

ipsc

**INSTITUTE for the PROTECTION
and SECURITY of the CITIZEN**



ANNUAL REPORT 2009

The Institute for the Protection and Security of the Citizen

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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.

ANNUAL REPORT
2009



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

Joint Research Centre
Institute for the Protection and Security of the Citizen

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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,

2009 was a year of great satisfaction for IPSC as we have gained more than 22 million euros from competitive contracts, contributing to approximately 1/3 of the 2009 JRC target. This is a confirmation of the Institute capacity to support the EU policy making process, and the ability of the Institute staff to deliver high-quality results. The recipients of our work, i.e. the Commission and other European and international partners are highly satisfied and the demand for more work is very strong.

The number of peer-reviewed publications has also increased with respect to 2008; this follows a firm positive trend already established in the last three years. In 2009 the Institute contributed to the development of the new JRC strategy, which is now undergoing the necessary approval stages, and which shall be deployed in the 2011 Work Programme.

The Institute contribution to several dramatic crisis situations has proven that our crisis management tools and capabilities work effectively in real life situations. Some examples: the L'Aquila earthquake in Italy, where we delivered situation maps hours after the event and provided support to reconstruction, and the Samoa tsunami, where our tsunami model yielded correct predictions. The feedback from real life situations to research helps us to constantly improve our crisis management tools and allows us to rapidly intervene in a pseudo-operational mode.

The increasing demands will also bring a lot of work for the future, but based on our staff's strong capabilities and the constant support from our clients and partners, I am sure that we will maintain an excellent position in the years to come.

Stephan Lechner
IPSC Director



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) covers the period 2007-2013, while the EURATOM Framework Programme covers the period 2007-2011.

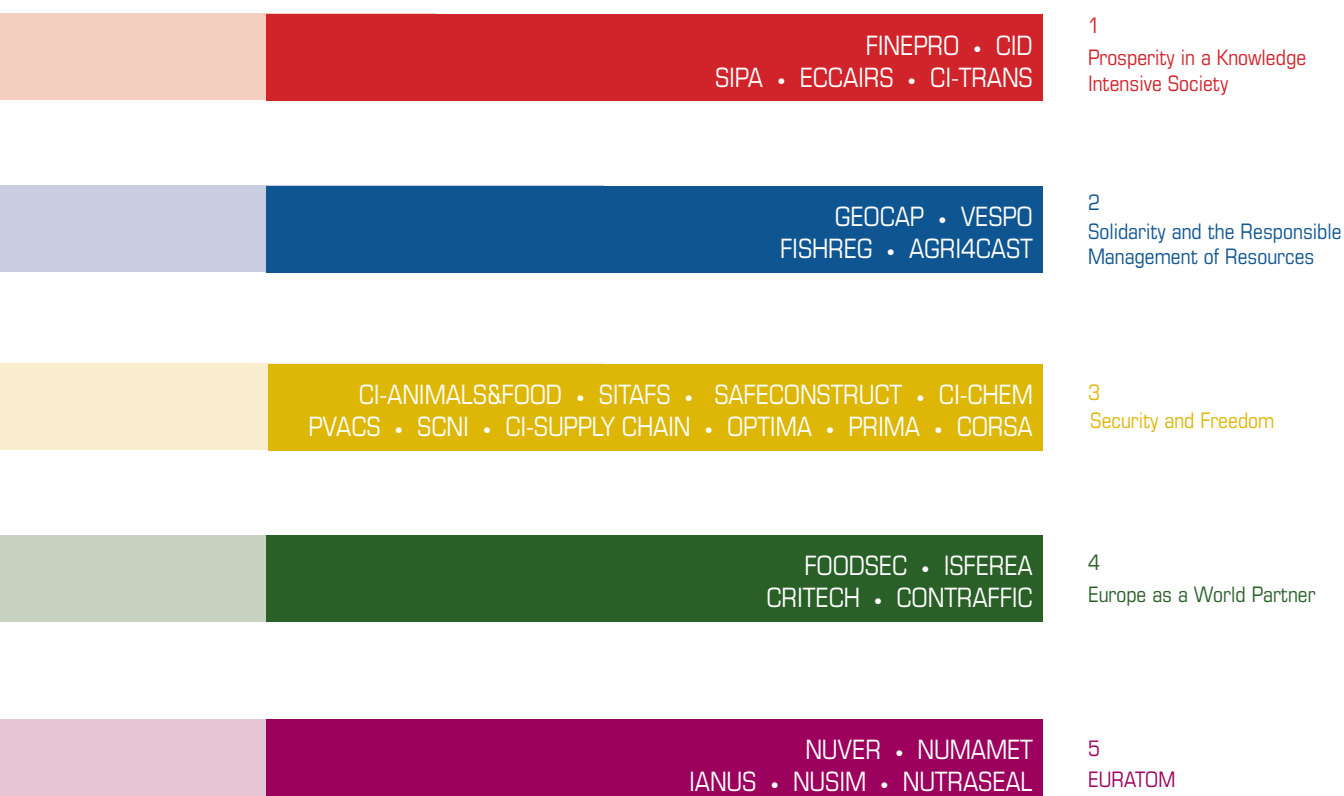
The current work of the JRC is based on the Multiannual Workprogramme 2007-2013, which is organised into five policy areas:

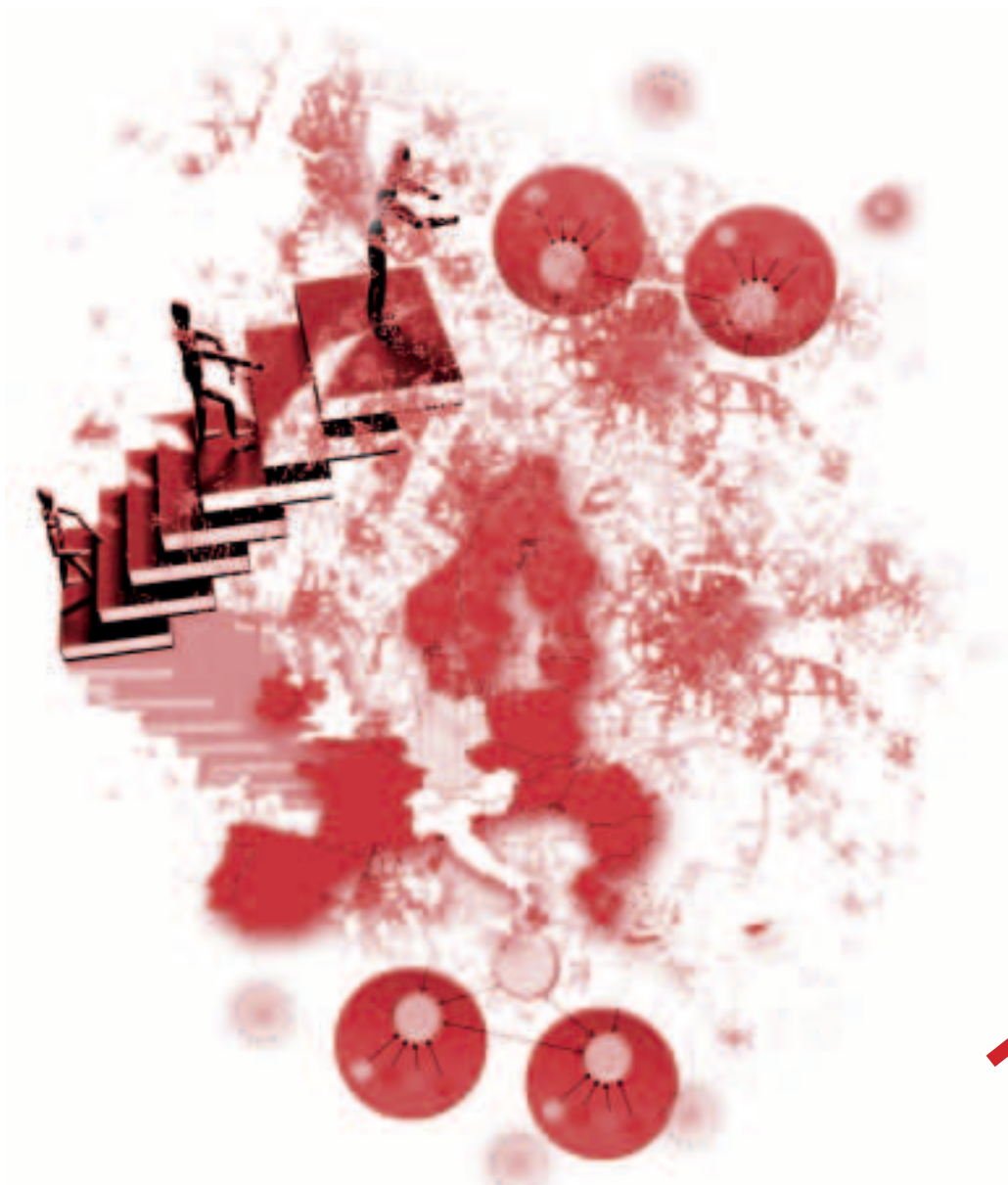
1. Prosperity in a Knowledge Intensive Society
2. Solidarity and the Responsible Management of Resources
3. Security and Freedom
4. Europe as a World Partner
5. the EURATOM Programme

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 2009 at the Institute for the Protection and Security of the Citizen, according to the thematic structure of the JRC Multiannual Workprogramme 2007-2013.

In 2009, the JRC-IPSC's workprogramme comprised 28 actions, distributed over all the 5 policy areas.





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 technological innovation and e-business of enterprises. It provides 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 the 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 contributes 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.

FINEPRO, SIPA, CID

1.3 Energy and Transport

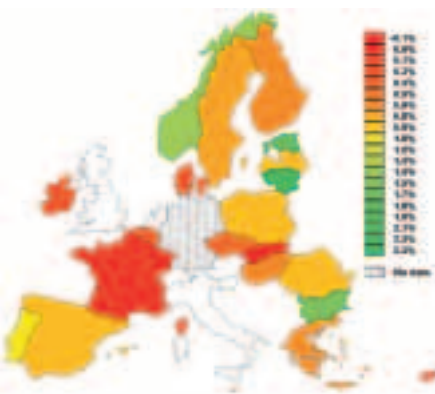
Sustainable transport relates to environment quality, mobility, competitiveness, single market and innovation. The JRC follows safety issues related to air transport and will develop methods and supporting technologies for assessing vulnerability of transport systems to unintended and malintended acts.

ECCAIRS, CI-TRANS

FINEPRO

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Deposit Guarantee Schemes in the EU Member States are currently funded in a very heterogeneous way (high percentages correspond to better funded schemes). The new EU legislation might propose the systems to converge to a more harmonized framework.

Analytic Methods for Financial and Economic Protection (FINEPRO)

The consequences of the crisis that started in the US in 2008 have spread around the globe. Commencing with a series of bankruptcies in the financial sector, the crisis has eventually reached businesses and households. In 2009 the European economy has faced the deepest recession since the 1930s, with a recession of about 5% in the euro area and a subsequent increase in unemployment. National governments, the European Central Bank and the Commission promptly reacted to the crisis by protecting savings, maintaining a flow of affordable credit for businesses and households, monitoring global imbalances, and coordinating Member States initiatives with the view to improving governance of the economic and financial system. With its expertise in financial modelling and econometrics, FINEPRO has been actively supporting the Commission Services in its crisis policy initiatives.

Major 2009 achievements

In 2009 FINEPRO supported the Directorates-General for Internal Market and Services (DG MARKT) and for Economic and Financial Affairs (DG ECFIN) on the following dossiers.

Deposit Guarantee Schemes

Deposit Guarantee Schemes (DGS) are a key element of the financial safety net ensuring that, if a bank fails, depositors will be able to recover at least part of their money. The role of DGS has been widely recognized during the financial crisis and the EC undertook a complete review of the DGS legislation.

FINEPRO developed a technical study proposing different models to estimate banks' annual premia reflecting the banks' risk profile¹ and assisted DG MARKT in preparing an extensive impact assessment accompanying a new EC legislative proposal.

Insurance Guarantee Schemes

Only a few Member States have Insurance Guarantee Schemes (IGS) in place. The lack of Community harmonisation in this area may create problems for the protection of policyholders in case of the winding-up of an insurance undertaking. The EC will adopt a White Paper setting out European solutions for IGS.

FINEPRO developed a methodology to conduct a quantitative assessment of several policy options. Results of these analyses were presented in a technical report which DG MARKT has used for an impact assessment accompanying the White Paper.

Tax relief procedures

Tax laws of EU Member States usually provide for withholding taxes on dividend and interest income paid to non-resident investors. These taxes are often reduced under bilateral agreements between States. However, procedures to verify claims are so complicated that investors may forego the relief or even be discouraged from investing across borders.

The EU Clearing and Settlement Fiscal Compliance Experts Group (FISCO) proposed solutions to improve these procedures. FINEPRO collaborated with DG MARKT and TAXUD to estimate costs and benefits of the FISCO proposals con-

1. http://ec.europa.eu/internal_market/bank/guarantee/index_en.htm

cluding that improving tax procedures could raise European GDP by more than 37 b€ over 10 years². Following this result, the Commission adopted a recommendation³ to simplify procedures for claiming cross-border withholding tax relief.

GAP: monitoring the adherence to the ‘Stability and Growth Pact’

GAP is the software developed by FINEPRO and used by DG ECFIN to monitor the Member States’ adherence to the ‘Stability and Growth Pact’. Two variables are fundamental for monitoring and analyzing the adherence to the ‘Stability and Growth Pact’: the Non-Accelerating Inflation Rate of Unemployment (NAIRU) and the potential Total Factor Productivity (TFP). Until 2008 DG ECFIN and Member States used Program GAP to estimate only the NAIRU. In 2009 the latest release of the GAP software (4.1)⁴ was extended to estimate the potential TFP. The new methodology implemented in GAP was endorsed in December 2009 by the Economic Policy Committee.

QUEST III: a model for macroeconomic analysis

QUEST is the dynamic stochastic general equilibrium model that the Commission uses for macroeconomic policy. The QUEST III version jointly estimated by JRC-IPSC and DG ECFIN is the basis of EC macro-economic analysis⁵.

In 2009 FINEPRO collaborated with DG ECFIN to develop QUEST (version III) in different directions. The QUEST extension was used to evaluate the impact of structural economic reforms aimed at promoting the Lisbon strategy for Growth and Jobs⁶. Moreover, QUEST was adapted in order to analyse potential causes of the financial crisis and possible responses⁷.

Solvency II: Insurance Companies Capital Requirements

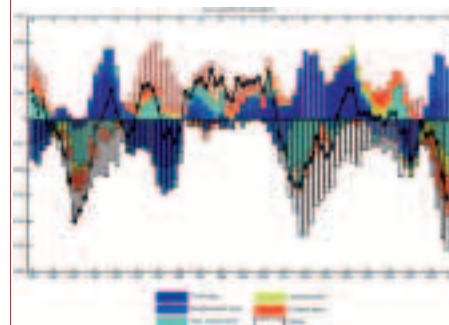
Solvency II is a wide ranging reform on Insurance Companies Capital Requirements, aimed at streamlining regulations across Europe and at making requirements based on economic risk criteria with the objectives of improving consumer protection, modernising supervision and deepening market integration.

In 2009 FINEPRO provided DG MARKT with updated quantitative estimates of the macro-economic impact of Solvency II.

