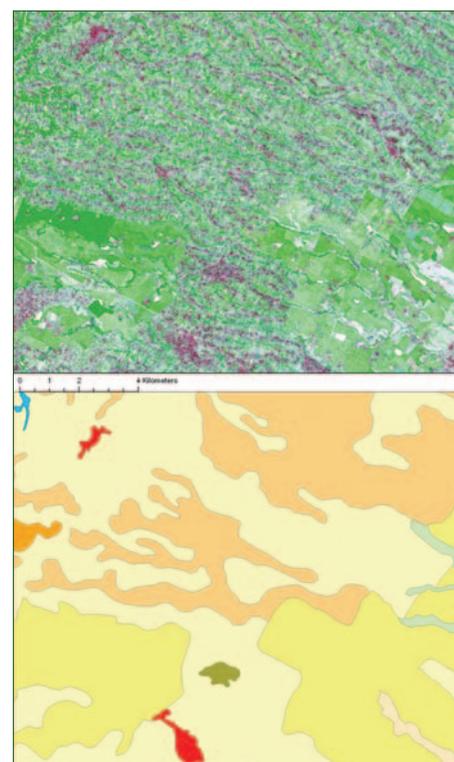
### Policy support

**Support to the Global Monitoring for Environment and Security (GMES) programme.** Within GMES, ISFEREA plays a leading role in projects focusing on the human security aspects of GMES. The action also contributed towards shaping the fast track GMES emergency response service, which aims to develop a service in support of enhancing response to disasters. Special emphasis was on the definition and testing of quality requirements of satellite-derived products for security-related applications, together with the analysis and benchmarking of the characteristics of new platforms and sensors.

**Support to the Africa, Caribbean and Pacific Countries (ACP) Observatory for Sustainable Development.** ISFEREA is contributing to the JRC's ACP Observatory for Sustainable Development through its activities in support to conflict prevention and disaster reduction in Africa.

### Challenges for the future

There are two main types of technical challenges ISFEREA will address in 2008: the first one concerns the fast evolution of satellite data sources and the second one is related to the usability of the final product. ISFEREA will address the need to improve the techniques available for data interpretation, which will need to take into account: the increase in the level of detail from the new generation of VHR satellite data, data complexity which leads to an instability of the classical inferential models, and high computational requirements. Geo-information layers produced for describing human settlements and fragile communities in urban environments, population risk assessments and damage and reconstruction assessments all need to be harmonised. Furthermore, GMES products and services concerned with crisis response (and especially post-crisis damage assessment) should be validated through an established and agreed protocol with relevant partners. Finally, the feasibility of global products (e.g. urban environments) derived from new generation satellite data should be demonstrated.



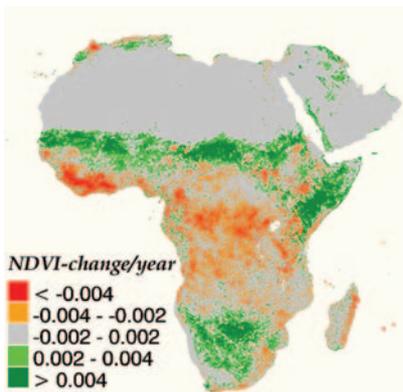
The figure (part above) shows the output of a new fully automated image understanding procedure developed by ISFEREA, focused on recognition of built-up structures and vegetation, represented in red and in green, respectively, in the image. The figure represents an area of 15x10 kilometres with scattered settlements in the north of the city of Nairobi, Kenya. In the part below the figure the same area is represented by the Africover dataset produced by traditional methodologies: in red the "urban" land cover.

The new procedure can use as input any optical satellite data with spatial resolution better than 10 metres, and is based on a newly-defined "built-up index" derived from anisotropic rotation-invariant image textural analysis for discrimination of built-up areas, and on a modified version of normalized vegetation index derived by combination of radiometric information. The procedure allows the description of the spatial distribution of built-up areas with unprecedented detail and consistency with respect to the traditional products derived from satellite data and available at regional level.

# MARS-FOOD

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*General trends of annual maximum Normalised Difference Vegetation Index (NDVI) for a time period of 25 years (1982-2006) derived from AVHRR NDVI data (Advanced Very High Resolution Radiometer - Normalised Difference Vegetation Index).*



*Wheat threshing in the Arsi zone of Ethiopia (October 2007).*

## Support to Food Security (MARS-FOOD)

Food Security in the poorer countries of the world is a main concern for European citizens, as reflected by the leading role of the European Union in the international donor community with a yearly contribution of 500MEuro. According to the United Nations Food and Agriculture Organisation (FAO), 815 million people worldwide are chronically food-insecure, while a further 5-10% of the population is at risk of “acute” food insecurity by natural and man-made crises.

The European Commission Food Security policy is defined by Council Regulation (N 1292/96) while the Communication “Advancing the Food Security Agenda to Achieve the MDGs” (COM(2006)21) laid the foundations for the new financing tool for Food Security started in 2007, the so called Food Security Thematic Programme (FSTP).

For the implementation of the European Food Aid and Food Security policy, early warning information is needed by the EuropeAid Cooperation Office (AIDCO) on the food and crop situation, as well as accurate estimates on national crop production and vulnerability of the populations.

The MARS-FOOD action has developed since 2001, in cooperation with the MARS-STAT action and in the framework of the Global Monitoring for Environment and Security (GMES) initiative, a system for regional monitoring and forecasting crop yields in various parts of the world: south America, Mediterranean Bassin, Russia and central Asia, the Horn of Africa.

An important Administrative Arrangement was signed between AIDCO and the JRC-IPSC for the period 2006-2008, in order to strengthen the national Food Security Information Systems in the particularly vulnerable area of the Horn of Africa: Eritrea, Ethiopia, Somalia, and Sudan.

### Major achievements in 2007

One of the key achievements in 2007 is the strengthening of our activities and a better visibility of our specific role in crop monitoring and vulnerability assessment.

Several international conferences were organized to animate networks of high level experts in this area, or to disseminate innovation or best practices to the users.

- The 2nd Crop and Rangeland Monitoring Workshop (CRAM) was organised with the FAO, in Nairobi, Kenya, from 27 to 30 March 2007
- The 1st Vulnerability Seminar on “Integrating Socio-economic and Remote Sensing information for Food security and vulnerability analyses” was held in Ispra, Italy, on 11-12 October 2007
- A training on the Crop Growth Monitoring System was held in Ispra, Italy, on 5-7 December 2007

In 2007, new development areas were defined and research initiated on a number of promising topics:

- The detection of long term-trends in climate and vegetation for analysing the impact of climate change on agriculture and livelihood: adaptation and coping strategies.
- The livestock/rangeland monitoring in Africa, combining satellite imagery with tracking systems, by the setting up of a network of national and international experts.

- The calibration and validation of rainfall estimates for improving the crop monitoring and water satisfaction modelling

### An operational support to AIDCO

In 2007 close working with the Commission Directorate Generals dealing with external relations was reinforced with the secondment of an expert in Rome to ensure a technical interface with the United Nations organizations: FAO and the World Food Program (WFP).

Two scientific studies were awarded following open procedures: an assessment of the post harvest losses for the creation of a database in support to the “food balance sheet” elaboration and analysis; A “Cereal stocks Assessment survey” in Ethiopia (IFPRI) in support to the Food purchase operation by WFP.