Challenges for 2010 and beyond

FINEPRO will continue supporting DG MARKT in the field of deposit insurance crisis resolution, focusing on specific issues to be identified in the consultation process among the European Commission, the European Parliament and the Council.

Following the decision of the Economic Policy Committee, FINEPRO will focus its research activities on Total Factor Productivity in EU MS, and will continue to work on the improvement and estimation of QUEST III to explicitly model a banking sector.



QUEST III model can be used to estimate growth decomposition for broad categories of economic shocks (technology, monetary policy, collateral, stock market, housing market).

GLOSSARY

GDP	Gross Domestic Product
DG ECFIN	Directorate-General for Economic and Financial Affairs
DG MARKT	Directorate-General for Internal Market and Services
DG TAXUD	Directorate-General for Taxation and Customs Union
DGS	Deposit Guarantee Schemes
FISCO	Clearing and Settlement Fiscal Compliance Experts Group
IGS	Insurance Guarantee Schemes
NAIRU	Non-Inflation-Accelerating-Rate of Unemployment
QUEST	Dynamic Stochastic General Equilibrium model
TFP	Total Factor Productivity

2. http://ec.europa.eu/taxation_customs/resources/documents/common/whats_new/study_fisco.pdf

3. C(2009)7924 final. Commission recommendation of 19.10.2009 on withholding tax relief procedures.

4. http://ec.europa.eu/economy_finance/sgp/convergence/data_methods/index_en.htm

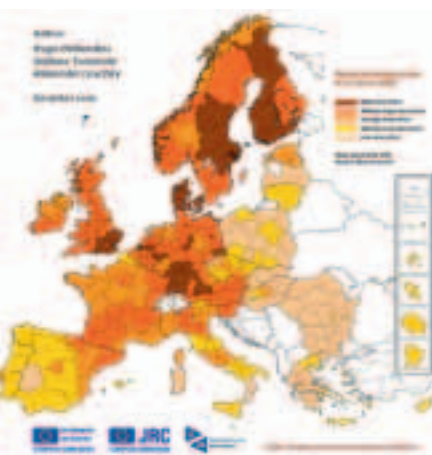
5. http://ec.europa.eu/economy_finance/publications/publication_summary15289_en.htm

6. Quarterly Report on the Euro Area: http://ec.europa.eu/economy_finance/publications/publication_summary16509_en.htm

7. http://ec.europa.eu/economy_finance/publications/economic/economic_paper/2010/ecp397_en.htm

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The 2009 Regional Innovation Scoreboard shows that the level of innovation in regions varies considerably in countries.

Statistical Indicators for Policy Assessment (SIPA)

SIPA offers econometric and statistical support for the implementation and monitoring of the EU policies. The Action has four lines of activity.

1. **Statistical indicators:** policy processes without tangible goalposts are meaningless. Policy targets need to be measurable and those measures need to be objective and comparable. SIPA has a considerable experience and international reputation in developing and testing (composite) indicators for policy analysis. In 2009 the Action worked on flexicurity, regional competitiveness, innovation scoreboard, governance, rule of law, and cost of capital.
2. **Sensitivity analysis:** How confident are you in the results of a model? How much will the results change if your basic data or your model is slightly wrong? These are the kind of questions answered by sensitivity analysis. SIPA develops algorithms and mathematical models to disentangle the relationship between a model whose input is uncertain and its results. We apply sensitivity analysis to real world models in different fields, from economic to environmental models.
3. **Quality of scientific information:** increasing the robustness of scientific advice to policy development is a common thread throughout the JRC work programme. SIPA develops guidelines and tools for quality assessment of policy relevant scientific information especially focusing on the management of uncertainty in the formulation and communication of complex issues.
4. **Lifelong Learning:** SIPA is particularly active in the evaluation and monitoring of education and training systems with its Centre for Research on Lifelong Learning¹ (CRELL).

Major 2009 achievements

In 2009 SIPA worked for several Directorates-General of the European Commission and together with international organisations (Organisation for Economic Co-operation and Development -OECD, United Nations, World Economic Forum), universities and research centres. The Action published 21 scientific papers in peer-reviewed journals, organised conferences and workshops, and gave trainings on statistical methods.

Statistical indicators

Using the procedures suggested by the Handbook for Constructing Composite Indicators² written together with OECD, SIPA tested the reliability of more than a dozen internationally known composite indicators, such as the OECD Product Market Regulation Indicators, the Environmental Performance Index of Yale and Columbia Universities, the Index of African Governance with the Harvard's Kennedy School, the Shanghai *Jiao Tong* and the *Times Higher Education* academic ranking of world universities.

SIPA also developed in house composite indicators: together with MERIT-Maastricht University, the Action developed for the Directorate-General for Enterprise and Industry (DG ENTR) the 2009 Regional Innovation Scoreboard³ which attracted considerable media attention. The results confirm the value of measuring innovation performance at regional level to complement the national level and emphasise the need for policies to reflect regional contexts. A composite indicator on regional competitiveness (together with the Directorate-General

1. <http://crell.jrc.ec.europa.eu/>

2. <http://composite-indicators.jrc.ec.europa.eu/Handbook.htm>

3. <http://www.proinno-europe.eu/>

for Regional Policy) and a set of indicators on flexicurity (together with the Directorate-General for Employment, Social Affairs and Equal Opportunities) are in the pipeline.

Sensitivity analysis

SIPA contributed to the guidelines on impact assessment developed by the Secretariat-General with a two courses on sensitivity analysis as an essential ingredient in preparing impact assessments⁴. A special issue on Sensitivity Analysis, edited by JRC-IPSC, was published by the *Reliability Engineering and System Safety* journal⁵. The volume includes a number of articles from SIPA staff and marks an important contribution to the development of research on sensitivity analysis.

Quality of scientific information

SIPA edited the book *Science for Policy* (Oxford University Press). This volume discusses the changing role of science in policymaking. Producers and users of science and technology for policy are increasingly aware of the need to change the ways in which knowledge is produced and deployed, especially science-based knowledge used to foster, support, or legitimise policy decision making. The challenge is to develop new decision-making styles in order to cope with deep uncertainty, even ignorance, about facts, and a plurality of value systems.

The Centre for Research on Lifelong Learning (CRELL)

CRELL co-authored the 2009 edition of the Commission Staff Working Document: *Progress towards the Lisbon objectives in education and training – Indicators and Benchmarks*⁶. This is the only publication of the Commission dealing with indicators in education and training and constitutes the main official document produced by the Directorate-General for Education and Culture (DG EAC) each year.

Moreover, CRELL developed studies on social cohesion, active citizenship, higher education, employability, equity and wellbeing widely used by DG EAC (and published or submitted in peer-reviewed journals). A major conference on measuring creativity was organised in May 2009 within the 2009 European Year for Creativity. A message from President Barroso to the participants underlined the crucial role of creativity for the development of societies. The proceedings of this conference are collected in a book⁷.

Challenges for 2010 and beyond

SIPA will continue supporting various Directorates-General and international partners in the creation and testing of composite indicators, while developing and testing original statistical methodologies for uncertainty and sensitivity analysis. CRELL will increase its support to DG EAC through new research activities in the areas of employability, equity and social cohesion and through a stronger participation in the 2010 Commission Staff Working Document: *Progress towards the Lisbon objectives in education and training – Indicators and Benchmarks*. Among our challenges there is also the upscale of the current standard in peer-reviewed publications.



CRELL constructed a composite indicator on EU lifelong learning used in the 2009 Progress Report

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GLOSSARY

CRELL Centre for Research on Lifelong Learning

DG EAC Directorate-General for Education and Culture

DG ENTR Directorate-General for Enterprise and Industry

MERIT Maastricht Economic and social Research and training centre on Innovation and Technology

OECD Organisation for Economic Co-operation and Development

4. http://ec.europa.eu/governance/impact/key_docs/key_docs_en.htm

5. *Reliability Engineering and System Safety* 94 (7); 2009

6. http://ec.europa.eu/education/policies/2010/doc/progresso8/report_en.pdf

7. http://ec.europa.eu/education/lifelong-learning-policy/doc2082_en.htm

CID

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WorldView2: DigitalGlobe's WorldView-2 Satellite was launched on October 8, 2009. The sensor provides a high resolution panchromatic band of 0.46 m resolution and eight multispectral bands of 1.8 meters resolution (GSD at nadir). The bands are four standard colours (red, green, blue, and near-infrared 1) and four new bands (coastal, yellow, red edge, and near-infrared 2). WV2 is presently being benchmarked by the CID Action for use in the CAP Control with Remote Sensing programme 2010 - the image shows the CID benchmark site Maussane, FR (MSP bands true colour, January 2010).

© DigitalGlobe [2010]

Community Image Data Portal (CID)

The Community Image Data portal (CID) Action was created at the start of the Seventh Framework Programme (FP7). The Action is a result of the long term experience in image data management and in image data applications built up at the JRC, which serves a series of purposes: to coordinate efficient image acquisition, procurement, quality access, efficient preparation and storage of data, data curation, ensuring a better use, a more efficient re-use and to encourage the use of imagery in new areas. The long term experience also serves to give input to an efficient collaboration with external partners (e.g. the European Space Agency - ESA, the Group of Earth Observation - The Global Earth Observation System of Systems - GEO/GEOSS, industry, image providers) and towards the Global Monitoring for Environment and Security initiative (GMES).

The Action places itself as the focal point for satellite (and aerial) remote sensing data management at the JRC as a Spatial Data Infrastructure (SDI). At present some 20 Actions – potential CID clients - within the JRC deal with and/or have data archives requiring interoperability, security and archive management. Achievement of this end-point objective is, nevertheless, stepwise. The CID Action is logically mostly applications-oriented with strength in conception, implementation and operations giving research-based support and operational support. A healthy balance towards science is however maintained through benchmark studies of new satellite remote sensing sensors, through data servicing and architecture engineering and through in-depth studies on image data policy.

Major 2009 achievements

CID Portal

The Community Image Data portal is now serving JRC clients with satellite remote sensing data. At present there are some 30 terabytes in the archive; the CID Portal end-2009 consists of data access/dissemination functionality with adequate authentication and cataloguing systems allowing for selective and secure access to data in the portal through discovery, view and download services and direct file-based access for internal JRC users, data loading routines, data preparation routines, supported by an underlying IT infrastructure, including image and image metadata storage, running in high availability mode. 2009 has seen:

- 2 major upgrades based on user feedback, and programmed enhancements
- continued data loading
- new OGC (Open Geospatial Consortium) services
- link to the Infrastructure for Spatial Information in Europe (INSPIRE) initiative - all CID portal metadata can be harvested and further discovered by INSPIRE Geoportal
- GEO/GEOSS component registration

Satellite image acquisition for the Common Agricultural Policy

Image Acquisition for the Common Agricultural Policy (CAP) Control with Remote Sensing programme: 2009 was the 7th year of successful Very High Resolution (VHR) image acquisition for the CAP controls; since the start in 2003 when 12.000 km² of VHR data were collected, a huge increase in volume has occurred: nearly 180.000 km² were successfully collected in 2009. The VHR sensors used were Ikonos, Quickbird, GeoEye1, Eros A/B, Formosat2 and SPOT supermode. The acquisition of High Resolution imagery saw a success rate of 95% in 2009. In total 655 images were acquired over 249 control zones. Sensors used for the HR Campaign were: SPOT, IRS, RapidEye, Landsat5 and DMC.

Framework Contracts

Technical specifications for new framework contracts for the “Supply of Satellite Remote Sensing Data products and associated services to Institutions and Bodies of the EU” were prepared and will be signed in 2010. State-of-the art image data licensing terms and conditions accompanying the specifications will allow harmonized purchase, use and re-use of data for the Institutions and bodies of the EU. These licensing terms and conditions take important steps towards INSPIRE, and GEO/GEOSS.

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

In 2009 CID completed a functioning GENESI DR compliant hardware and software infrastructure and completed the first loop of validation tests for the project (totalling 4.4.M € grant, led by the European Space Agency - ESA, ending in April 2010). The project concerns providing harmonized access to multiple, distributed European Earth Science data repositories and integrating distributed computing infrastructures for Earth Observation science users. JRC-IPSC is contributing to the Project through the CID Action (main JRC partner), and the ISFEREA Action. The project is considered of importance for CID also to profile itself towards the main digital repositories in the EU.

Challenges for 2010 and beyond

Efficiency of the CID portal has been demonstrated at Unit level and to selected external clients in 2009. 2010 aims at IPSC level and to move towards JRC level. This means the continued loading of image data of the various interested Actions, to guarantee a secure data storage preserving its long term availability.

Concerning CAP satellite image acquisition, CID aims at increasing efficiency through streamlined technical and administrative management system and reduced administrative overheads, while ensuring the procurement framework to support this. This will include, in collaboration with JRC-IPSC's Action GEOCAP and the Directorate-General for Agriculture and Rural Development (DG AGRI), setting up a roadmap for alternative means of managing the administration of the CAP Control with remote sensing image ordering. This will allow the Action to concentrate on the scientific aspects of the image management.

Substantial input has been given during 2009 to the GMES initiative on data access and image data policy; this is mirrored in the currently running GMES Space Component Data Access portfolio run by ESA. The challenge for 2010 will be to increase efficiency, and to prepare a more efficient data access, and data policy to be used in the Delegation Agreement and the GMES Initial Operations which will kick off in October 2010.



THEOS: The Thailand Earth Observation Satellite (THEOS) is the first operational earth observation satellite of Thailand, launched on October 1, 2008. The sensor provides a high resolution panchromatic band of 2m resolution (22km of imaging swath) and four standard (blue, green, red, near infrared) multispectral bands of 15 meters resolution (90km swath). The Geo-Informatics and Space Technology Development Agency (GISTDA) owns and distributes the THEOS products that are presently benchmarked by the CID Action for use in the CAP Control with Remote Sensing programme 2010 - the image shows the CID terrestrial test site in Maussane, FR (MSP bands true colour, April 2009)

© GISTDA [2009-2010]

GLOSSARY

- CAP** Common Agricultural Policy
- DG AGRI** Directorate-General Agriculture and Rural Development
- ESA** European Space Agency
- GEO-GEOSS** Group of Earth Observation - The Global Earth Observation System of Systems
- GENESI-DR** Ground European Network for Earth Science Interoperations - Digital Repositories (FP7 project)
- GMES** Global Monitoring for Environment and Security
- INSPIRE** Infrastructure for Spatial Information in the European Community
- OGC** Open Geospatial Consortium
- SDI** Spatial Data Infrastructure
- VHR** Very High Resolution

ECCAIRS

CONTACT

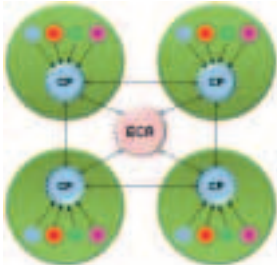
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 website:
<http://ipsc.jrc.ec.europa.eu/showaction.php?id=9>



Simplified software Architecture of the new multimodal ECCAIRS Common Framework.

ECCAIRS Common Framework

One of the main implications of the decision to use ECCAIRS for different transport sectors was the need for a new software architecture, able to support different types of taxonomies and customisable user interfaces. This new system, called the EC-CAIRS Common Framework (ECF) and pre-released during 2009, offers increased flexibility for customer organisations while at the same time reducing development time to a minimum. All collection, presentation and analysis modules are available off the shelf and can be used immediately. Development is reduced to just creating the taxonomy (data-fields and values) and designing a suitable user interface.