JRC-IPSC is one of the 7 agencies officially involved in the implementation of the Integrated Humanitarian Phase classification (IPC). This new instrument, funded by the EU and coordinated by FAO, is based on a consensus building approach and will be crucial for a better assessment of the Food insecure regions. Substantial contributions were provided to the IPC roll-out process in Eastern Africa (Nairobi, October 2007).

At the end of 2007, JRC-IPSC participated as EU observers at several CFSAM (Crop and food supply assessment missions) or EFSA (Emergency Food Security Assessment) missions (North Sudan and Ethiopia).

Capacity building and transfer of know-how is a key issue and several training courses were organised on crop monitoring with remote sensing (1- 3 weeks courses) in Khartoum, Nairobi, for a total of 30 participants from Sudan, Ethiopia, Somalia and Sudan.

### MARS-FOOD Bulletins

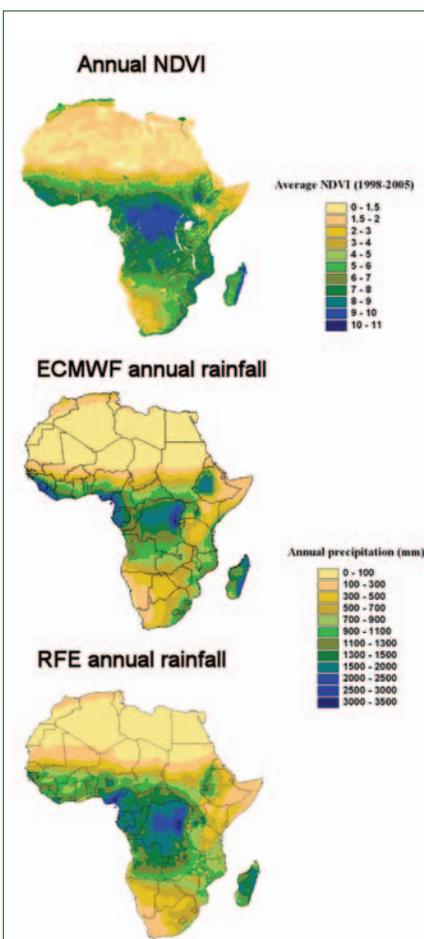
More than 40 regional or national bulletins were published in 2007 describing the agricultural and pastoral situation in the monitored countries and providing qualitative and sometimes quantitative yield forecasts.

Following a successful training, the Sudan crop monitoring bulletin is presently issued by National institutions. MARS FOOD covered new countries like Kenya with improved forecasts on maize yield (July) and prepared future extension to cover Uganda in 2008.

### Challenges for the future

Food security becomes more critical in a global context of climate change, rise of agricultural commodities prices linked to emerging countries and development of bio-fuels. Crop monitoring faces a number of key challenges in the 7th Framework Programme:

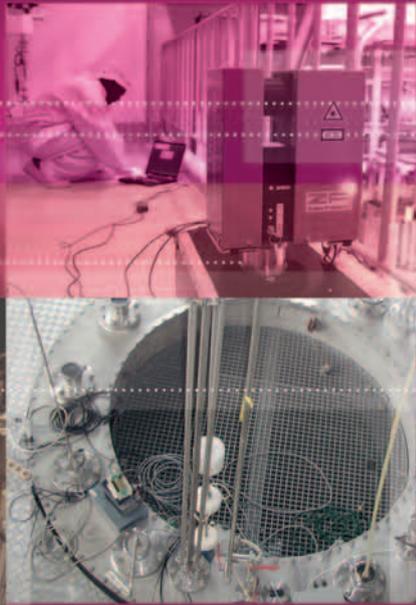
- Improve and extend the quantitative crop yield modelling and forecasting, by more accurate rainfall estimation and crop development information;
- Analyse how future productions may be affected by climatic changes and related extreme events as a basis for adaptation or mitigation strategies;
- Address the problematic of areas estimates, in relation to the pressure on land use, desertification or land degradation.
- Build bridges between classical crop monitoring and vulnerability information.



*Spatial relationship between annual Normalised Difference Vegetation Index (NDVI), European Center for Medium Range Weather Forecasts (ECMWF) and Rainfall Estimates (RFE).*

**2nd Workshop on Crop and Rangeland Monitoring in Eastern Africa**  
27-30 March 2007 - Nairobi (Kenya). Organised in collaboration with regional and national counterparts and the Food and Agricultural Organisation, this workshop grouped experts mainly from the Horn of Africa but also from South and West Africa. It allowed updating of the state of the art and of the progress made since the first workshop of 2003, but it also launched the idea and built a consensus for the development of an Africa-wide crop and rangeland monitoring system coupled with compatible national sub-systems.

# 5



## EURATOM

The nuclear activities of the JRC, implemented under the Euratom Multiannual Work Programme, so called “Direct Actions”, aim to satisfy the R&D obligations of the Euratom Treaty 1 and to support both Commission and Member States in the field of safeguards and non-proliferation, waste management, safety of nuclear installation and fuel cycle, radioactivity in the environment and radiation protection.

The objective of the programme is to develop and assemble knowledge on nuclear energy production, its safety and reliability, its sustainability and control, its threats and challenges and its future exploitation potential, including safety and security of innovative/future reactor systems.

## 5.3 Nuclear Security

Although the JRC has over 30 years experience in supporting the Euratom and Non-Proliferation Treaties, technical innovations and improvements are continued to be required to implement the evolving safeguards policy. The Additional Protocol aims to assure the absence of undeclared nuclear operations. Its implementation requires a number of techniques different from those involved in verifying nuclear material accountancy. It requires an overall description of a country's nuclear activities, provisions for more extensive site declarations and more varied inspection requirements.

The detection and the identification of illegally transported or stored nuclear material constitute a major line of defence against the illicit trafficking. Nuclear forensic science provides clues on the origin of the seized material. Establishing appropriate response plans for handling cases of detection remains an important issue.

NUMAMET, VERTEC, AMENUS,  
NuTraSeal, PhyMod



# NUMAMET

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## Nuclear Materials Measurement Techniques and Additional Protocol (NUMAMET)

The action NUclear Material measurement METHods, NUMAMET, performs research on new methods for the detection of fissile material and special chemical compounds, such as explosives, and delivers support to the European Commission with respect to the development and implementation of measurement methods for nuclear safeguards and nuclear security. This includes training of inspectors. This experimental work is partially performed in contact with the PHYMOD action, which concentrates on the modelling side of this work and does comparison measurements in the nuclear laboratories.

### Major 2007 achievements

#### Pulsed Neutron Interrogation Test Assembly (PUNITA)

PUNITA is a versatile experimental facility intended for research in a variety of areas. The most significant projects currently undertaken are mass assay of small amounts of fissile materials in dense matrices, and explosives detection by gamma activation analysis [Figure 1]. The device incorporates a pulsed 14-MeV neutron generator and a large graphite mantle surrounding a sample cavity. In this configuration a relatively high thermal neutron flux with a long lifetime is achieved inside the sample cavity. By pulsing the neutron generator, a sample may be interrogated first by fast neutrons and a few hundred microseconds later, by a pure thermal neutron flux. For the detection of materials such as conventional explosives the device employs scintillation detectors for the detection of characteristic prompt gamma rays either from inelastic scattering by fast neutrons, or from capture of thermal neutrons. As such, PUNITA is a unique facility for testing and developing innovative Non-Destructive Assay (NDA) techniques.