EU Collection and integration process for aviation safety information. Each green circle represents a Member State. Their Points of Contact (CP) are responsible for exchanging and integrating the data in the European Central repository (ECR).

Multimodal Public Transport Safety (ECCAIRS)

Safe transport remains a top priority for EU policy makers. Unfortunately some severe fatal accidents during 2009 reminded us that this priority has been set for a good reason. It is clear that efforts to improve transport safety on a national and European level must not only continue, but given the continuous growth of the public transport sector, should even be strengthened.

An important method for improving safety is the understanding of the causes that lead to transportation incidents and accidents. European legislation has been put in place to collect, exchange and learn from safety information in the aviation, the maritime and the railways sector. JRC-IPSC's ECCAIRS (European Coordination Centre for Accident and Incident Reporting Systems) activity supports these policies by assisting EU policy-makers (the EC Directorate-General for Energy and Transport - DG TREN) and policy-implementers (European Transport Agencies and National Competent Authorities). ECCAIRS provides these organisations with tools and services that allow them to plan, implement, monitor and evaluate EU and national policies.

By the end of the Seventh Framework Programme (2013) ECCAIRS will have produced a multimodal public transport safety network providing tools and services to EU policy makers, national competent authorities and the three transport agencies. During 2009 the focus of the activity was on completing the integration network of aviation safety information, starting the collection of maritime casualty reports and evaluating the feasibility of collecting railways safety information.

Major 2009 achievements

European Central Repository of aviation safety data

Directive 2003/42/EC and the related Regulation (EC) 1321/2007 require Member States to integrate their national aviation safety data in a European Centralised Repository (ECR). The JRC-IPSC implements this legislation by running a Data Integration Network for ECCAIRS Repositories (DINER). This network is based on in-house developed software and uses the Internet as a transport medium. All integrated data is stored in the ECR (a secure database environment at the JRC in Ispra) and is made available to the competent authorities of the EU Member States, the three involved EFTA States (Iceland, Switzerland and Norway), Eurocontrol and the European Aviation Safety Agency in Cologne.

At the end of 2009, twenty out of the thirty States involved were integrating their data in the European Central Repository, demonstrating the feasibility of the integration process. For the first time, more than 250.000 occurrence reports have now been integrated in a single repository. With all States joining the integration process in 2010 this amount of safety related information is bound to grow significantly in the next years.

Launch of the European Marine Casualty Information Platform

In 2008, following a successful joint study, the European Maritime Safety Agency (EMSA) decided to implement the European Marine Casualty Information Platform (EMCIP), as required by Directive 2009/18/EC. At the beginning of the year a web based instance of EMCIP, based on a pre-released version of the ECCAIRS mode-independent Common Framework, was set up in the JRC-IPSC and became fully operational in May 2009. At the end of the year repositories had been created for more than 25 organisations in the EU, most of which started using the system immediately.

Contrary to the aviation version of ECCAIRS, the EMCIP system takes a strongly centralised, web-based approach where casualty reports are stored in repositories provided by a single centralised service. This means that Member States do not have to set up a localised ECCAIRS environment and can fulfil their reporting obligations remotely. While Member States access the EMCIP system at a national level, EMSA accesses the completed national reports, using the same IT infrastructure, from a European perspective.

Worldwide partnerships

The recommendation expressed by the International Civil Aviation Organization of the United Nations (ICAO) at the end of 2008, to use the ECCAIRS system as a tool for ICAO Contracting States submitting electronically their accident notifications and reports, resulted in an increasing interest from competent authorities all over the world. The ECCAIRS web portal, with hundreds of registered professionals, plays an essential role in keeping this growing co-operative ECCAIRS network successful.

Inside Europe a Memorandum of Understanding signed between JRC-IPSC and the French Aviation Accident Investigation Body 'Bureau d'Enquêtes et d'Analyses' (BEA), covering collaboration in areas like training, analysis and further development of the ECCAIRS system, exemplify the ongoing shared effort to extend and improve the deployment of the ECCAIRS Reporting System in the EU Member States.

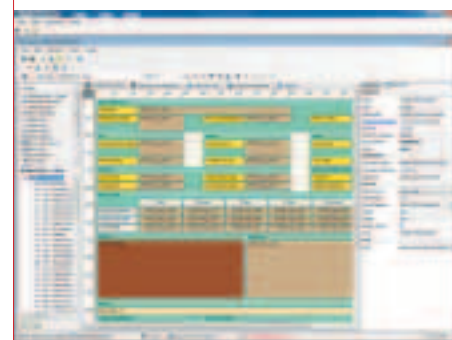
Challenges for 2010 and beyond

ECCAIRS is now successfully used for collecting, exchanging and integrating safety data related to accidents and incidents in the aviation and the maritime sector. There is a clear interest expressed by the European Railways Agency (ERA) to use ECCAIRS for implementing their new E-Rail system. Other new activities foreseen for 2010 include the prototyping of a Geographical Information System (GIS) extension for ECCAIRS, which can be used to combine occurrence data with geographical and domain specific data (e.g. flight routes or nautical charts). Finally, the Action will complete the Safety Recommendation Information System, a prototype which came out of a study performed by a seconded national expert working in the JRC during 2008 and 2009.

Of course the collection and exchange of data is only a means to an end. Since 2008 the activity is focusing more and more on using the data. However, the analysis requires that the collected data meets some basic quality requirements. From the initial data integration, taking place in the aviation sector during 2008 and 2009 (which resulted in an integrated EU data base of more than 250.000 occurrences), it became clear that important issues related to the quality of the data need to be resolved in the mid-term before a consistent and EU wide trend analysis can be made in the long-term.

Data Quality

Whenever data is integrated at a European level, the quality of the integrated data becomes of major concern. First and foremost, data standardisation contributes to homogeneous and easily merge-able data. The ECCAIRS experience in aviation teaches us though that standardisation alone is not sufficient. A common 'reporting culture' where professionals share the same approach for encoding data, apply similar procedures and disciplines in the reporting process and have the same understanding of the common taxonomies used is also important. In addition, the identification of duplicate reports during the integration process has a direct influence on the reliability and quality of the data. In general a good co-operative network and common training initiatives are required to make progress in these areas.



The new ECCAIRS User Interface Designer tool allowing Member States to completely customise their user experience.

GLOSSARY

- BEA** Bureau d'Enquêtes et d'Analyses
- EFTA** European Free Trade Association
- DG TREN** Directorate-General for Energy and Transport
- DINER** Data Integration Network for ECCAIRS Repositories
- ECF** ECCAIRS Common Framework
- ECR** European Centralised Repository
- EMCIP** European Marine Casualty Information Platform
- EMSA** European Maritime Safety Agency in Lisbon
- ERA** European Railways Agency in Valenciennes
- GIS** Geographical Information System
- ICAO** International Civil Aviation Organization

CI-TRANS

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Roadside check of the driving times and rest periods of truck drivers, attended by the JRC in the area of Montpellier, France, in December 2009, to study in-field enforcement practices and vulnerabilities of the digital tachograph. JRC participated as observer together with 'gendarmes', controllers, local and national authorities.

Critical Infrastructures in Transport and Distribution Systems (CI-TRANS)

The CI-TRANS Action focuses on the review and development of methods for the identification, protection and security assessment of 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 2009 achievements

European Critical Infrastructures

The European Programme for Critical Infrastructure Protection, adopted by the Commission in December 2006, recognises that the security and economy of the European Union, as well as the well-being of its citizens, depend on certain infrastructure and the services they provide. The disruption of such infrastructure could mean the loss of lives, the loss of property and a collapse of public confidence in the EU. The Council Directive 2008/114/EC requires Member States (MS) to identify their European Critical Infrastructures (ECI), which if they fail, would significantly impact on MSs.

In 2009, CI-TRANS continued to work closely with MSs in providing training, as well as technical and scientific guidance for the application of the Directive Guidelines and its criteria for infrastructure identification. The Action established a process to monitor the progress of the implementation of the Directive in MSs and organised two workshops attended by MSs' formal representatives to review the progress on the implementation, identify best practices, and provide technical guidance. Results of these workshops and of other ad-hoc bilateral meetings with MSs are reported directly at Council level in PROCIV meetings (Council Committee on Civil Protection Matters) or in MSs Contact Points meetings. It is via these channels that the Action defines User Requirements for its R&D activities in Modeling and Simulation (M&S), data collection and disaster consequence evaluations.

CI-TRANS is also contributing, together with the JRC-IPSC Action SCNI, to a Commission task-force to define the needs, requirements and business models for the possible establishment of a European Reference Centre for Critical Infrastructure Protection (ERN-CIP). The work of the task force is to explore the needs and opportunities to set up a European network of experimental and M&S facilities with the mission to provide MSs and other stakeholders with independent, enhanced and the most scientifically advanced testing products and services for security, including secretive conditions, in order to enable them to protect the EU's Critical Infrastructures against all hazards and to leverage the EU's diversity to create sustainable competitive advantage

Towards a more secure and efficient Digital Tachograph (DT)

As of 1 May 2006, a new control device for road vehicles, called Digital Tachograph (DT), became mandatory on newly registered commercial trucks and buses. The tachograph is an electronic device that records data concerning driving times, breaks and driver rest periods. The security of the DT system, and the authenticity and integrity of electronic data recorded are key for providing

trustworthy information to enforcers, and ensuring the enforcement of some of the European social legislation in road transport. In this respect, CI-TRANS is managing two major services of the DT: the European Root Certification Authority, which oversees the cryptographic key management infrastructure, and the Laboratory for Interoperability Certification, which provides one of the three certificates requested for granting new equipment type-approving¹.

In 2009, CI-TRANS researched efficient counter-measures to reduce the risk of in-field physical attacks against the DT to prevent its correct functioning. This research, which was conducted closely with industry and enforcers, led to the publication of new legal requirements² to ensure adequate protection of the DT motion sensor against tampering, such as by the use of magnets, and corroboration of vehicle movement by additional and independent movement sources. Additionally, CI-TRANS prepared a report on the vulnerability and controllability of the DT and animated a stakeholder conference, which launched a public consultation to seek opinions of interested parties on the possible review of the EU legislation on tachographs. Finally, in view of the mandatory introduction by mid-2010 of the DT in non-EU contracting parties to the AETR (European Agreement Concerning the Work of Crews of Vehicle Engaged in International Road Transport), the JRC-IPSC was recognised by the United Nations Economic Commission for Europe as the AETR Authority for root certification and for interoperability certification.

Dangerous Goods Transport Vulnerability Atlas

In 2009 CI-TRANS created a vulnerability atlas of dangerous goods transport. This atlas maps societal vulnerability to releases of toxic gases from bulk transports. It supports policy makers in the fields of dangerous goods transport and CBRN (chemical, biological, radiologic and nuclear), and helps to demonstrate Intelligent Transport Systems (ITS) applications including routing and geo fencing. The atlas approximates the number of affected people and economic loss sustained by businesses in case of a release on a nearby route. The atlas covers nearly 3 million km of road and railroad across the EU Member States, Switzerland and Croatia. It includes all important roads at local or higher levels. At 100m intervals on 13.4 million segments the societal vulnerability is calculated to an average value per segment. This is used to compare the situation in Member States, as well as for routing applications. It is based on land cover and population density data consistent on a European scale, created by the JRC, the Environment Agency and Member States and it uses commercial network data.

Challenges for 2010 and beyond

With the introduction of the Directive 2008/114/EC, Member States have two years to identify and designate their European Critical Infrastructures. The Action will continue to provide its technical and scientific expertise to assist Member States in this process. A key scientific challenge will be to study the interdependencies existing between infrastructures in key societal sectors such as transport, energy and ICT, and of the consequences and cascading effects that one or many infrastructure failures can have on the other sectors.

The Action will also be a key actor in the 2010 full-scale revision of the basic legislation defining the DT. The challenge consists in defining a highly dependable and secure system that is inter-operable or integrated with the forthcoming open in-vehicle platform for the deployment of ITS for road transport, as put forward by the Commission Action Plan for the deployment of ITS in Europe³.

1. <http://dtc.jrc.ec.europa.eu/>

2. Com. Reg. No 1266/2009 of 16/12/2009

3. Com(2008)886



Illustration of the Dangerous Goods Transport Vulnerability Atlas. Two routes based on the vulnerability atlas between arbitrary points north of Antwerp and south of Brussels, Belgium. The blue route is the quickest one, the green route avoids densely populated areas. A transport following the safer green route takes 115 minutes, one following the less safe blue route takes 61 minutes, but passes more than twice as many people. A red network colour signifies high, and green low vulnerability of its surroundings. (This map was produced for research purposes only).

GLOSSARY

AETR European Agreement Concerning the Work of Crews of Vehicle Engaged in International Road Transport

CBRN chemical, biological, radiologic and nuclear

DT Digital Tachograph

ECI European Critical Infrastructures

ITS Intelligent Transport Systems

M&S Modeling and Simulation

MSs Member States

PROCI Council Committee on Civil Protection Matters



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

GEOCAP, AGRI4CAST,
FISHREG, VESPO

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. Under this header, work is carried out (VESPO action) on monitoring of activities at sea in the context of maritime safety, security and enforcement, linking this area with the Security Agenda. 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.

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Example of incorrect reference parcel boundary delineation identified during the LPIS quality assessment processes (red: incorrect boundary line – yellow: correct parcel boundary). Such LPIS errors may lead to ineffective administrative checks and thus result in undue payment to the farmer.



Example of parcel perimeters obtained from repeated measurements of a parcel during the validation test of a GPS device. Repeated measurements permit the determination the buffer width of the perimeter. Only GPS devices with a buffer width not exceeding 1.5 m should be used by Member States for area measurements in the frame of the control of the CAP subsidies.

Geo-Information Management and Control Methods (GEOCAP)

The Common Agricultural Policy (CAP) is one of the EU's most significant policy instruments in financial terms, impacting agricultural practices, environmental and rural sustainability, and the economic livelihood of rural areas. A major CAP goal is the responsible and sustainable use of rural resources, which includes the correct management and control of these direct payments by Member States and Commission services.

The GEOCAP action addresses information needs for European Policies related to Agriculture and Regional Development, such as Cross Compliance, Farm Advisory System, or food quality and agri-product origin.

The Action follows up future developments in geomatics techniques, and supports land administration (cadastre) and multipurpose large scale mapping approaches, common specifications, standard measurement and data management tools. It validates methods to reinforce the consistency of land parcel identification and area measurement (using remote sensing or GPS tools) across the Union and in Candidate Countries.

Major 2009 achievements

Methodology for LPIS Database Quality Assessment

A first implementation by Member States in 2010

A Land Parcel Identification System (LPIS) is a national GIS register of agriculture land (so-called reference parcels) to allow the identification, location and administrative checks of the agricultural parcels claimed by European farmers. It is part of the Integrated Administration and Control System (IACS) used by public administrations in Member States to manage CAP direct payments.

Any LPIS has spatial (e.g. boundary coordinates and areas) and alphanumerical attributes (e.g. unique identification, maximum eligible hectares value) which are essential in safeguarding the aid flows toward the European farmer. However, until now, no common and systematic assessment of this instrument was implemented. Following a request of the Directorate-General for Agriculture and Rural Development (DG AGRI), the GEOCAP Action developed in 2009 a LPIS quality assurance (QA) framework that evaluates compliance with the Regulation requirements. It consists of testing a series of quality elements that are essential for the LPIS to perform its role (i.e. correct quantification of reference area, ability to prevent double claim of areas...).