Following some years dedicated to the construction, licensing and preliminary characterisation experiments, PUNITA carried out its first experimental activities during 2007. For the purpose of developing a gamma detection system for gamma rays in the MeV range, which is suitable for an industrial environment, a performance evaluation of a newly developed scintillation detector based on the  $\text{LaBr}_3:\text{Ce}$  crystal was undertaken. This scintillation detector offers a better energy resolution and higher efficiency for high-energy gamma rays compared to standard scintillation detectors. As such the new detector is particularly effective for the detection of the high energy gamma rays encountered in the Prompt Gamma Neutron Activation Analysis (PGNAA). The chemical elements of interest to explosives detection include oxygen, hydrogen, nitrogen, carbon, fluorine and chlorine which emit characteristic gamma rays in the range of 1 to 11 MeV. The task to calibrate the detector in the MeV range was undertaken by using standard radioactive sources resulting in the calibration for gamma rays up to 3 MeV, and by using proton activated materials to extend the calibration beyond 3 MeV. The latter was achieved in collaboration with the MC40 Cyclotron at the JRC. The calibration of the new detector constituted an effort in basic physics research which is however fundamental to the application of explosives detection. The graph below shows the efficiency calibration achieved for the new detector [Figure 2].

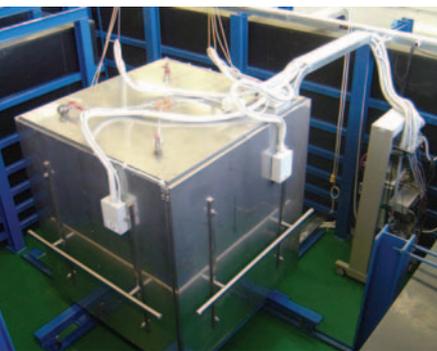


Figure 1: PUNITA.

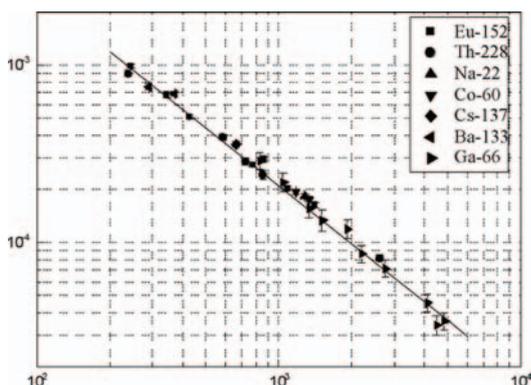


Figure 2: Efficiency calibration of a  $\text{LaBr}_3$  detector in the high energy range

Other activities in PUNITA in 2007 included extensive testing of the new state-of-the-art neutron correlation analyser. The analyser, known as a list mode device, is capable of receiving signals from neutron detections on 32 parallel signal lines and analysing the signal pulse train in almost real-time. Also the initial trials for determination of element ratios for the explosives detection were carried out. Figure 3 shows the experimental set-up for the determination of some critical element ratios in a compound similar to chemical explosives.

### PERformance Laboratory (PERLA)

A comprehensive work in the PERLA laboratory was finished and published in 2007, namely a new experimental determination of Pu attenuation coefficients in a wide energy range. Such data belong to the background of any gamma spectrometric methods for Pu mass determination. Ongoing work is related to practical application: a new detector type for gamma radiation,  $\text{LaBr}_3$  scintillator, has been tested for enrichment measurements on heavily shielded Uranium containers [Figure 4]. The results encourage further work aiming at practical solutions for inspection measurements.

As permanent task of the action NUMAMET, several inspector training courses were performed using the nuclear material and the infrastructure of PERLA. Training is following the changing needs of EURATOM and the International Atomic Energy Agency (IAEA): a common course of the two organisations, “Pu Diversion Detection”, is under preparation. The IAEA inspector course “Advanced Non-Destructive Assay of Nuclear Material”, traditionally held at Los Alamos National Laboratory, will be held for the first time in PERLA in the Spring of 2008.

### Challenges for the future

Our experimental activities in security research, with active methods, have intentionally focused on instrumentation and techniques which realistically can be operated under field conditions. However in order to improve the performance of such instrumentation we need to develop nuclear signal processing electronics capable of handling very high acquisition rates over short time periods. For the purpose of achieving field applicable results faster, these research activities are being aligned with the programmes of other laboratories working in this field. Such inter-laboratory collaborations were initiated recently and will be increased in the near future. Another specific challenge in the field of nuclear security, with passive methods, is to search for ideas for the sensitive detection or sensitive signal analysis methods for the discovery of weak radiation signals from non-natural sources in real environmental conditions.



Figure 3: Test sample in the PUNITA cave.

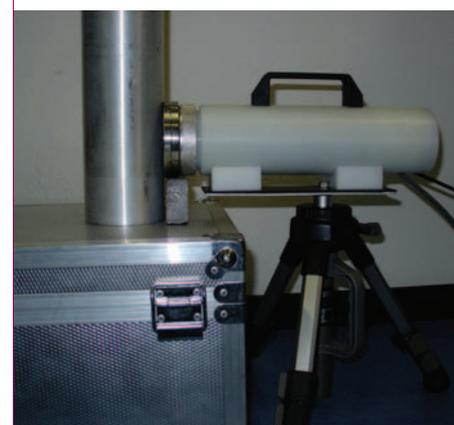
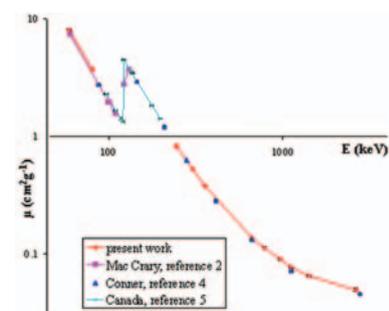


Figure 4: Field set-up of  $\text{LaBr}_3$  detector for enrichment measurement.



Attenuation coefficients of Pu.

# VERTEC

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## Verification Technologies and Methodologies for Nuclear Safeguards (VERTEC)

VERTEC designs, develops, integrates and pilot tests applications of emerging information and communication technologies to cope with present and emerging challenges in the evolving scenarios of EURATOM Treaty Safeguards and the Additional Protocol to the Non-Proliferation Treaty. It also supports the implementation of a new Commission recommendation on Nuclear Material Accountancy and Control systems and related audits of such systems. VERTEC activities also include inspectors' training in relevant fields.

### Major 2007 achievements

#### 3D Technologies: Laser Item Identification System (LIIS)

Within the scope of a task by the International Atomic Energy Agency (IAEA), VERTEC designed an unattended automated Laser-based System for container identification and authentication. The system was field tested in two European Uranium enrichment facilities. LIIS makes contactless measurements and aims at uniquely identifying UF<sub>6</sub> cylinders as they move through the enrichment plant. It can accommodate several types of cylinders with different diameters and is insensitive to a wide range of ambient temperatures. In September 2007, VERTEC and the IAEA began a pilot deployment at a Japanese enrichment facility, where LIIS is operating on a trial basis for six months. The IAEA remotely monitors LIIS from its headquarters in Vienna. Operational data is being collected to characterise the system's performance and will be used for the necessary improvements and follow-up versions.

#### Inspectors Training for Laser-based Design Information Verification

VERTEC developed a 3D Laser Range Finder for Design Information Verification (3DLRD) of nuclear installations. The 3DLRD system is capable of:

- creating accurate geometric models (millimetre accuracy) of a physically existing complex facility;
- detecting changes in the facility since a previous inspection;
- integrating Safeguards data and measurements for easy presentation and interpretation. Following the successful deployment at the Rokkasho Re-processing Plant, Japan, the IAEA intends to make wide use of the 3DLRD system and has asked VERTEC for the necessary "hands-on" training courses. Four training courses took place in 2007, three at VERTEC's 3D Vision Laboratory in Ispra, Italy, and one at IAEA's Tokyo office. In total 32 inspectors from different organisations received training in the use of the 3DLRD system.



*Site Investigation Tool (SIT) interface showing the site satellite image, the overlaid site building representation and the detailed information for a user-selected building, including the Additional Protocol specific declaration.*

#### 3D Reconstruction of Onkalo Geological Repository

Finland is constructing an underground facility, known as Onkalo at Olkiluoto, Eurajoki, for the final disposal of spent nuclear fuel. Underground construction started in 2004 and in July 2007 the access tunnel was 2194m long, reaching a depth of 207m. Geological repositories introduce major technical challenges for nuclear safeguards. VERTEC, in cooperation with STUK, Finland's nuclear regulatory authority, engaged in an exercise aiming at verifying the applicability of 3D technologies to modelling and safeguarding geological repositories. The exercise aimed at sharing information and practices as to measurement equipment and methodologies including data processing and visualisation software. The 3D model provides accurate documentation for 3D verification and can be relevant to detect future changes indicating the presence of undeclared rock spaces. The exercise showed (a) that 3D laser technologies can be easily

deployed to create accurate models of real sites and (b) that it is possible to perform design verification of large underground facilities.

#### **Supporting DG TREN Development of Audit based Methodologies for Safeguards**

VERTEC collaborated with the Directorate General for Energy and Transport (DG TREN) in producing a recommendation for Nuclear Material Accountancy and Control (NMA&C) systems that will be a reference for DG TREN auditing. This was based on participation with DG TREN in a number of trial audits designed to test concepts. The recommendation also drew heavily on the Guidelines for Good Practice in NMAC Systems produced by the Audit working group of the European Safeguards Research and Development Association (ESARDA) to which VERTEC was a contributor.

#### **Site Information Tool for European Safeguards (SIT-ES)**

SIT-ES is a geographic information system aimed at supporting the management and analysis of Safeguards related information at DG TREN. SIT-ES enables an integrated access to the Commission's multiple and distributed Safeguards databases. SIT-ES already supports the management of Additional Protocol declarations. VERTEC developments have allowed SIT-ES to enter its production phase at DG TREN using its own internal secure information network.

#### **Safeguards Review Station**

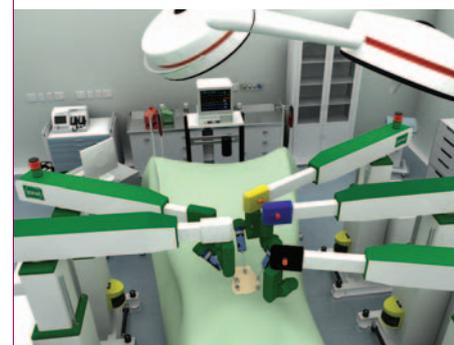
The increasing use of surveillance cameras in nuclear installations raises the issue of efficient review of the surveillance data streams. VERTEC uses context sensitive sequential analysis of safeguards relevant events to reduce the amount of images presented to an inspectors' review, whilst guaranteeing the detection of all events. Field experiments with real surveillance streams have shown that it is possible to reduce inspectors' workload by at least 45% compared with current review tools.

#### **Integrated Remote Operation and Monitoring**

Based on its own R&D and patents in the field of robotics and tele-operation for safeguards, VERTEC engaged in industrial third party work for the development and testing of two pre-commercial robotics manipulators for a tele-operated surgical system with force sensing. This system, named ALF-X, will advance robotics for tele-surgical procedures through enhanced surgeon perception, improved flexibility of operation and safety. In 2008, a team of surgeons will start experimental testing of ALF-X.

### **Challenges for the future**

Nuclear safeguards increasingly relies on verification equipment for the effective detection, and hence prevention, of the diversion of nuclear materials. Further, new generations of equipment and methods are needed to enable the timely detection of undeclared changes in a plant that might lead to undeclared activities. VERTEC will be active in the design and the effective integration of multi-sensory data, characterised by multiple resolutions and time-frames. This involves new data processing, fusion and analysis algorithms as well as effective presentation tools to meet the requirements of the last element of the chain: the nuclear safeguards inspector.



*Graphical representation of an operating theatre with five force-reflective, tele-robotics surgical systems for laparoscopy.*

# AMENUS

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## What is Generation IV International Forum (GIF)?

The Generation IV International Forum is a framework for international co-operation in research for a future generation of nuclear energy systems on which 10 founding countries agreed and to which EURATOM adhered.

The GIF overall objective is to support research and development, within a time frame from 15 to 20 years, of concepts for one or more Generation IV Systems that will provide competitively priced and reliable supply of energy to the country(ies) where such systems may be deployed, while satisfactorily addressing nuclear safety, waste, proliferation and public perception concerns.

## Assessment Methodologies for Nuclear Security (AMENUS)

There is an overall trend to increase the use in the security domain of systems analysis techniques derived from the safety domain. This newly created action contributes to the development of methodologies, software tools and probabilistic methods for the evaluation of nuclear safeguards effectiveness, proliferation resistance of existing and advanced nuclear energy systems including related fuel cycles and research reactors.

Motivated by the EU Council Regulation (1334/2000 and amendments) setting a “Community regime for the control of exports of dual use items and technology”, an activity has started on the identification of data sources for export control, in view of a possible use in non proliferation studies.

Open source information and technical knowledge of the fuel cycle are used, on customer demand, for compiling Nuclear Country and regional profiles as well as for characterising emerging proliferation threats.

Networking is an essential asset in a knowledge growing society. JRC-IPSC was among the founders of the European Safeguards Research and Development Association (ESARDA) and of the European Safety Reliability and Data Association (ESReDA). The action contributes and supports both associations.

## Major 2007 achievements

### PR&PP Methodologies and Studies

This activity is mainly related to support the Euratom participation in the Generation IV International Forum (GIF). AMENUS contributes to the GIF Working Group on “Proliferation Resistance and Physical Protection” (PR&PP), which is developing a methodology for the evaluation of the proliferation resistance and physical protection robustness of Generation IV Nuclear Energy Systems.

In 2007, Revision 5 of the PR&PP methodology has been made available on the GIF web site<sup>17</sup> and a new two-year case study, aimed at highlighting how the application of the PR&PP methodology can provide useful feedbacks to designers, has been initiated. The study analyses the response of an entire hypothetical nuclear energy system, named Example Sodium Fast Reactor (ESFR), to different proliferation and theft strategies.



### JRC ASTRA-3 Software Package

Classic systems analysis/risk assessment techniques and related tools have been mainly conceived for applications in the area of safety. Special tailoring and development of these tools is needed for a suitable application to the security domain. JRC-IPSC's ASTRA-3 Fault Tree analysis code has been especially designed and developed not only for safety but also for security related applications involving the need to model events with high probability values and mutually exclusive actions (e.g. different ways of attack) [Figure 1]. Preliminary testing in security applications proved the usefulness of the approach.

Figure 1: JRC ASTRA-3.