This methodology, fully supported by DG AGRI and accepted by Member States, will be integrated into the CAP legislation. As from 2010, Member States will have to implement the LPIS QA framework, which will allow them to assess the state of their LPIS and monitor their performance.

Guidelines for GPS device validation test. A standardised way for the estimation of the performance of tools for area measurement

In the framework of the controls of farmers' aid applications, Member States have to select a sample of agricultural parcels for examination of their area. According to the CAP legislation¹, Member States shall use measurement tools that are "proven to assure measurement of quality at least equivalent to that required by applicable technical standards, as drawn up at Community level". The quality of a given tool is defined by its technical tolerance (which accounts

1. Art. 34 of Reg. 1122/09 (ex. Art. 30 of Reg. 796/04)

for the uncertainty specific to any measurement technique). Therefore, Member State should use only tools that allow measuring both the area and perimeter and should make sure that these tools meet the measurement accuracy (i.e. the maximum 1.5m buffer width) requested by the regulation.

The GEOCAP Action has developed a validation approach to provide a standardized way for the estimation of the performance of GPS devices for area measurement. This protocol, based on ISO 5725, consists in carrying out repeated measurements under different conditions. Member States will thus have to acquire either certified GPS devices or to assess the reproducibility limit of their devices by following the protocol designed by the Action. The GEOCAP action will further support Member States in the design of their test and their data analysis.

Test on Good Agricultural and Environmental Conditions (GAEC) checks using remote sensing imagery. Prospects of time and cost effective method for Member States

The 2003 CAP reform introduced an obligation for farmers to meet agri-environmental requirements to receive their full aid payments (the so-called Cross-Compliance). As a result, a wide range of new elements have to be checked at parcel and/or farm level, such as soil erosion, soil structure, maintenance of soil cover, or maintenance of landscape features.

In 2009, the GEOCAP Action provided support to the Italian Administration in order to perform a test aiming at providing quantitative results of the use of remote sensing imagery for the GAEC checks. It consisted in making qualitative and quantitative comparisons of results obtained independently from image interpretation and direct check on the field of the same sets of agricultural parcels selected in different sites in Italy.

Results turned to be very satisfactory providing for many GAEC a very low level of omissions (i.e. GAEC infringement observed in the field and not identified on images), not mentioning the exhaustive view and ‘access’ to parcels offered by RS imagery compared to field visits. Not ignoring that this study should be reiterated by other Member States, it gives prospects for Member States to ensure their GAEC checks using a more time and cost effective method compared to traditional on the field ones.

Challenges for 2010 and beyond

In 2008, the reformed Common Agricultural Policy (CAP) underwent a “Health Check”, to assess where the 2003 legislation can be fine-tuned and to pave the way for the future design and priorities of the CAP. 2010 will be an intermediate year between the implementation of these reforms, and the preparation of the post-2013 CAP.

In the framework of implementation of the reforms, the GEOCAP Action will monitor activities of Control with Remote Sensing and GPS parcel measurement. Support will be given for the first implementation of the land parcel identification system quality assurance assessment that has been developed in 2009. Concerning cross compliance, special emphasis will be put in providing support for the Commission report to Council (end 2010) on the Farm Advisory System. Scientifically based input will be given for the further development of Commission policies related to agriculture such as environment, renewable energy, climate change mitigation; the implementation of new GAEC issues and standards (landscape features, buffer zones...) and the development of a whole farm record keeping concept.



On field picture of landslide phenomenon resulting from bad farming practices and the same phenomenon identified on a Very High Resolution Satellite image. Note also the evidence of erosion on the satellite image (white arrow) which was not spotted during the field check because it was hidden by the land topography.

GLOSSARY

CAP	Common Agricultural Policy
CwRS	Control with Remote Sensing
DG AGRI	Directorate-General for Agriculture and Rural Development
GAEC	Good Agriculture and Environment Conditions
GIS	Geographic Information System
GPS	Global Positioning System
IACS	Integrated Administrative and Control System
INSPIRE	Infrastructure for Spatial Information in the European Commission
LPIS	Land Parcel Identification System

AGRI4CAST

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Generation of weather data for biophysical models via downscaling from GCM climate projections.



Projected percent differences between the decades of 2020 and 2000 in April-September water availability.

Crop Production Forecasts and Climate Change Impact (AGRI4CAST)

The main target of this Action is providing crop yield forecasts and biomass estimations through the European Commission Crop Yield Forecasting System. The mandate is given through a regulation stating its maintenance, operational run and analysis. The system started to run in 1992 and since then has been continuously improved. The geographical area covered has been also enlarged and includes all Europe and parts of Asia and Maghreb. The System monitors crop 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 system integrates remote sensing, meteorological observations, agrometeorological modelling (Crop Growth Monitoring System, CGMS) and statistical analysis tools.

During the Seventh Framework Programme, the Action is putting an increasing emphasis on the impact of climate change on agricultural systems. As a consequence, the Crop Yield Forecasting System is being adapted in order to run on climatic scenarios at different levels (from 10 days to 100 years) to improve the crop yield forecasts but also to generate climate change impact scenarios on farming systems. The agrometeorological infrastructure know-how has allowed the Action to carry out important studies on fields such as agricultural insurances, plant health and energy needs.

In the field of crop area estimates, a few pilot studies are run in Spain and Ukraine. The Action is the repository of techniques tested in the 90's by the MARS project and is a methodological reference point on the use of remote sensing and area frame sampling to estimate crop areas. The group is also active in the field of population density mapping, in particular for the new definition of rural/urban areas under study by the European Commission.

Major 2009 achievements

European Crop monitoring

Our crop forecasts and regular weather updates provided to the Directorate-General for Agriculture and Rural Development (DG AGRI) and the Member States are equally accessible to the public through the internet. The targeted crops are wheat, barley, maize, sunflower rapeseed, sugar beet and potato. Dedicated bulletins are issued for pastures and rice. The forecasts are regularly used to help DG AGRI taking decisions on the management of agricultural markets. The availability of a large and regularly updated meteorological database allows studies to be undertaken in related fields, from agricultural insurances (JRC reference report produced in 2009) to the analysis of energy demand for heating and cooling.

The main elements of methodological improvement in 2009 were moving to a finer resolution grid, improving crop masks and integration of seasonal weather forecasts. Outside the European Union, the main progress in 2009 was the implementation of crop forecasts in Morocco and Ukraine.

The weather database to analyse the impact of climate change on agriculture

Global Circulation Models (GCM) provide simulations of climate under different scenarios of green house gas emissions. Such climate scenarios require further

1. EC Regulation 78/2008 of 21 January 2008.

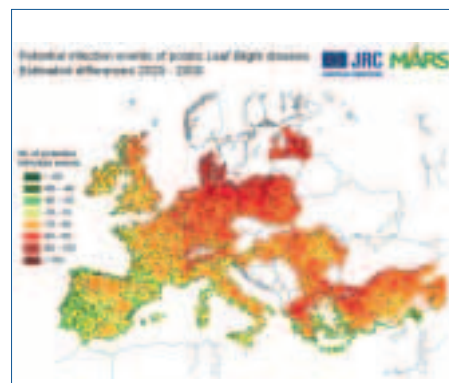
processing in order to be usable as inputs for biophysical models (spatial scale, daily and hourly values, derived variables). A database of daily weather covering EU27 and the Mediterranean was generated. It comprises a series representing baseline weather—i.e., based on observed historical weather—and of several series each representing climate change weather. These were generated using climate output from two GCMs, i.e., the Hadley3 (Hadley centre, UK meteorological office) and ECHAM-5 (Max Plank Institute), and corresponding to two emission scenarios (IPCC A1 and B1) and two future time frames, centred in 2020 and 2050. The LARS weather generator (Rothamsted Research Centre) and the CLIMA-AGRI4CAST libraries were used in the database generation. The resulting database will be made accessible for public use.

Extending modelling capabilities

Biophysical models used in current crop simulations assume that crops are well adapted to their environment. Such models thus provide a good quantitative response to weather variables within a mean range, but typically do not capture the impacts on crops of extreme events, such as heat waves, cold shocks, excess precipitation or flooding, which may lead to damage and crop failure beyond given coping thresholds. A set of model components, i.e., discrete and reusable units of software, was developed to enhance current modelling capabilities and include impacts of extremes on crop dynamics. Components are used operationally within a new software platform being developed at AGRI4CAST, BioMA – Biophysical Model Applications, to run simulations at EU scale. Both BioMA and its components are made available to third parties for free use in research. Figures 2-4 provide a sample of BioMA climate change impact analysis capabilities.

Challenges for 2010 and beyond

The changes in climate means and climate variability expected in coming decades, the widely recognized site specificity of weather impacts on agricultural productivity, as well as the need to assess production under a set of socio-economic and policy moving targets (e.g., different goals of CAP policy; introduction of bio-fuels directives; food security concerns; food price dynamics; etc.) translate directly into new requirements for simulation tools. On the one hand, crop model capabilities need to be extended in order to capture new crop dynamics under changing agro-climatic environments; on the other, software infrastructure needs to become more flexible, in order to quickly address new analysis demands. Finally, a new pattern of interaction with and across Member States is needed in order to foster improved channels for the effective exchange of data and modelling tools. AGRI4CAST is actively targeting such goals with the development of tools and procedures that are both used operationally and made available to external institutions.



Projected differences between 2020 and 2000 in the potential infection events of a pathogen of potato.



Changes in maturity date of Cabernet Sauvignon comparing projections in 2020 with respect to 2000.

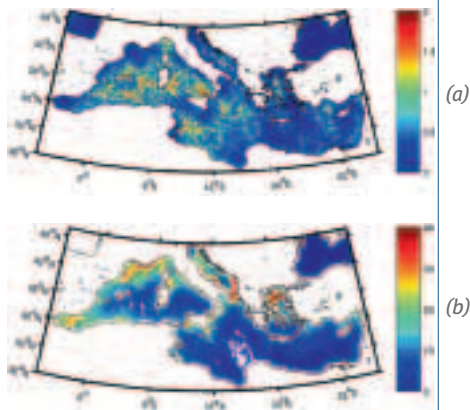
GLOSSARY

- BioMA** Biophysical Model Applications
- CGMS** Crop Growth Monitoring System
- DG AGRI** Directorate-General for Agriculture and Rural Development
- GCM** Global Circulation Models
- IPCC** Intergovernmental Panel on Climate Change
- MARS** Monitoring Agriculture with Remote Sensing

FISHREG

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*Multiannual mean prediction of Bluefin Tuna (*thunnus thynnus*) spawning (a) and feeding (b) habitat in the Mediterranean Sea (2003-2009) derived from satellite data of sea surface temperature and chlorophyll-a content (MODIS-Aqua sensor). The habitat occurrence is expressed in percentage of total days where satellite data was available. A minimum value of 14% (feeding habitat) and 28% (spawning habitat) was applied to show consistent maps.*

Fisheries Management and Enforcement (FISHREG)

The Common Fisheries Policy (CFP) is the EU's instrument for the management of fisheries and aquaculture. It aims at protecting fish stocks and ensuring the future of the fishing sector.

The evaluation of the CFP in 2008 revealed that CFP is not reaching its targets. Overcapacity of the fleets, low profitability, ineffective controls, and adverse environmental impacts are among the important issues that need to be solved. Addressing such shortcomings requires high quality scientific advice, high quality data (biological, economic and control data) and state-of-the-art modelling capacity, among others. The Action FISHREG has been contributing to these goals through research and support to policy. In 2009, its key customers included the Directorate- General for Maritime Affairs and Fisheries (DG MARE), the Community Fisheries Control Agency (CFCA), and also the Directorate-General for the Environment (DG ENV) - for the Marine Strategy Framework Directive (MSFD).

Major 2009 achievements

Structure and economic performance of the EU fishing fleet

FISHREG managed the entire process leading to the production of the “2009 Annual Economic Report on the European Fishing Fleet”. This key policy support document provides an overview of the structure and economic performance of the EU fishing fleets. In terms of coverage, the 2009 Report is the most comprehensive one ever produced by the Commission. It includes detailed structural and economic analyses of selected fleet segments, qualitative economic performance predictions, as well as information on EU fish prices and price trends for the period 2002-2007. The report serves the needs of 3 Subgroups of the Commission's Scientific, Technical and Economic Committee for Fisheries (STECF), as well as policy makers of DG MARE. The report is also widely requested by the EU research community as its data is of use in the bio-economic modelling community.

Advising policy-makers on fish stocks

FISHREG coordinated 3 expert Working Groups of the STECF and served 2 formal data calls under the Data Collection Framework (DCF) Regulation focussing on Mediterranean and Black Sea fisheries. The Action co-authored 3 reports with scientific advice to policy makers on fish stocks and stock assessment standardization for the two sea basins. These reports were the basis for 2 Council Regulation proposals, one fixing fishing opportunities in the Black Sea and the other one detailing provisions for fishing in the GFCM agreement area. On the occasion of the workshop on Mediterranean Stock Assessment held in Murcia on 2-6 March 2009, it was possible to critically review methods for estimating the key parameter of “natural mortality coefficient”, to discuss the estimation of growth parameters for fish stocks in the Mediterranean Sea and the possibility of combining data from related stocks.

Forensic technologies for fisheries control and enforcement

FISHREG chaired the Food and Agriculture Organisation (FAO) Informal Workshop on the use of forensic technologies in fisheries monitoring, control and surveillance, on 9-10 December 2009, in Rome. Forensic methods are used in investigations and court cases. These methods are relevant in cases of product substitution, misidentification, false labelling and false origin assignment. The workshop report will be useful for developing countries that require technical assistance in the use of forensic genetics to address illegal fishing and govern their resources more effectively.

COBECOS: Costs and Benefits of Control Strategies

FISHREG was scientific coordinator and partner of the FP6 project COBECOS that ended in October 2009. COBECOS provided a basic theory of fisheries enforcement, software for modelling fisheries enforcement and case studies with parameters and relationships estimated. COBECOS demonstrated that it is possible to optimize fisheries enforcement strategies. Key beneficiaries are expected to be EU fisheries management and enforcement authorities and the CFCA. The Action intends to further pursue this line of work through a pilot project with the CFCA starting in 2010.

Fisheries enforcement

FISHREG completed two cost-benefit studies of interest to fisheries enforcement. The first study, “Cost benefit analysis of VDS versus air surveillance control”, analyzed the impact of applying Vessel Detection technology (VDS) to supplement traditional air control means in fisheries enforcement and control.

The second study, “Cost benefit analysis on the extended use of modern technologies for fisheries”, set to quantify the costs and benefits of changes to the application of the Vessel Monitoring System (VMS), the Electronic Reporting System (ERS) and the Automatic Identification System (AIS). It was needed by DG MARE in discussions with Member States (MS) on extending the use of control technologies to smaller vessels. Although it proved possible to estimate costs for the 6 selected MS, insufficient data was made available by the MS to quantify the benefits.

The “fish descriptor” indicator

FISHREG, with the International Council for the Exploration of the Sea (ICES), coordinated the Expert Working Group on the “fish descriptor”, in the context of development work for the MSFD Directive (the environmental pillar of the Integrated Maritime Policy). This is one of the 11 qualitative indicators that needed to be defined and specified in order to tackle the overall goal of achieving good environmental status for Europe’s seas by 2020. It relates to populations of all commercially exploited fish stocks. This work was part of a larger collaboration between JRC-IPSC and JRC-IES under a service level agreement with DG ENV.