17. <http://www.gen-4.org/Technology/horizontal/proliferation.htm>

### Dual Use and Trade Analysis for Non proliferation Studies

Under the additional protocol the International Atomic Energy Agency (IAEA) can take advantage of a variety of sources of information to draw conclusions about the non-existence of undeclared activities in a country. In this respect trade data might play a role. To explore this possibility, a catalogue of existing trade data bases and services has been compiled [Figure 2]. During 2008 these trade data will support case studies to assess the potential and limitations of the approach.

A seminar on “Best practices in the area of technical review of export licences” was jointly organised by the National Nuclear Security Administration of the United States Department of Energy (US DOE NNSA) and JRC-IPSC. 21 people participated, of which 10 attendees from various Member States plus 8 lecturers. The success of the event led to the decision to repeat it in 2008.

### Open Source Analysis for Country Nuclear Profiles

Data on nuclear non-proliferation issues are systematically collected from public multilingual sources such as news articles, scientific and technical documentation. The information is then used to compile, on demand, regional or state level reports on nuclear activities and other activities that could be linked with the development of the nuclear fuel cycle. In the course of the year new country nuclear profiles have been delivered and specific short studies have been carried out upon request. The activity provides technical support on sensitive issues to EU stakeholders.

### ESARDA & Networking

JRC-IPSC continued to provide the general secretariat to ESARDA including the maintenance of the on-line knowledge repository where all the symposia proceedings and other relevant documents can be fully accessed<sup>18</sup>. Direct contribution was provided to the Working Groups activity on Integrated Safeguards, Verification Technologies and Methodologies and Knowledge Management. This last group is also promoting education on nuclear safeguards and non-proliferation: a 1 week course dedicated to university students was organised and hosted, for the third year, at JRC-IPSC in March 2007.

The 29th ESARDA Symposium took place in Aix en Provence (France) from 22 to 24 May 2007 and was attended by more than 260 participants. More than 160 papers and posters were presented in 30 sessions. The Symposium, organised by ESARDA with the support of the French Institut de Radioprotection et de Sûreté Nucléaire (IRSN) has been the largest of all ESARDA Symposia. As usual the proceedings were edited and published by JRC-IPSC, and widely disseminated [Figure 3].

The support to ESReDA continued, with the publication of the Seminars Proceedings. JRC-IPSC hosted the 33<sup>rd</sup> ESReDA Seminar, dedicated to Future Challenges to Accident Investigation, a cross cutting issue for safety and security.

### Challenges for the Future

The current nuclear renaissance is triggering a variety of initiatives worldwide and non proliferation is one of the main concerns for a secure and sustainable nuclear energy development and deployment. AMENUS will continue to be active in all the relevant non-proliferation activities. Work on methodologies and tools will provide the scientific and technical bases for such a contribution.



Figure 2: Geographical coverage of investigated trade data services.



Figure 3: ESARDA Proceedings.

<sup>18</sup>. <http://esardaz.jrc.it/>

# NuTraSeal

## CONTACT

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*JRC Candu Seals (JCS) reading system.*



*JRC Candu Seals (JCS) identities.*

## Development and Validation of Nuclear Traceability and Sealing Systems (NuTraSeal)

Within the framework of Nuclear Safeguards there is a demand for a robust and durable system of seals making possible the tracing and tracking, the monitoring, the identification and the verification over a period of several years of containers used either for the underwater storage of fissile materials to be reprocessed or for the transportation of nuclear fuel. The seals have to be radiation resistant and reliable even in very harsh environmental conditions. New solutions and improved designs are continuously requested by the inspection agencies.

The NuTraSeal action provides technical support to the Euratom Treaty, to the Directorate General for Energy and Transport (DG TREN) and to the International Atomic Energy Agency (IAEA) in the form of research development and deployment of sealing and identification equipment and of environmental and electromagnetic testing of inspector equipment in the SILab and TEMPEST laboratories.

The specific tasks are agreed with the customer in the framework of the JRC-DG TREN co-operation agreement and the EC Support Programme (SP-1) with the IAEA.

### Major 2007 achievements

#### JRC CANDU Seals (JCS)

Up to now, IAEA has used ARC<sup>19</sup> seals to secure underwater storage of spent nuclear fuel bundles from CANDU<sup>20</sup> type reactors, located at the Darlington (Canada) and Cernavoda (Romania) power generation facilities. After a nearly twenty-year service life, the ARC seal is no longer easily manageable. For this reason IAEA urgently needed a reliable alternative sealing system for the various CANDU reactors throughout the world.

Within the framework of SP-1, IAEA asked JRC-IPSC to develop a new CANDU sealing system based on the ultrasonic one patented by JRC-IPSC and currently used in Sellafield and The Hague.

Designing the new seals required considerable efforts, but eventually the first JRC Candu Seals (JCS) were placed in the spent fuel pond of the Cernavoda reactor in June 2006. The very good results of this first sealing campaign encouraged IAEA to decide on replacing half of the existing ARC seals with JCS seals.

Every spent fuel bundle stack is sealed with two seals: one of them is a JCS seal and the second an ARC seal to assure continuity of knowledge. About thirty JCS seals were successfully installed during 2007 and the plan for the future is to install only JCS seals. In the meantime, a JCS sealing system with 50 seals and reading software were produced for a vulnerability assessment commissioned by IAEA to Sandia National Laboratory. The results will be made available by mid-2008. The design will be upgraded according to the findings of the vulnerability assessment. A further supply of 100 seals for Cernavoda was required and will be delivered in 2008.

19. ARC: AECL Random Coil - AECL: Atomic Energy of Canada Ltd

20. CANDU (CANada Deuterium Uranium) is a registered trademark of AECL

### JRC Dry storage Seals (JDS)

Another line of development was to further rationalise the ultrasonic sealing concept and use it for new applications. IAEA and DG TREN requested the development of a system for long term dry storage (e.g. in CASTOR containers), which entailed a new design of seals, reading heads (able to read in dry conditions) and the development of remotely operated reading equipment.

A generic multi-purpose bolt seal for dry storage applications was designed. Its performance is the same as for the underwater bolt seal, but specific features were added to prevent the otherwise easy tampering due to the accessible position of the seal in dry storage. The new design fits Castor type containers (M24) but could be adapted to any dry storage container. A preliminary internal vulnerability assessment was carried out at JRC-IPSC to better show the limits of the design in relation with the cost benefits. A sealing system and 50 seals have been produced for a vulnerability assessment commissioned by IAEA to Sandia National Laboratory. The results will be made available by mid-2008 and the design will be upgraded accordingly.

### Security of confidential documents related to inspections

IAEA and DG TREN are also investigating a more widespread use of the technology used in safeguards and requested the design of a solution for a management system for confidential/security documents (e.g. reports on inspections, etc.). A preliminary study was started at the end of 2007.

### Challenges for the Future

NuTraSeal foresees an increased request for ultrasonic seals by IAEA. The target is to extend the sealing system used in Cernavoda to other Candu reactors. In 2008 a couple of hundreds seals and two reading systems for Candu are to be fabricated and delivered. The sealing systems for dry applications are also very promising. A custom application for a specific container is now under study.

IAEA asked SILab to be the European reference laboratory for vulnerability assessment of inspecting equipment developed outside Europe.

A new specific task will be opened by IAEA to support the development and delivery of a system for secure storage of classified documents.



*Ultrasonic seals fabrication phases.*

# PhyMod

## CONTACT

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### Safeguards for Gas Centrifuge Enrichment Plants

During 2007 PhyMod initiated a study to develop a Theoretical Centrifuge and Cascade Simulator (TCCS). Several numerical algorithms are under development to model centrifuges and corresponding cascade configurations. The models that are used are all based on a substantially grounded theory. The TCCS is designed in a flexible way and different types of centrifuges and cascades can be analysed with it. The TCCS is mainly used in the field of country profiles for making rapid assessments of enrichment capacities. In particular, it has been applied for monitoring the evolution of the Iran capability following the installation of new centrifuges at the Natanz plant.

A Real-Time Mass Evaluation System (RTMES) is under development for the nuclear material accountancy verification in a gas centrifuge enrichment plant. The proposed RTMES analyses weight data that is collected continuously from the feed, tails and product stations. Real-time evaluation of these load cell data by mass balancing is an attractive proposition, because it is not intrusive. It neither looks inside the cascade hall nor impinges on plant operation. In addition, the RTMES is Real Time system that is able to alert the safeguards inspectors if an issue is evolving. This is because the delays in presenting the mass balance results will be extremely short relative to the IAEA timeliness criterion.

## Physical Modelling and Analysis of Instruments and Systems (PhyMod)

JRC-IPSC has developed methods (based on Monte Carlo techniques) to simulate the behaviour of Non-Destructive Assay (NDA) instruments used in nuclear safeguards. Physical models of most of the neutron devices were also generated and validated. The simulation technique has become a valid and valuable tool to replace measurement every time the experiment is impossible (for instance due to lack of reference materials) or simply too cumbersome.

Safeguards approaches are moving towards an increased use of monitoring to automatically control nuclear activities in facilities such as reprocessing and to follow processed nuclear materials. It can reduce requirements for inspector presence and increase safeguards effectiveness both in terms of timeliness and sensitivity. Monitoring involves the integration of data from a variety of sensors (pressure, mass, neutron, gamma, ...) to control activities involving material in transit or in process. The analysis and interpretation of the large amount of process data in complex facilities requires also system modelling. A JRC-IPSC's software tool is developed that continuously monitors nuclear material flow through a reprocessing plant based on syntactic pattern recognition analysis. This process monitoring tool aims at a verification of the consistency and coherency of plant operation with safeguards requirements, and so at near real time accountancy. This allows timely comparison of the operational reports of the facility and the inspector's observations.

### Major 2007 achievements

#### Process monitoring

JRC-IPSC developed the Data Acquisition and Interpretation (DAI) software tool for continuously monitoring/tracking nuclear material flow through a reprocessing plant, while verifying the coherency with safeguards purposes. The tool was deployed and validated in major European reprocessing plants. During 2007 the major achievements were DAI installation and tank calibration on the THORP reprocessing plant in Sellafield (UK), the configuration of the SMS system for Rokkasho (Japan) and the training for inspectors from the Directorate General for Energy and Transport (DG TREN) and the International Atomic Energy Agency (IAEA).

#### Neutron counting

In the framework of design and modelling of NDA equipment the project of the development of a SCRAP Multiplicity Counter was completed. The experience gained during the experimental campaign performed in 2006 enabled the action to write three peer-reviewed papers published in Nuclear Instruments and Methods.

In the framework of a collaborative project within European Safeguards Research and Development Association (ESARDA), neutron measurement specialists from JRC-IPSC, from Los Alamos National Laboratories and from the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) performed a joint campaign of measurements in the Performance Laboratory (PERLA) in Ispra, Italy. The scope of this common project was to assess the performances of new digital-based acquisition systems for neutron multiplicity counting intended to replace in the medium term the traditional analogue electronics based on shift register modules. This served as a basis for an international benchmark exercise. Furthermore, an expert meeting organised by the IAEA and chaired by JRC-IPSC gathered the

main experts to share the most recent developments on data acquisition and evaluation.

### Training on Complementary Access

A Workshop on Additional Protocol (AP) was organised in March 2007. During this workshop several Complementary Access exercises were simulated in some of the nuclear facilities: ESSOR spent fuel pond, Ispra-1 reactor, ADECO hot cells and ETHEL laboratory. The goal was to test and improve the investigative and observation skills of nuclear inspectors in the detection of undeclared activities. To do that a modified AP site declaration was prepared with deliberate missing or wrong information. The inspectors were challenged to discover the inconsistencies and the possible indicators of clandestine nuclear activities. The workshop was attended by 13 IAEA inspectors and 5 DG TREN staff playing the role of state authority. The Agency highly appreciated the workshop which could become a permanent part of the IAEA training scheme.

### Workshop on CANDU safeguards

A workshop on CANDU reactor safeguards was organized by JRC-IPSC in Ispra on 29 and 30 May 2007. The goal was to profit from the experience from the Canadian authorities and IAEA in the safeguards of CANDU type reactors and fuel facilities in order to assist the implementation of DG TREN inspections in the CANDU facilities in Romania. The two-day workshop was attended by experts from the Atomic Energy of Canada Ltd (AECL), IAEA, DG TREN and experts from the Romanian Nuclear Commission (CNCAN) and Chernavoda Nuclear Power Plant. New R&D developments were identified and they will be undertaken by JRC-IPSC and AECL under the framework of the cooperation agreement Euratom/Canada.

### Nuclear Security

An Administrative Arrangement was signed with the Directorate General for Justice Freedom and Security (DG JLS) in July 2007 to provide a study on “Survey of Radiological Vulnerability in EU Member States”. This will analyse the current status of preparedness of Member States to a radiological threat, the legal issues connected with binding international treaties, the existing legislative measures and the practical implementation of countermeasures. The first part of the work consisted in the analysis of the situation in five representative countries through meetings with national authorities in France, Spain, Germany, Slovakia and Poland.

### Challenges for future

The TANK MEasurement (TAME) laboratory gained a thorough experience in process monitoring techniques especially applied to Nuclear Safeguards of fuel reprocessing plants. The main development of the forthcoming years will deal with the extension of the application of the technique to a broader spectrum of nuclear installation with a particular focus on uranium enrichment facilities.



*Experimental setup in the TAME laboratory.*



*Cascade hall in a gas centrifuge enrichment plant.*

## Exploratory Research Projects

The IPSC exploratory research programme has the aim to provide IPSC's scientific staff with the opportunity and the means to carry out research in new and innovative fields related to IPSC's mission, i.e. the security and protection of the European citizen. This research, which can last maximum 2 years, is not necessarily focused towards responding to the customer DG needs, more to anticipate technical/scientific needs of emerging EU policy issues and produce tangible results that could lead to future activities to be included in the mainstream of the institutional work programme. The IPSC Scientific Committee has adopted an open attitude and encourages proposals from all thematic areas of IPSC.

In 2007 seven projects were carried out. They ranged from improving rice production forecasts to building reconnaissance in satellite imagery and to safely remove nuclear material canisters. The specific credits spent were €161500 while 6.9 person-years were requested.

#### Imaging Sensor Authentication for Video Surveillance

Surveillance cameras play an important role in many security applications, including the surveillance of nuclear facilities within the framework of nuclear safeguards. Surveillance cameras may obviously be subject to tampering and interception with the goal to manipulate the images transmitted – or appearing to be transmitted – by the camera to the central. The objective of this project was, therefore, to investigate whether a cost-efficient, real-time authentication of the imaging sensor is feasible.