Challenges for 2010 and beyond

The 2012 CFP reform will aim at long term sustainability of the stocks, balancing economic, environmental and social objectives. It is expected to include regional management solutions, rights-based management instruments to achieve economic efficiency, provisions for coastal community sustainability and integration of the CFP in the broader maritime policy context. The Action FISHREG is looking forward to these big challenges and is boosting its own capacity in economic analysis, bio-economic modelling, and high quality data infrastructures to enhance its policy impact.



Forensic methods, like DNA-based analysis, are used in investigations and court cases as evidence of false declarations of origin or false labelling of fish

GLOSSARY

AIS	Automatic Identification System
CFCA	Community Fisheries Control Agency
CFP	Common Fisheries Policy
COBECOS	Costs and Benefits of Control Strategies (FP6 project)
DCF	Data Collection Framework
DG MARE	Directorate-General for Fisheries and Maritime Affairs
DG ENV	Directorate-General for the Environment
ERS	Electronic Reporting System
FAO	Food and Agriculture Organization of the United Nations
FMCS	Fisheries Monitoring Centres
GFCM	General Fisheries Commission for the Mediterranean
ICES	International Council for the Exploration of the Sea
MSFD	Marine Strategy Framework Directive
STECF	Scientific, Technical and Economic Committee for Fisheries
VDS	Vessel Detection System
VMS	Vessel Monitoring System

VESPO

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General architecture leveraging satellite communications for vessel surveillance, as developed in the TANGO project.

Vessel Surveillance and Port Security (VESPO)

The Action VESSEL Surveillance and PORT security (VESPO) started in 2009 as a follow-up of the previous Action on Maritime Surveillance (MASURE).

The boundless nature of the sea requires regional, European and global approaches, not national ones. VESPO focuses its attention mainly on maritime surveillance concepts and systems with an emphasis on emerging technologies for maritime observation, including space-based ones, and risk assessment methodologies for port security. VESPO aims at developing and providing the technical and scientific expertise that is essential for the policy makers to put these complex technological tools to their advantage. The Action is related to all EU ("pre-Lisbon") pillars, as maritime surveillance implies applications for many Community policies, policing, security and defence. The Action fits within the security objectives of the Global Monitoring for Environment and Security initiative (GMES).

The main objectives of the Action are:

- To address maritime surveillance using an integrated approach, building a knowledge base where different information sources (from satellite data to local data) can be assessed and compared and new surveillance technologies and concepts can be tried out, for the benefit of different European-level users.
- To support the Directorate-General for Energy and Transport (DG TREN) in producing guidelines (minimum standards, guidelines, best practices) for efficient application of the new port security regime¹.

Major 2009 achievements

In 2009, VESPO delivered its output in the form of peer-reviewed journals, reports, participation to conferences, contribution to joint customs and maritime surveillance exercises, and advice (ad hoc as well as structured) on technical and scientific matters requested by its partner DGs and Agencies.

In the last 2 years, VESPO had the possibility to grow mainly through new externally-financed collaborative research projects. Under the Seventh Framework Programme (FP7), 6 out of 7 proposals for new projects were successful (OPERAMAR, ARGOMARINE, ASPIS, WIMAAS, I2C and SEABILLA). Moreover, the excellent working relation with Commission services, such as the Directorates-General for Energy and Transport (DG TREN), for Maritime Affairs and Fisheries (DG MARE) and for Justice, Freedom and Security (DG JLS), and EU Agencies (in particular, the European Maritime Safety Agency - EMSA) is also reflected through the continuation of administrative arrangements with some of these services. In 2009, 4 collaborative research projects were successfully concluded (MONRUK, EFFORTS, OPERAMAR, TANGO).

Under institutional funding, the Action has provided scientific support to the implementation of key policies of DG MARE (integration of maritime surveillance), DG JLS (EUROSUR) and DG ENTR (GMES Security). For EMSA, new satellite image analysis tools have been developed, and with Frontex joint trials have been performed into the detectability of small boats by satellite radar.

1. ISPS Code, Regulation 725/2004.

The TANGO Project - Telecommunications Advanced Networks for GMES operations

In the framework of the TANGO project, a new architecture for fisheries surveillance of remote areas has been tested. This architecture makes use of satellite communication in complement to the already mature imagery-based Vessel Detection System (VDS) that uses SAR (Synthetic Aperture Radar) satellite images. The purpose is to allow countries with extended fisheries areas but limited control means to have operational access to this technology without the costs of installing and maintaining heavy equipment such as ground receiving stations and patrol means.

The Comoros Union has over 150,000 km² of Exclusive Economic Zone (EEZ) with good fishing stocks, in particular tuna. They have recently acquired a Vessel Monitoring System (VMS) system which allows them to track fishing efforts based on reported GPS positions of the fishing boats. However, the lack of non-cooperative surveillance tools (VDS, air and sea patrols, coastal radars) does not enable them to track Illegal, Unregulated and Unreported (IUU) fishing. This threatens long term sustainable fishing in the area and causes losses of revenues for the country.

VDS campaigns in the area can already be run in a non-real time mode. However, to enforce the law and deter IUU fishing, a Near Real Time (NRT) VDS campaign with inspection ability – to identify and chase up the infringing ships – would be needed. The TANGO project demonstrated how this can be done. In an experiment that ran between March 27 to May 8, 2009, images taken by the ENVISAT and RADARSAT-2 satellites were delivered via European ground stations and specially set-up satellite communication links to the local authorities in the Moroni Fisheries Management Centre (FMC). Turns around times of 1/2-2 hours were achieved, which is fast enough for fisheries enforcement purposes on the open sea. The vessel detections from the satellite images were correlated with a patrol inspection run by Madagascar in the Comoros EEZ. The Minister of Agricultural and Fisheries Development visited the demonstration staff on April 3rd. The TANGO project was led by EADS Astrium, and the companies NAVIGS, SES TechCom and Newtec were partners to JRC-IPSC in this work package.

Challenges for 2010 and beyond

In its new integrated maritime policy for the EU, the Commission is advocating further integration of maritime surveillance systems and information 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.

Concerning new major challenges, in 2010, following the request of Commission services, VESPO will launch a new pilot project in the field of anti-piracy.

GLOSSARY

- ARGOMARINE** Automatic Oil-Spill Recognition and Geopositioning integrated in a Marine Monitoring Network (FP7 project)
- ASPIS** Autonomous Surveillance in Public transport Infrastructure Systems (FP7 project)
- DG ENTR** Directorate-General for Enterprise and Industry
- DG JLS** Directorate-General for Justice, Freedom and Security
- DG TREN** Directorate General for Energy and Transport
- EEZ** Exclusive Economic Zone
- EFFORTS** Effective Operation in poRTS (FP6 project)
- EMSA** European Maritime Safety Agency
- ESA-ESRIN** European Space Agency – European Space Research Institute
- EUROSUR** European Border Surveillance System
- Frontex** European Agency for the Management of Operational Cooperation at the External Borders
- GMES** Global Monitoring for Environment and Security initiative
- I2C** Integrated System for Interoperable sensors & Information sources for Common abnormal vessel behaviour detection & Collaborative identification of threat (FP7 project)
- IUU** Illegal, Unregulated and Unreported
- MONRUK** Monitoring the Marine Environment in Russia, Ukraine and Kazakhstan using satellite Synthetic Aperture Radar (FP6 project)
- NRT** Near Real Time
- OPERAMAR** An Interoperable Approach to European Union Maritime Security Management (FP7 project)
- SAR** Synthetic Aperture Radar
- SEABILLA** Sea Border Surveillance (FP7 project)
- TANGO** Telecommunications Advanced Networks for GMES operations (FP6 project)
- VDS** Vessel Detection System
- VMS** Vessel Monitoring System
- WIMAAS** Wide Maritime Area Airborne Surveillance (FP7 project)



Security and Freedom

3

JRC has been 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 is 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 addresses prevention, preparedness and risk management in several actions where relevant. Provision of support to the EU Crisis Management structure (ARGUS) is also foreseen.

PRIMA, CORSA, CI-SUPPLY CHAIN, PVACS, OPTIMA, SCNI, SITAFS

3.2 Disasters and Response

Actions are dedicated to the development of better capacity to prevent and deal with natural and technological disasters. Modelling is given specific attention with respect to the occurrence of natural events such as floods and drought (JRC-IES). The reporting on and drawing lessons from natural and technological disasters will be maintained as key feature of progress in this area. Another area of research under this agenda concerns the development and calibration of models to assess the vulnerability of constructions to earthquakes.

CI-CHEM, SAFECONSTRUCT

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.

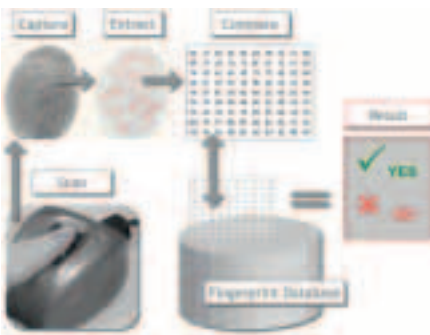
CI-ANIMALS&FOOD

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.

PRIMA

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Biometry-Based Access to Critical Infrastructures.



Electronic passport on a reference antenna.

Passport, Identity Management and Access Control (PRIMA)

Application areas requiring identification, verification and authentication are expanding from persons to processes and infrastructures, including hardware and components, and addressing additional objectives for verification and authentication, moving from static environments to flexible and mobile ones.

To respond to these trends, the PasspoRt, Identity Management and Access Control Action (PRIMA) has expanded the scope of its predecessor BORSEC embracing activities on electronic identification both in the context of border security and in access control. The main interest remains in cross-border and European-wide challenges related to secure electronic identity management.

Besides identification related technologies, such as biometrics, Public Key Infrastructures (PKI) or identification based on the use of hardware tokens (mainly smartcards), its goals include improving the underlying processes which play an important role to ensure overall interoperability in EU wide applications for citizens' security.

The Action addresses upcoming needs, chances and challenges for necessary assessments, foster related methodologies, initiating required standards and criteria as a harmonised European security reference.

Major 2009 achievements

Conformance Testing of EU electronic passports

Following the successful interoperability and cross-over 2008 tests campaign, PRIMA completed in 2009 conformity testing of EU electronic passports. Standard implementations in electronic testing must be complemented by standard procedures in testing readers and inspection systems in order to ensure full interoperability. For this purpose, PRIMA started a joint project with the European Telecommunications Standards Institute (ETSI) which aims at developing a standard procedure to test conformity of readers and inspection systems, which will ultimately be used at borders to read and check electronic passports.

A new method to measure electromagnetic disturbance in electronic passports

The electronic passport, which has been in force in the EU since 2006, contains an electronic component which consists of a contactless smartcard (also called a "proximity card"). Information on the contactless smartcard is read by authorised readers by using a contactless protocol. PRIMA has been performing conformity and interoperability tests on electronic passports for a number of years. One of the tests which is performed on the chip measures the electromagnetic disturbance (EMD) emitted by the contactless smartcard. The EMD is an unwanted form of load modulation that degenerates the communication between the card and the reading device. An ISO standard specifies a limit for the EMD level that a proximity integrated circuit card is allowed to emit during a time period before it transmits. In 2009 scientists in PRIMA proposed a new method to measure the EMD level based on the use of a high resolution data acquisition system and dedicated analysis software. The method proposed by PRIMA proved to be better performing than a previous method based on a spectrum analyzer and therefore will be included in the normative EMD test method and the C programming code given as example in an informative annex.

Preventing spoofing of biometrics recognition

In an effort to increase border security, biometric identifiers have been introduced in various border control applications or systems (e.g. the electronic passports). The expected added value of biometrics is the increased prevention of counterfeiting and unique identification of individuals. However, it has been already observed for a long time that biometric identification devices (as used today) can be spoofed. Information on spoofing fingerprints and other modalities is available on the internet, ranging from general discussions to very detailed guidelines. In an exploratory research project, PRIMA evaluated such “public” information against several biometric sensors and for several modalities. Results show that, while efforts in the direction of developing sophisticated anti-spoofing technologies are still needed, particular attention must be paid also to the enrolment process which is the most delicate step of the workflow in which potential attackers would have access to the biometric system.

MOBIDIG: requirements and challenges for mobile identification

PRIMA organised two workshops to prepare the set up of a European Working Group on mobile identification addressing identification and verification of individuals as well as authentication of documents in mobile environments. As a result, terms of reference and a future roadmap have been agreed.

Challenges for 2010 and beyond

The Action has been very active for a few years in the conformity and interoperability testing of electronic passports playing a prominent role in the organisation and execution of interoperability test events with relevant players in the field and acting as an independent source of technical and scientific expertise in the field. Work in this area will be consolidated with the accreditation of the testing laboratory and with the extension of the conformity testing to other types of machine readable travel documents (such as visas and third country residence permits) and associated reading equipment. Machine readable travel documents are also becoming an important element in making border crossing more convenient and fast as well as secure, for “trusted traveller”, promising to replace trusted travellers schemes based on pre-registration and proprietary cards. Usability and security studies, as well as studies on the quality and security of biometrics applied to these automated border control systems will be the Action’s next challenges on studying the security of electronic passports.

As the electronic passport and electronic ID cards become more widespread, the possibility to realise cross-border “e-applications” will become more and more natural. Electronic identity management in EU-wide cross-border applications for European citizens will still require secure and trusted technical solutions for interoperable services. To respond to these trends, the Action will contribute to the technical assessment of security, trust and privacy of future applications in electronic identification applicable in static and mobile environments.



Electronic passport protocol test reference reader.

GLOSSARY

- EMD** Electromagnetic disturbance
- ETSI** European Telecommunications Standards Institute
- PKI** Public Key Infrastructure

CORSA

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CORSA studies, tests and evaluates security of sensors, communication and navigation Systems.

RF Interference Impact Assessment on Global Navigation Satellite Systems
 CORSA has performed a study on the radio frequency interference (RFI) with global navigation satellite systems (GNSS).



Laboratory test bed for the WiMax UWB MB-OFDM coexistence measurements in the conducted modality.

Communication and Radar Sensors Networks for Security Applications (CORSA)

Communication and navigation technologies are at the heart of the modern society: public services, industry and private life all depend on a host of 24/7 communication services.

In Europe, different technologies are used nationally for public safety communications. In case of civil emergencies when a multi-national effort has to be coordinated for joint rescue operations, a major bottleneck is the interoperability of different communication systems. CORSA studies a key enabling technology called Cognitive Radio to allow these systems to work together in a flexible and secure manner. The Action also supports European efforts on standardisation in this domain.

CORSA investigates the security of satellite-based navigation technologies. As global satellite-based navigation systems (GNSS) such as GPS become a common part of the citizen's life through a variety of public services, their security and reliability needs to be assessed. The next generation navigation system, Galileo, being launched by the European Union will enhance the range and quality of GNSS services for the citizen. CORSA scientists carry out laboratory-based tests of radio frequency (RF) threats and interference in communication and navigation systems. These can have serious impact on intelligent transportation systems and next generation ICT systems.

Furthermore, the Action studies wireless sensor networks for surveillance and safety applications. This includes body-area networks and radar-sensor arrays for person detection. Looking to ICT security, we study vulnerabilities of converging information-communications systems.