#### Effect of top-dressing nitrogen fertilization on radiation use efficiency: physiology, crop modelling and remote sensing - TOPFERT

The TOPFERT project aimed at improving the system currently used by the European Commission for rice yield forecast. In particular, the project's activities focused on the improvement of the simulation of rice growth in the crucial period which starts at the beginning of the stem elongation and ends at the heading stage. Other objectives of the project were the analysis and modelling of the relationship between rice Radiation Use Efficiency (RUE) and Plant Nitrogen Concentration (PNC) and the development of a procedure (based on the use of satellite data) for large-scale estimation of PNC [Figure 1].

#### Characterization of Reprocessed Fuel by Wide Environmental Sampling

Under the International Atomic Energy Agency's (IAEA) Additional Protocol, wide environmental sampling is considered part of the novel safeguards technology for future use by the IAEA inspectorate. This project investigated the possibility of applying this monitoring technique also to characterize reprocessed fuel and localize the corresponding place of radiochemical processing. Therefore, correlations between the environmental signature (measured volatile fission product isotope ratio's) and fuel characteristics (burn-up and isotopic composition as well as produced Pu) were determined. The study also examined how these correlations can be used for detection, localisation and identification of undeclared activities.

#### Assessment of hurricane-induced damage to and hazardous materials releases at offshore oil and natural gas platforms - HIDOP

The objective of this project was to assess the structural damage to the offshore oil and gas infrastructure in the Gulf of Mexico hit by Hurricanes Katrina and Rita to extract lessons learned that may possibly be transferred to other parts of the world. The project also aimed at identifying and analysing the oil spills and hazardous-materials releases triggered by the storms from offshore oil and gas platforms and pipelines and at identifying lessons learned concerning

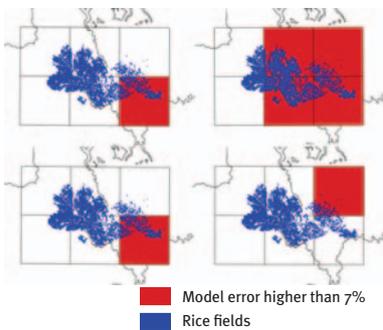


Figure 1: Performances of the standard version of the rice model WARM and of the WARM version which includes the products of the exploratory research TOPFERT. Comparison with official yield data.

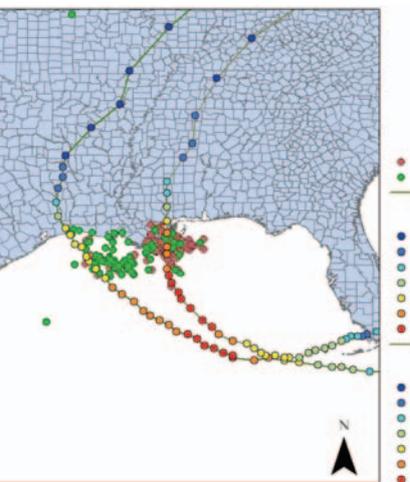


Figure 2: Hurricanes Katrina and Rita paths and the location of the triggered hazardous-materials releases.

the emergency management and clean-up activities in response to the hazmat problems caused by the storms [Figure 2].

### 3-D Urban Structure information extraction from Very High Resolution InSAR imagery

The main advantages of Synthetic Aperture Radar (SAR) systems are their independence of the solar illumination as well as their insensitivity to weather conditions. JRC-IPSC is developing its expertise in urban settlement characterisation as part of its activities in support of crisis management, damage assessment, territorial management in third world countries and assessment of urbanisation in African mega cities.

This project explored the information content of very high resolution (VHR) SAR imagery of 3-D urban structures in a staged approach: in a first step, a scaled building model was measured in the European Microwave Signature Laboratory (EMSL) under well-controlled conditions with a variety of viewing configurations; in a second phase VHR SAR data of real urban scenes acquired by an airborne SAR sensor was analysed, which allows controlling different parameters in the acquisition phase. Finally, real satellite VHR SAR data was exploited to confirm and tune results from previous steps [Figure 3].

### Techniques for safe removal of nuclear spent fuel from dry storages at Andreeva Bay

In the ex-naval base of Andreeva Bay, North-West Russia, over 22000 nuclear spent fuel assemblies (SFA) coming from nuclear-powered submarines and ice-breakers are stored in very poor conditions. Safe retrieval of spent nuclear fuel is a technical challenge that requires complex remotely controlled operations in highly radiated conditions and tight space constraints. The aim of the exploratory research project was to design, develop and test a safe and novel approach using remotely operated techniques and tools for the retrieval of spent nuclear fuel from storage tanks [Figure 4].

### EU aquaculture from a fisheries management viewpoint

Global production of farmed fish and shellfish has more than doubled in the past 15 years and now accounts for almost 50% of the world's food fish. Given the projected population growth over the next two decades, it is estimated that at least an additional 40 million tons of aquatic food will be required by 2030 to maintain the current per capita consumption.

The aquaculture industry of EU-25 produces a total of 1.3 million tons of fishery products a year for a value of about €3 billion, and is responsible for 57 000 full-time jobs. This represents about one-third of the total value of EU fishery production and about a fifth of its volume.

The project's objective was to assess the economic importance of EU aquaculture and its development over time.

A full description of the IPSC 2007 Exploratory Research Projects is available on line at <http://ipsc.jrc.ec.europa.eu/publications.php?id=2>

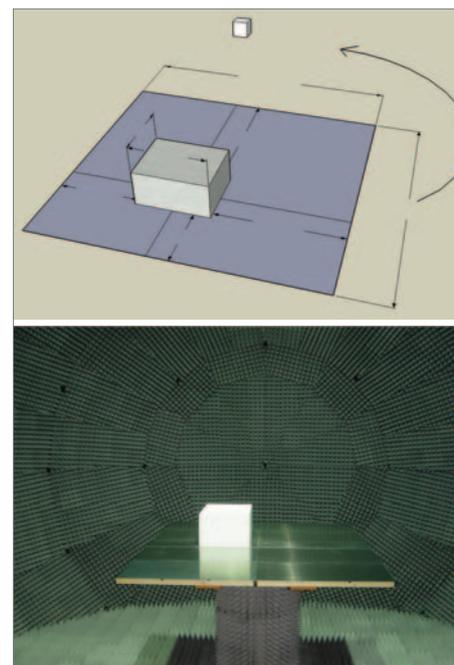


Figure 3: Setup of EMSL experiment.

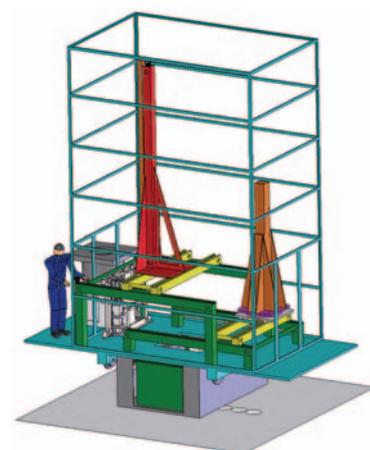


Figure 4: The JRC concept of the preparatory unit of the spent nuclear fuel retrieval machine.