Major 2009 achievements

Communication Systems for Public Safety

Public safety communications systems are used by various national agencies for civil protection and crisis management in cases of floods, fires and other natural and man-made disasters. At present national authorities use a number of different systems, not always interoperable. Standardization is a key enabler for the interoperability of diverse technical systems adopted by these agencies. Reconfigurable Radio Systems (RRS) technology is a leading candidate to help achieve interoperability amongst diverse communication systems. The standardisation effort has therefore been focused on RRS. CORSA has been a leading force behind the standardisation of RRS for public safety domain, working with the European Telecommunications Standards Institute (ETSI). Two of its technical reports were adopted by ETSI as its official documents: ETSI TR 102 733 and TR 102 745.

Global Navigation Satellite Systems (GNSS) security assessment

GNSS is the technical term for satellite-based navigation systems that provide geo-spatial positioning with global coverage. CORSA has carried out a variety of laboratory-based tests and measurements on GNSS threats and interference and prepared for the Directorate-General for Justice, Freedom and Security (DG JLS) a technical report: entitled "A laboratory test-bed for GNSS interference impact assessment" as part of a formal study on the security of GNSS receivers. The novelty of the JRC-IPSC work was the introduction of a metric to quantify the interference with navigation systems by assessing the receiver environment and to determine a threshold for an error-free GNSS signal acquisition necessary for

use in safety critical systems. CORSA was also responsible for a related study on Radio Frequency (RF) threats to navigation and telecommunication infrastructures. As part of these studies, CORSA developed a laboratory test-bed to carry out controlled tests on GPS interference that characterise malicious attacks such as jamming and spoofing.

Radio Spectrum

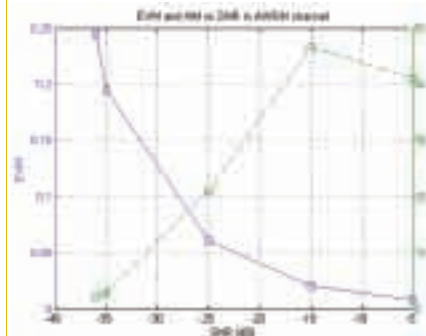
During 2009, CORSA supported the Directorate General for the Information Society and Media (DG INFSO) in the implementation of the EU Radio Spectrum policy through reference measurements. In the context of the use of the ultra-wideband technology (UWB), CORSA carried out a coexistence study to assess experimentally the validity of the limits set in the Commission Decision “Allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community” based on numerical models and simulations specified by the Conference of European Postal and Telecommunications Administrations (CEPT). The results of the pilot phase have proven the co-existence of UWB systems with broadband wireless access and radar systems without the risk of harmful interference to the latter. DG INFSO has recently proposed to formalise the support role of the JRC-IPSC on a long-term basis to carry out interference measurements to validate CEPT recommendations before reaching a Decision.

Ultra Wideband Standardization

CORSA experts were closely involved in DG INFSO’s policy support on ultra wide-band (UWB) as a technology for short range communication. In this context, the “Wireless Alliance for Testing Experiment and Research” (FP7 WALTER project) aimed to develop the technology needed for measurement, calibration, and testing radio signals broadband. The emphasis of the work done with the European Telecommunications Standards Institute (ETSI) has been on the evaluation of an ultra wideband technique called Detect and Avoid (DAA). JRC-IPSC has defined new procedures for DAA testing and has run international measurement campaigns jointly between its own European Microwave Signature Laboratory (EMSL), Technology Metrology Centre of China and AT4 Wireless of Spain. In November 2009, CORSA took part in a joint UWB/DAA measurement campaign in China that will eventually lead to the adoption of the European norms on UWB in the Chinese national legislation. JRC-IPSC was asked to continue to carry out reference measurements in support to standardisation process in collaboration with ETSI, including the related initiatives by DG INFSO on Future Internet.

Challenges for 2010 and beyond

With increasing reliance on satellite navigation, greater emphasis will be laid on research into GNSS security. Laboratory-based experiments will be carried out for countermeasures against jamming and spoofing as intentional threats to GNSS. A test-bed will be developed for test and evaluation of GNSS receivers. RF interference remains among the most important challenges to unintentional security threats to GNSS and terrestrial communication alike. Cognitive radio will be studied as a key enabling technology for interoperable communication systems and will be deployed in various laboratory test beds. New applications for radar and sensor networks will be explored to address contemporary security challenges e.g. navigation in GNSS denied areas as well as for area surveillance.



Radio Frequency Interference Impact Assessment on Global Navigation Satellite Systems.

Compatibility of Ultra Wideband with Broadband Wireless Access and Radar Services

CORSA has been mandated to provide testing facilities to support the development of Community spectrum legal measures under the Radio Spectrum Decision (676/2002/EC). In the frame of this pilot phase, researchers have successfully completed the implementation and extensive testing of both a state-of-the-art laboratory test-bed and a simulation tool.

GLOSSARY

CEPT Conference of European Postal and Telecommunications Administrations

DAA Detect and Avoid

DG INFSO Directorate General for the Information Society and Media

DG JLS Directorate-General for Justice, Freedom and Security

EMSL European Microwave Signature Laboratory (JRC-IPSC, Ispra)

ETSI European Telecommunications Standards Institute

GNSS Global satellite-based navigation systems

GPS Global Positioning System

ICT Information and Communication Technology

RF Radio Frequency

RRS Reconfigurable Radio Systems

UWB Ultra WideBand

WALTER Wireless Alliances for Testing Experiment and Research (FP7 project)

CI-SUPPLY CHAIN

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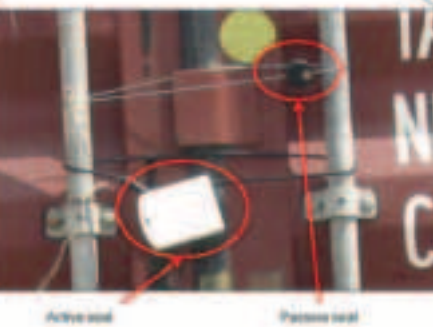


Fig. 1: container sealed with JRC RFID seals leaving the Livorno harbour (Italy)

Tracing Technologies in the Supply Chain (CI-SUPPLY CHAIN)

Intermodal transport network is a critical infrastructure in today's economy. Security of the Supply Chain shall be improved and achieved through tracing and tracking techniques to guarantee a controlled delivery of goods to the final distributor for the benefit of the citizen. The increased international awareness on security issues calls for improving, evaluating and making available best tracing technologies in order to reduce risks.

The Action CI-SUPPLY CHAIN develops and tests technologies related to identification, sealing, tracing and tracking for security oriented purposes, of commercial goods, transport and storage of hazardous materials and to reduce risks and increase the security of the citizens.

Main objectives of the Action consist in the development and test of Radio Frequency Identification (RFID) active and passive smart seals, remote monitoring systems, controlled and secure systems for loading of goods that are crucial equipment used to reduce and prevent diversion. Moreover, the Action carries out tests and vulnerability assessments, essential to qualify the in house developed systems to a common European standard enabling effective tracing throughout Europe and worldwide.

The same technologies have also been developed to further increase the security and quality of life of the citizen, in particular the disable and blind people. These projects reached a state of maturation now allowing technology transfer.

Major 2009 achievements

Live demonstration of electronic seals to Italian Customs Agency

In the framework of a collaboration agreement with the Italian Customs Agency, a live demo of RFID sealing systems patented by the JRC-IPSC was carried out in Livorno harbour and Prato hub (Italy) in July 2009. Tests aimed at showing the effectiveness of RFID technology in improving the supply chain security.

The seals and the related information management systems shown to Italian Customs and seaport/hub authorities worked properly during the live tests (Figure 1). Additionally, vulnerability tests have been performed with X-ray container scanning to verify the integrity of RFID seal electronics after ordinary Customs checks. All the RFID material successfully passed the vulnerability tests.

Smart loading system for a secure Supply Chain

A prototype of RFID system for the secure container loading was developed and shown to representatives of the Italian Inland Transport Consortium. The goal of the system is to minimise errors and diversions in loading goods in containers. Different types of RFID tags are used to identify goods (classified according to their nature, e.g. chemicals, explosives, etc.), pallets, forklifts, and operators. The idea is that gates open the restricted secure area upon consensus when the forklift approaches (RFID identity checks on operator and forklift) and that barriers open the access to container only if the expected load is approaching (checks on pallet and goods) (Figure 2). The risk of errors in loading goods on containers is then minimised.

Non intrusive detection of hidden people inside container

The unauthorized entrance in Europe of persons from developing countries is an everyday phenomenon. Very often, people are being transported in containers or trucks used for goods, food or liquid. Since millions of containers are used in the

supply chain, full screening is up to now impossible as, currently, the only way to detect people is the opening of the containers (which are sealed throughout their journey) or high power X-ray scanning.

The JRC-IPSC developed and patented an innovative electrostatic sensor able to detect even very small static charges produced by people moving behind walls. Tests carried out on a container electrically isolated with rubber from the soil (which simulates a container on a truck) showed that it is possible to detect the presence of people through the electrostatic charges produced by the movement of the thoracic cavity due to breathing or even simply by the heartbeat.

Technology transfer of SESAMONET

SESAMONET (Safe and Secure Mobility Network) is a system patented by the JRC-IPSC to assist visually impaired people. The system is based on the use of passive RFID tags as electronic landmarks to form a virtual path; these landmarks, detected and decoded by the system, are transformed into audible information for the user. In 2009 the licence for using SESAMONET was released to the Italian Blind Peoples Association (UIC – Unione Italiana Ciechi).

Challenges for 2010 and beyond

The security of the supply chain will remain a hot topic also for the next years. Therefore, the Action will continue to provide technical support to European Customs agencies through:

- Tests of electronic & mechanical sealing, tracing & tracking systems internally developed or proposed for tests by the agencies including compatibility, reliability and vulnerability assessment.
- Critical analysis & review of supply chain standards related to electronic and mechanical seals and development of associated test procedures.

The challenge is to arrive in a few years to the definition of a European electronic seal as standard seal authorised for use and recognised by the countries having the largest exporting / importing volumes (e.g. US, China, etc), as well as the compatibility with the European Digital Tachograph.

Moreover, the Action will extend the prototype of an active RFID based secure loading system for container-truck, simulating the full Supply Chain implementation, including reading & authentication of driver & vehicle, verification of goods with respect to planned bill of lading, selection of appropriate container, registration of associated container seals, management of information database.

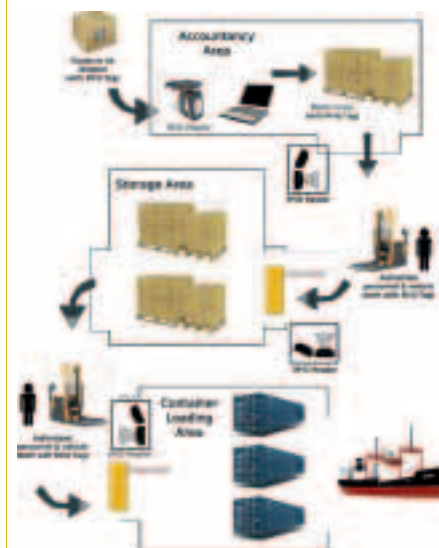


Fig. 2: general scheme of the smart loading system: goods to be loaded are tagged and related information (type of material, destination, etc.) is inserted in a database through a laptop. RFID readers are placed along the path to the container and barrier open only upon authorization.

GLOSSARY

- RFID** Radio Frequency Identification
SESAMONET Secure and Safe Mobility Network
UIC Unione Italiana Ciechi

PVACS

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Physical Vulnerability Assessment of Critical Structures (PVACS)

The Action PVACS deals with the risk mitigation of structures subjected to extreme abnormal loads, such as explosions or impacts, due to accidents or intentional attacks. The activity is in line with the EU's initiative of the European Programme for Critical Infrastructure Protection (EPCIP). Vulnerability assessment methodologies are being developed for quantifying the effects of such loads to critical structures and to their occupants, and subsequently their possible repercussions to associated infrastructure networks.

Major 2009 achievements

Rail Transport Vulnerability

The project RAILPROTECT "Innovative Technologies for Safer and More Secure Land Mass Transport Infrastructures under Terrorist Attacks" was concluded in May 2009. The project started in support of the transport security policies of the Directorate-General for Energy and Transport (DG TREN), in the aftermath of the bomb attacks in Madrid and London.

Both station infrastructures and rolling stocks have been considered. The effects of explosions on such structures were assessed through advanced numerical modeling, and several scenarios were run with regard to the quantity of explosive charge, its position and the details and refinement of the geometrical model.

A 3rd and final workshop of the project was successfully organised at JRC-IPSC in Ispra on 19th March 2009 and brought together major European rail transport stakeholders and end-users. A comprehensive exposition of the developed methodologies, based on the numerical code Europlexus, was presented together with their salient features and potential difficulties of their application. Several recommendations for the design of new structures and trains were outlined in the concluding report.

A detailed risk model was implemented in Europlexus for obtaining maps of the zones where the probability of death (due to head impact, whole body impact or lung hemorrhage) and of eardrum rupture are high. Appropriate PROBIT functions were employed based on the determination of the wave overpressure and impulse at a point. The parameters of these functions were verified using a scenario attack similar to that of Madrid. Since the windows are the most fragile part in the mass transport systems, the behaviour of different glazing was studied with special attention dedicated to laminated glass.

The response of single train carriages and of long trains composed of several carriages to internal explosions was also thoroughly investigated. Calculations showed that the probability of death can be reduced dramatically by internal structures, like seats and separation diaphragms (compartmentalization). The presence of passengers was also simulated, as it was verified to have strong influence on the absorption and attenuation of pressure waves. In addition, the situation of internal explosion in trains inside tunnels was investigated: as shown, structural damage is in general smaller than in an open-air environment due to the fact that the pressure inside and outside the train carriage is similar; however, the corresponding human injury risk is higher and is considerably extended due to the reduced possibility of release of the wave pressure.

A follow-up to this activity was the participation and contribution of the PVACS team to the work of the Task Force on Rail Transport Security at the United Na-



- (a) Typical carriage of a long train
- (b) Its finite element geometrical model
- (c) The injury risk contours inside the carriage due to an internal explosion (red indicates 100% probability of death)
- (d) Damage of train structure (green) and displacements of passengers (red) due to the explosion

tions Economic Commission for Europe (UNECE), Geneva. A collaboration was also established with the European Chemical Biological Radiological Nuclear Explosive (CBRNE) Centre, Sweden, which opened new possibilities towards validating the human injury predictions of the Europlexus mathematical models against real clinical cases.

Physical vulnerability and network analysis of critical infrastructures

The EU project MANMADE “Diagnosing vulnerability, emergent phenomena, and volatility in man-made networks” was also successfully concluded in 2009. The issue of vulnerability of critical infrastructures is addressed in PVACS from the view-point that the facilities that make up the network (nodes and links) are physically-connected engineering structures extending over a large geographical area. The natural language to study networks is graph theory; however, a purely theoretical approach, by itself, would not be sufficient to describe the complexity of a geographically distributed system.

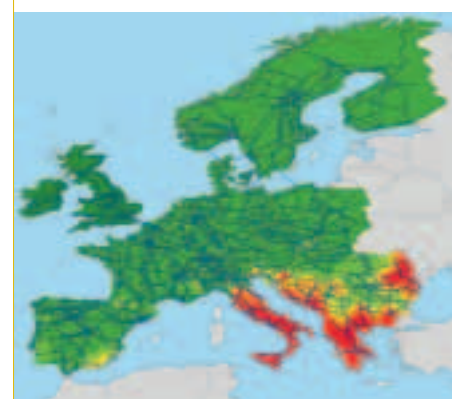
The approach taken for this study was to merge graph theoretic concepts with techniques from probabilistic structural analysis and to represent the results on a GIS platform. Thus, in the first instance, graph theory is used for condensing the primary information concerning the topological properties of the network (figure for the EU gas transmission system). Then, the graph properties of the gas and electricity transmission systems are combined and overlaid onto a map of the natural hazard to which they are exposed (e.g. an earthquake hazard map). It is then possible to introduce a probabilistic structural reliability model to generate network fragility curves of the spatially distributed interconnected network systems. More specifically, using key graph-topology indicators, the *structural fragility* curves of individual network items (e.g. transformers, pipelines etc) can be percolated through the network in order to generate an aggregate *network fragility* curve. The method was successfully employed to analyse the interconnected European gas and electricity transmission networks highlighting the vulnerability of the network to seismic hazards.

Challenges for 2010 and beyond

For the years ahead PVACS will try to extend its expertise on physical vulnerability assessment by entering into the problem of progressive structural collapse and by contributing to the relevant standardisation needs. The completion of the upgrading of the Large Hopkinson Bar facility and the availability of other innovative dynamic testing apparatuses will be essential.



Ranking of gas transmission pipelines into and through Europe



Seismic vulnerability of major European interconnected electricity transmission systems

GLOSSARY

CBRNE Chemical Biological Radiological Nuclear Explosive

DG TREN Directorate-General for Energy and Transport

EPCIP European Programme for Critical Infrastructure Protection

GIS Geographical Information System

MANMADE Diagnosing vulnerability, emergent phenomena, and volatility in man-made networks

UNECE United Nations Economic Commission for Europe

OPTIMA

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The Event Moderation System. This system enables the selection, moderation and storing of the automatically generated events. This allows the construction of a reliable, quality controlled set of events, for future use



The new-look EMM NewsBrief. The new NewsBrief has a cleaner look and more intuitive grouping of information and features. It also features several new graphs

Open Source Text Information Mining and Analysis (OPTIMA)

The OPTIMA Action focuses on developing and testing pragmatic solutions to extract value from Open Source information in order to enhance decision-making in crisis management. This ranges from information analysis for risk reduction/prevention and preparedness to early warning and response and the monitoring and understanding of trends and impacts in EU policy making. The solutions are typically tested and applied in environments like traditional media monitoring, open source information monitoring for health related information systems, operational law enforcement, counter-terrorism, as well as in crisis management and related decision making. The solutions consist of early warning and alerting systems and automated open source monitoring, mining and analysis systems, which combine the Action's R&D and expertise in web, information and language technologies.

Optima achieves this through the development and maintenance of a number of systems and services, operated either by the action or at client sites. Open source text data is gathered in real time and transformed using a range of techniques like classification, clustering, sentiment analysis and statistical analysis that form the scientific backbone of this action. Integrating these techniques allows the automated extraction of information from this data, such as who is mentioned in the text, where did the event take place, what was said (quotes) and what is the text about.

Major 2009 achievements

Event extraction

The coverage of event types of the automated event detection system was extended to include Armed Conflict and Maritime Accidents bringing the total number of detected event types to 38. The coverage of languages in the system was extended to Portuguese in addition to English, French, Spanish, Italian and Russian. In order to facilitate the adaptation of lexical resource to new domains (event types) and new languages, two new automatic lexical acquisitions tools were created and evaluated. The real-time event visualisation system was extended to provide "fly-overs" in Google Earth, and animated carouselling of events in Google Maps. A major milestone was the introduction of a prototype Event Moderation System that allows analysts to review the output of the Event Detection System correct it and store validated events for future analysis. This work yielded 3 scientific publications in 2009.

Blog monitoring

A new information processing system has been developed, specifically to monitor Blogs. As with the Europe Media Monitoring (EMM) system only selected feeds (blogs) are being monitored. The system detects new posts, comments to these posts and changes in the original post. The system was built to be fully compatible with the EMM processing chain and this means that all analyses which are applied to other sources on the Internet can also be applied to the Blogs. The system is capable of aggregating information from a large number of blog sites under various headings and categories, and has a user interface based on the EMM Newsbrief. However, a second monitoring system aggregates the information per blog, and is capable of presenting an in-depth analysis of a blog site, in terms of topics, people and sentiment detected in the blog. An interesting feature of the blog monitoring is the analysis of all hyper links (URLs) across all the blogs monitored. This allows a user to detect blog sites that are referred to from blogs already monitored, but not as yet included in the list of sites to

be monitored. A separate management system allows selected users to add or remove blogs from the list of blogs to be monitored.

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 2009, both the European Centre for Disease Control and the European Food Security Agency strengthened their collaboration with OPTIMA in order to fine-tune MediSys for their requirements. Both Agencies have adopted MediSys as an important tool for their open source monitoring activities. An important result was achieved in 2009 when MediSys was effectively used in detecting early reporting on a new outbreak of Chikungunya on the island of La Reunion. The recent case of Q Fever also raised awareness in the Directorate-General for Health and Consumer (DG SANCO) in extending the use of MediSys as an early warning tool for animal disease outbreaks.

Challenges for 2010 and beyond

A large part of the work and the research done until now in the context of the EMM family of applications has focused on algorithms and techniques for information gathering and information extraction. This research will be on-going due to the ever changing Internet and simply to improve and extend the information analysis capabilities of the EMM system. Increasingly however, the research is also shifting into other challenging areas, namely how to derive real value from this information, specifically in the context of (crisis) early warning. This research is being helped by the fact that the Action has active partners and users of its systems from various domains, e.g. intelligence, medical and humanitarian, that typically have their own way of processing information for early warning purposes. Thus, Optima is not only a technology partner implementing these techniques but also serves as a knowledge broker between these different communities. The challenge for the next few years will be to strengthen this position by delivering systems and services that integrate these different methodologies thereby maintaining the active collaboration with these different communities.

From a scientific point of view, the challenge will be to extend the analysis techniques to cover ever more languages. This means the adaptation of existing algorithms, but also an increase of resources for language dependent techniques. Most of the information is extracted in the original language. In order to make the results of the information extraction more accessible it would be of great advantage to be able to make these results available in a common language. Optima is currently looking at ways of providing translation capabilities in the EMM family of applications.

Europe Media Monitor (EMM)

The core product of the action is EMM, a ‘media monitoring engine’ that has been developed and enhanced over the last 8 years. On top of this engine various products have been built, e.g. EMM NewsBrief (<http://emm.newsbrief.eu>) and MediSys (<http://medisys.newsbrief.eu>). EMM monitors news media sources on the World Wide Web from all around the world in many languages. EMM classifies the news, analyses the news using information extraction techniques, aggregates the information, provides notifications depending on the news content and provides visual presentation of the information found. The system currently monitors, in real time, 100.000 new news articles per day from 2500 news web-sites world-wide in 42 different languages. The EMM engine forms the backbone of a number of applications developed by the Action in support to EU policies concerned with crisis management, counter terrorism, organised crime and media monitoring.

GLOSSARY

DG SANCO Directorate-General for Health and Consumer

EMM Europe Media Monitoring

MediSys Medical Information System

SCNI

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IPSC Industrial Networking Security Laboratory



Virtual System Architecture

Protection and Security of Networked Critical Infrastructures (SCNI)

SCNI looks at the protection of the cyber aspects of Critical Infrastructures. The European Programme for Critical Infrastructure Protection (EPCIP), and the specific policies on Critical Information Infrastructure Protection (CIIP), and Critical Energy Infrastructure Protection (CEIP) are the European policies of reference. The understanding of the cyber vulnerability and the potential cyber threats to the European and national critical infrastructures demands scientific and technical support, not the least due to the complexity of the infrastructural systems and their interdependencies and the novelty of the technologies employed. Beneficiaries are not only European and national authorities, but also the operators of critical infrastructures and the technology suppliers. The Action SCNI provides support by:

1. Systematic modelling, simulation and assessment of the vulnerabilities and threats of industrial control systems, and evaluation of relevant standardization efforts;
2. Definition of identification criteria for the critical information infrastructure;
3. Design of pan-European security information exchanges;
4. Development of test-beds in dedicated laboratories for the simulation of security scenarios;
5. Study, in coordination with the Member States, the establishment of a EU reference network of labs and testing centres for critical infrastructure protection (ERN-CIP).

Major 2009 achievements

“European Reference Network for Critical Infrastructure Protection” Task Force

SCNI, in conjunction with the Action CI-TRANS, set up the Task Force for the development of a roadmap and project proposal for a European Reference Network for Critical Infrastructure Protection (ERN-CIP). This Task Force, composed of JRC staff and 3 National Detached Experts, executes the work under the mandate of the Directorate-General for Justice, Freedom and Security (DG JLS). During 2009, the work consisted of establishing contacts and visiting the Member States with the aim of understanding their priorities and needs, and the existing capabilities and experimental installations. The results will be delivered in 2010.

Protection of industrial ICT systems

SCNI designed, implemented and tested in 2009 new approaches to countering cyber threats menacing industrial critical installations. These solutions include an innovative filtering of potentially dangerous packets, and a state-based attack detection mechanism (that acts as an ad-hoc Intrusion Detection System), based on the proactive monitoring of the critical states of the system. These solutions are being tested and further developed in the Industrial Networking Security lab. In addition, SCNI has collaborated with the Action SOS (Security of Supply) of the JRC’s Institute for Energy, in the modelling and assessment of the cybersecurity of the critical energy infrastructure.

Modelling malicious cyber attacks

SCNI has developed models of the potential cyber attacks affecting critical infrastructures. This theoretical work has resulted in two main publications: “Risk Assessment of Malicious Attacks against Power Systems” published in IEEE Transaction on Systems, Man and Cybernetics; and “Integrating Cyber Attacks within Fault Trees”, published in Reliability Engineering and System Safety.

Standards for SCADA cybersecurity

The security of SCADA systems has to be implemented by the industrial operators and the manufacturers of control systems. Normally they refer to standards for deciding on the best available practices and the more appropriate technologies and methodologies. The European Project ESCoRTS, a joint endeavour of the European Committee for Standardization (CEN), utilities, leading manufacturers of control equipment and the JRC-IPSC, aims at fostering progress in this field in Europe. In 2009, JRC-IPSC contributed with a survey of existing standards, and a taxonomy of security solutions.

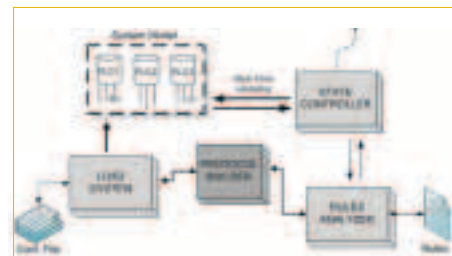
Launch of the Internet resilience lab

SCNI has extended its experimental security approach for dealing with Internet resilience. The work included the design of the laboratory, the implementation of a first architecture, and the performance of first tests of security issues. The objective is to apply rigorous scientific methods for supporting disruptive experiments. This is an innovative field, where much work will be required in the future. In 2009, we demonstrated how it is possible to emulate networks with dynamic topologies reproducing cyber events in a controlled manner, measuring and regulating the experiments for their better characterisation.

Challenges for 2010 and beyond

In 2010 SCNI intends to accompany the evolution of the CIIP/CEIP European policies, continuing with the on-going technical activities. Major emphasis will be given to the development of experimental security work in the SCNI laboratories, the preparatory work for ERN-CIP, and the support to pan-European security exercises. Of particular relevance from the point of view of information, networking and Internet security is the Communication on “Protecting Europe from large scale cyber-attacks and disruptions” of March 2009, and the Conclusions of the European Union Ministerial Conference on Critical Information Infrastructure Protection (held in Tallinn, 27-28 April 2009), which highlighted the need to support the coordination among the Member States, facilitating the sharing of reliable and actionable data regarding security incidents, and fostering the definition of joint contingency plans.

A key point for 2010 is the elaboration (in collaboration with the action CI-Trans and national experts) of the project plan and the roadmap for ERN-CIP. This activity will involve a strong interaction with the Member States, national labs and research centres, and critical infrastructure operators, together with all relevant services in the Commission.



State Based IDS Logical Architecture

GLOSSARY

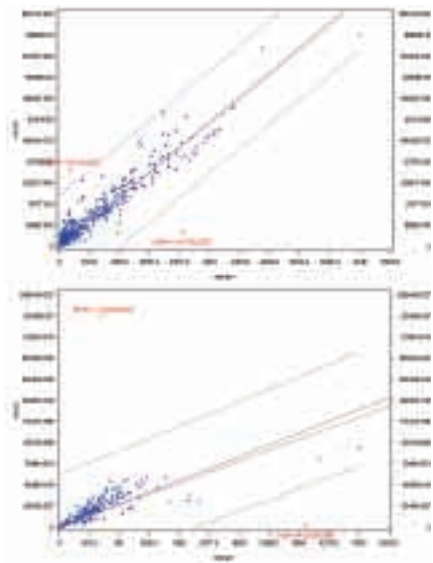
- CEIP** Critical Energy Infrastructure Protection
- CEN** European Committee for Standardization
- CIIP** Critical Information Infrastructure Protection
- DG JLS** Directorate-General for Justice, Freedom and Security
- EPCIP** European Programme for Critical Infrastructure Protection
- ERN-CIP** European Reference Network for Critical Infrastructure Protection
- SCADA** Supervisory Control and Data Acquisition systems

SITAFS

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Extract of 89 companies characterised to be prone to declare low price imports out of 4165 companies declaring 2,138,939 imports into one Member State over a 12 month period



The two transactions of company 132ad8f05281df6c9bcd4b221a035ca9 detected as low price outliers for two similar trade flows

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

This Action addresses selected topics in anti-fraud and international security and provides the IT infrastructure for storing, retrieving, analyzing and visualizing data on external aid donated by the European Union and the International Community to third countries.

Selected topics include the detection of fraud against the budget of the EU, the monitoring of the data submitted by participants of the Kimberley Process Certification Scheme (KPCS) in order to detect compliance issues in the implementation of this important international agreement to suppress the trade of “conflict” diamonds, and the protection of the financial system of the EU from infiltration from trade based money laundering. Contributions to these diverse topics are made in collaboration and support to the European Anti-Fraud Office (OLAF), and the Directorates-General External Relations (DG RELEX) and Internal Market and Services (DG MARKT). The approach of SITAFS in all these topics is the development and application of innovative statistical methods for the detection of a relatively small number of patterns in appropriate trade data, aggregated or dis-aggregated, publically available or of restricted access.

Whereas trade data are fairly standardised in their reporting, currently there is no operational infrastructure for storing project level data on development and humanitarian aid. This impediment to data sharing by the aid donors to eliminate the duplication of effort and enhance transparency is addressed by the TR-AID project. TR-AID collects information about aid projects from different sources, maps this information into one format, stores the information into a database, allows searches in the data it stores, and visualises search results in a user-friendly manner.

Major 2009 achievements

Statistical detection of price outliers in operational datasets for the detection of trade-based money laundering

In 2009, SITAFS concluded a project on the *Statistical Detection of Price Outliers with a view to Trade-Based Money Laundering*. The project was carried out on the complete set of import and export declarations made to the customs services of three Member States in the EU. Data sets comprised records of the order of millions.