## FIGURES

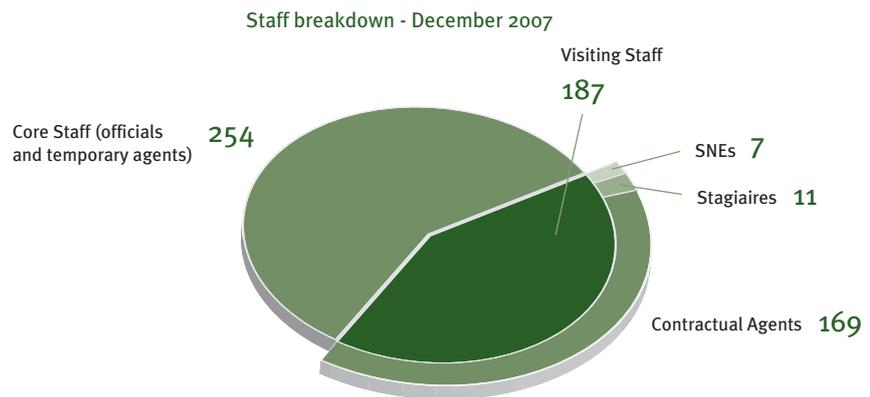
## STAFF

## JRC-IPSC in figures

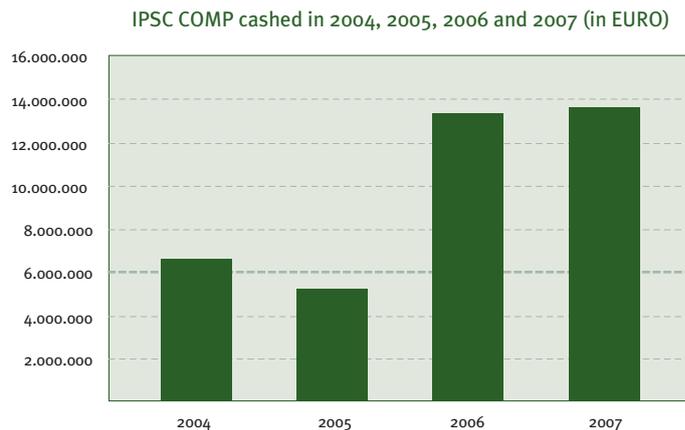
**Staff**

As of 31 December 2007 JRC-IPSC employs 441 staff of which 254 are European Commission officials and temporary agents, the others being contractual agents, trainees and seconded national experts (SNEs). Women represent 28% of the total staff figures.

Of the 441 total, roughly 370 staff members are working on scientific projects in support to customers and 71 staff members are doing administrative or support work.

JRC-IPSC  
COMPETITIVE  
ACTIVITIES**JRC-IPSC competitive activities**

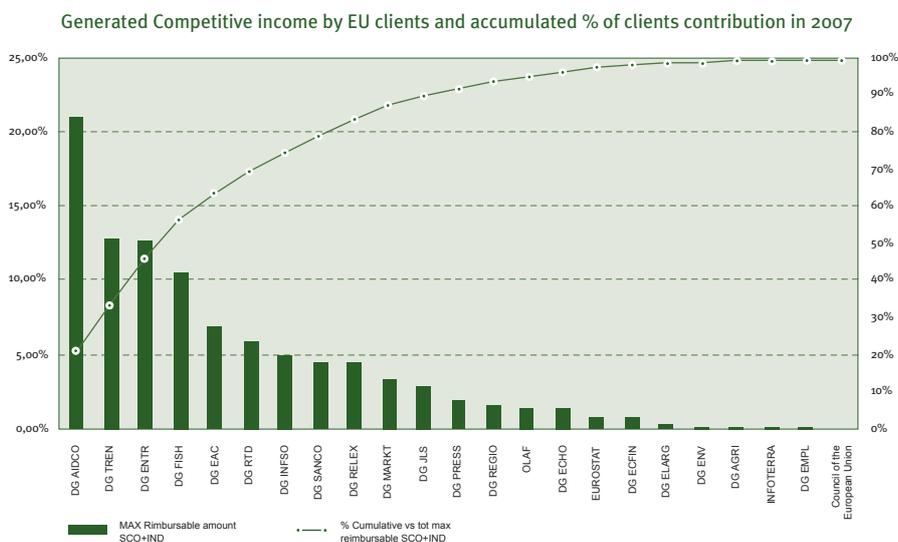
A part of the Institute's budget is competitive income from work performed in support to Directorates General of the Commission (SCO), income from participation in EU Framework Programme (Indirect Actions, IND) or from work performed for third parties (TPW). In 2007 JRC-IPSC has cashed 13,6 million euro, a very good result, similar to what had been achieved in 2006.



In total 71 new competitive projects were started in 2007, representing a total value of 11,449 millions of euros.

The new EU Framework Programme for Research and Technological Development (FP7) started in January 2007. During the year 61 proposals were submitted as partner in Indirect Actions, the biggest proportion in calls within "Security" and "Information and Communication Technologies". The results are not yet known at the time of writing this report.

Here below the 2007 income by customer in support to Directorates General of the Commission (SCO), and from participation in EU Framework Programme (Indirect Actions, IND):



Due to its expertise information and communication technologies, combined with experience in Nuclear Safeguards, the institute cooperates with many different services of the European Commission with competitive activities, as shown by the above bar chart. As it can be seen the range of IPSC partners is quite broad and well distributed in the different areas of competence of the EC.

More information on IPSC competitive activities is available at <http://ipsc.jrc.ec.europa.eu/activities.php?id=2>

## Publications

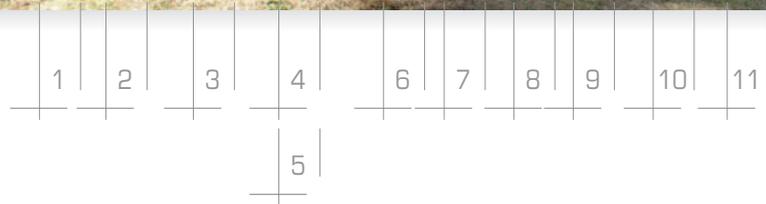
Research carried out in IPSC is reported in scientific publications, such as scientific journals, conference proceedings and scientific and technical reports.

The full list of IPSC publications in 2007 is available on <http://ipsc.jrc.ec.europa.eu/publications.php>

Category	2007 IPSC publications
Monographs and articles	89
JRC Reports and Notes	93
Contributions published in Conference Proceedings	92
Special Publications (e.g. PhD theses, maps)	7
<b>TOTAL</b>	<b>281</b>

## PUBLICATIONS

## JRC-IPSC organigramme



1. Head of the Agriculture Unit  
**Mr Jacques Delincé**
2. Head of the Management Support Unit  
**Mr James Gray**
3. Head of the Nuclear Safeguards Unit  
**Mr Willem Janssens**
4. Head of European Laboratory for Structural Assessment Unit  
**Mr Michel Geradin**
5. Head of the Support to External Security Unit  
**Ms Delilah Al Khudhairy**
6. Director of the Institute  
**Mr Stephan Lechner**
7. Head of the Sensors, Radartechnologies and Cybersecurity Unit  
**Mr Alois Sieber**
8. Head of the Econometrics and Statistical Support to Antifraud Unit  
**Mr Andrea Saltelli**
9. Assistant to the Director  
**Mr Pierpaolo Malinverni**
10. Head of the Traceability and Vulnerability Assessment Unit  
**Mr André Poucet**
11. Acting Head of the Maritime Affairs Unit  
**Mr Thomas Barbas**

S. Lechner was appointed IPSC Director from 1<sup>st</sup> November 2007.

A. Sieber served as IPSC Acting Director until 31 October 2007.





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