The work entailed further development and fine-tuning of the detection of price outliers by the backward search and the prioritisation of the outliers detected for investigations by Customs and Financial Intelligence Units. This prioritisation has been a novel challenge. Two approaches were developed: the first approach prioritises the detected outliers by the estimated under- or over-valuation. The second approach characterises importer or exporters companies as prone to produce “fairly”, highly or lowly priced declarations, by detecting statistically positive associations between declaring companies and their analysed declarations.

From preliminary results of investigations conducted by the data owners on the prioritized findings, it appears that the first approach points out to data quality issues present in the trade data. The second approach focuses on cases of economic impact against the budget of the Member States and the Union.

Advances in the Forward Search (FS) for the detection of outliers

The *Forward Search Data Analysis* toolbox, which performs the forward search in regression problems, has been pre-released¹, including extensive documentation of the method for prospective users. This work was conducted in collaboration with the University of Parma.

The results will be used to further fine-tune the FS procedure, support the discussion on the procedure to be used in operational data and will be reported in a publication to be peer-reviewed.

Transparency in aid

In 2009, the TR-AID project made solid technical progress in allowing users to export selected results on projects and organizations, normalized sector related information across different sources, implemented UNIT testing, and produced an XML model to facilitate data exchange with diverse data sources. This work was partially supported by an administrative agreement with OLAF. The evolution of TR-AID in 2011-2012 has been agreed with the EuropeAid Co-operation Office (AIDCO) and the Directorates-General for Humanitarian Aid (ECHO) and for Development (DG DEV). The TR-AID data model will be extended to include ECHO data, and TR-AID will provide a platform for producing updated donor atlases.

Statistics for the Kimberley Process (KP) Certifying Scheme (KPCS) - Detection of spikes in exports of rough diamonds from countries neighbouring to Zimbabwe and the Ivory Coast

Statistical inference procedures developed by SITAFS for the detection of large unexpected increases were applied in subsets of the export trade reported by KP participants. Results were included in a European Commission paper and presented orally in the intersessional and plenary meetings of the KP in Namibia, in 2009.

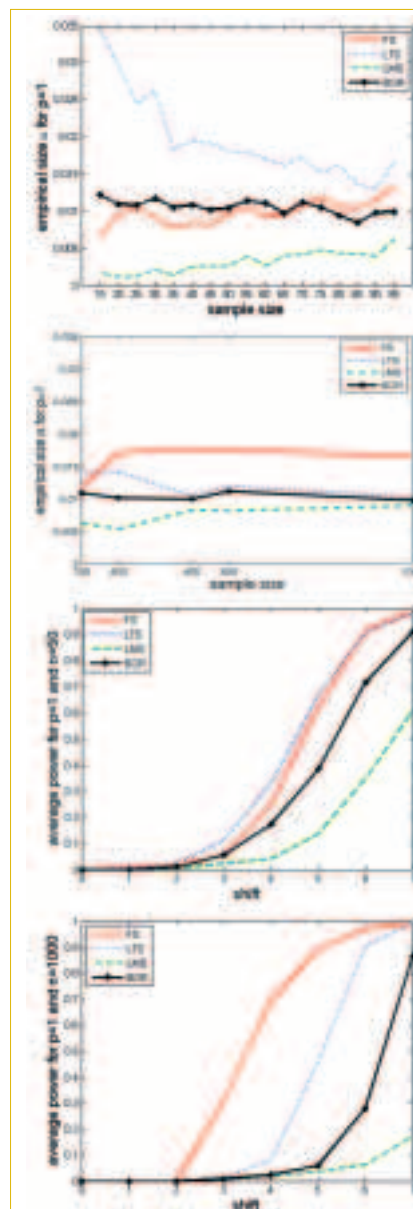
The KP Administrative Decision on Guinea was taken after the presentation of findings in the KP plenary meeting. The results were received with particular attention from other KP participants. The US lead delegate to the KP stated “[...] this was a very useful product that could go a long way to furthering the discussion on Zimbabwe. [...], the U.S. will focus in the coming weeks on the specific spikes referenced with our trade and appreciate the JRC’s identification of these issues.”

Challenges for 2010 and beyond

Regarding the application of the forward vs backward search procedures for the detection of outliers in operational data, procedures alternative to the backward search will have to prove to be of operational grade to be adopted in practice. Limitations on the routine use of the backward search will be further investigated.

In the field of aid transparency, the ambition is to make TR-AID an internal tool of the Commission for sharing aid data. A major milestone for this is that in 2010 humanitarian aid data will become available from ECHO and incorporated into the TR-AID data base. The biggest challenge for 2010 is the enrichment of TR-AID with data from Member States.

The challenge for statistics for the KPCS is to partially automate the preparation of tables with significant findings to be reported on country analyses and to convince the KPCS community on more objective, efficient and effective methods to proactively detect compliance issues for the KP.



Estimated test and four procedures of detecting outliers in linear regression models with one parameter

GLOSSARY

- AIDCO** EuropeAid Co-operation Office
- DG DEV** Directorate-General for Development
- DG MARKT** Directorate-General for the Internal Market and Services
- DG RELEX** Directorate-General for External Relations
- ECHO** Directorate-General for Humanitarian Aid
- FS** Forward Search
- KPCS** Kimberley Process Certification Scheme
- OLAF** European Anti-Fraud Office

1. <http://www.riani.it/MATLAB.htm>

CI-CHEM

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MAHB

The Major Accident Hazards Bureau provides research-based scientific support to the European Union on the formulation, implementation and monitoring of EU policies for the control of major accident hazards, chiefly the Seveso II Directive. DG Environment 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 learned in order to prevent recurrence of similar events.

Major Hazards and Protection of Chemical Infrastructures (CI-CHEM)

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. The Action is centred around MAHB, the Major Accident Hazards Bureau, and uses its competences not only for the control of major hazards, but also for protection of critical chemical infrastructures and for chemical preparedness.

Major 2009 achievements

Accident Analysis and Lessons Learned

A number of obligations put on the Commission by the Seveso Directive 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 CI-CHEM.

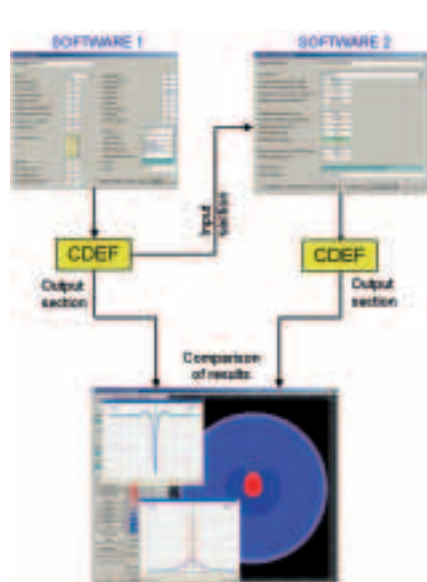
MARS is the reference major accidents database worldwide. It contains the accident reports submitted by the EU Member States in the context of the Seveso Directive¹. In 2009 the new online system eMARS² – whose development was based on the Action's longstanding experience in accident analysis, and which implements the Commission Decision³ for a new accident report form – was fully implemented and adopted by the Member States, while extended also to the OECD countries. Accident reporting and analysis constitute fundamental scientific input to risk management and prevention and as such, they represent key requirements of the Seveso II Directive. In parallel, the population of the SPIRS system, which is also managed by CI-CHEM, was completed this year with data from the almost 10.000 EU Seveso establishments and provides the Commission and the Member States with useful insights on the profile of industrial hazards.

Hazard potential and support to the review of Seveso Directive

The transposition of the new Globally Harmonised System (GHS) for classification of hazardous substances into the Seveso II Directive resulted in the need for a review of the Directive, and especially Annex I, defining its scope. This task was based on the scientific input of CI-CHEM covering assessment of the major accident hazard potential of the different categories of substances and analysis of historical data from past accidents involving these substances.

Guidance to the authorities on Risk management, Inspections and Land-Use Planning

The consistent and efficient implementation of the legislation is ensured through guidelines, good practice references and common databases, which are developed by CI-CHEM in close collaboration with the Member States and industry. Addressing the way the Member States are managing risks in low-tier sites - i.e. sites where hazardous substances are present in lower quantities and the Seveso requirements are less stringent – the Action performed a survey and developed a document of good practices in the use of Seveso instruments, such as Safety Management Systems and Major Accident Prevention Policy. Ensuring the comparability in the results of consequence and risk assessments performed by different analysts, the Action defined and tested an XML data format allowing the interoperability of software tools for accident consequence analysis. This system, together with the Guidelines on Land-Use Planning and the database of



Comparing the results of different consequence models as input to risk management decisions and Land-Use Planning: The CEM tool allows quick comparison of the output of different consequence and risk models, using the Common Data Exchange Format

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

2. <http://emars.jrc.ec.europa.eu>

3. Commission Decision C(2008) 7530 of 2 December 2008, published in OJ

common accident scenarios that is being developed by CI-Chem, will contribute to more consistent Land-Use Planning and risk management decisions.

The Action, 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 risk management and inspection policies. In 2009, focus was given to Human Factors and to risk management practices in industrial parks.

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. The Action participated in the IMPROVE research project, aiming at the development and testing of a dedicated methodology for security vulnerability assessment of those Seveso plants regarded as Critical Installations.

Natech disasters (Natural event triggered technological disasters)

The research of CI-CHEM 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 2009 include the systematic analysis of the damage on chemical establishments caused by the catastrophic earthquake in Sichuan, China, the analysis of natech risks from floods and lightning incidents and the conclusions from a survey among the OECD member countries on natech risk management practices and collection of natech accidents.

Disaster Risk Reduction

In support to the initiatives on Disaster Risk Reduction following the Hyogo Conference, the Action is acting as the reference point for Europe/Africa and has created the DRH-Europe/Africa node in collaboration with the DRH-Asia partners. Further collection of measures, tailoring to the needs of the African users and strengthening the collaboration with institutions of the African Union is an on-going challenge for the node.

Integration, enlargement and international activities

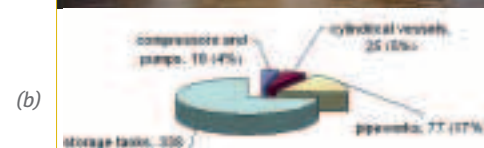
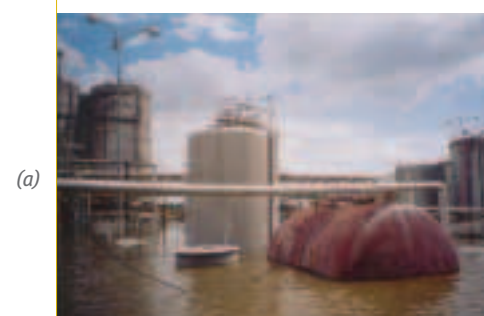
The Action has been very active in assisting the New Member States and Candidate Countries achieve the *acquis communautaire*. Highlights of 2009 include the extensive training on Seveso issues provided to the Croatian Environment Agency, the collaboration with the Lithuanian authorities on risk assessment and the development of a Flexible Risk Management Framework for the developing countries in the context of the UNEP programme, with training provided to the Philippines and Cambodia.

Challenges for 2010 and beyond

Future challenges include the assessment of the 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. The further development and testing of security risk methodologies and their application to related problems is also one of the challenges for the near future.

What are Natech accidents?

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



Natech accidents triggered by floods: Industrial equipment flooded; and Statistical analysis.

(a) Industrial equipment flooded

(b) Equipment involved in Natech accidents triggered by floods.

(c) Natech accidents initiated by flood events.

GLOSSARY

DG ENV Directorate-General for the Environment

DG JLS Directorate-General for Justice, Freedom and Security

DRH Disaster risk Reduction Hyperbase

GHS Globally Harmonised System

MARS Major Accident Reporting System

OECD Organisation for Economic Co-operation and Development

SPIRS Seveso Plants Information Retrieval System

UNEP United Nations Environmental Programme

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Training on the Eurocodes: Workshop on Design of Masonry Structures organized by JRC-IPSC and DG ENTR, Brussels, 2-3 April, 2009

Risk Prevention and Safety in Construction (SAFECONSTRUCT)

The Action SAFECONSTRUCT runs the European Laboratory for Structural Assessment (ELSA) and provides policy support to the Commission in the construction sector. This activity concentrates on the support to the implementation of the Eurocodes (58 new standards which, from March 2010, will replace the national codes for design of buildings and other civil engineering structures) and also on the definition of the strategies for further development of the European standards for design and construction to take into account the issues of safety, health, energy economy and heat retention and environmental sustainability.

The Action also played a key role in the issues related to risk assessment, management and mitigation with short term impactful activities, such as the coordination of the technical report of the European Field Mission after the L'Aquila Earthquake, in Italy, and the participation in that mission with two experts.

Unique experimental tests on full-scale composite bridge beams were carried out, research on modular construction was conducted and technical advice to Small and Medium Enterprises was provided. The Action also provided key contribution to the setup of the Seismic Centre of the International Atomic Energy Agency (IAEA) for Seismic Assessment of Nuclear Power Plants.

The Action has a Memorandum of Understanding with the Directorate-General for Enterprise and Industry (DG ENTR) for the support to the implementation and further development of the Eurocodes. The Action develops also a set of European joint research projects (5 Shared Cost Actions) concerned with earthquake risk reduction and vulnerability assessment and industrial risk, including management of Users Access to the ELSA reaction-wall experimental facility.

Major 2009 achievements

Support to the European policies and standardization for construction – A New Mandate to the European Committee for Standardisation (CEN) for the 2nd Generation of the Eurocodes

This policy support activity requires demanding interactions with various stakeholders, namely DG ENTR, CEN, National Authorities and National Standardization bodies, research institutions and industry.

The work on support to the implementation of the Eurocodes in the Member States comprised also development of informatics tools and databases to collect Nationally Determined Parameters. Furthermore, a series of policy support documents were achieved in areas concerned with strategies for implementation and promotion outside of EU, further harmonization, need for new developments, etc. Based on these reports and on the 'white paper on the Eurocodes' jointly drafted by CEN-TC250 and JRC-IPSC, the Commission is issuing a Mandate for the 2nd Generation of the Eurocodes.

The Eurocodes are approaching a very important milestone fixed for March 2010, when the Member States are deemed to move from their National codes to the common European Standards (the Eurocodes), which represents the biggest change ever experienced by the European construction sector.

The new Mandate will further facilitate implementation at national level and take on board market developments, innovation and research both through

modifications/additions to existing standards as well as development of new standards.

European Civil Protection field mission to the L'Aquila (Italy) earthquake

Following the L'Aquila earthquake in Italy in April 2009, SAFECONSTRUCT participated with 2 experts to the European Civil Protection Field Mission, co-ordinated by the Commission's Monitoring and Information Centre (MIC). The Action also coordinated the Technical Report resulting from the 1-week damage evaluation inspections in co-operation with the Italian Civil Protection.

The MIC report was widely mentioned at several high-level meetings/events. It was also a reference document for the mobilisation of ~500 million Euros from the EC to Italy (Activation of the European Union's Solidarity Fund) to help rebuilding the central town of L'Aquila.

Database of "Earthquake Experience for Nuclear Power Plants" moves to the IAEA

The activity is the result of the Practical Arrangement between the JRC-IPSC and the IAEA, which is intended to provide the IAEA NSNI (Division of the Nuclear Installation Safety) with an Internet accessible database containing the IAEA Safety Series (Technical Documents, Safety Guides and Safety Standards).

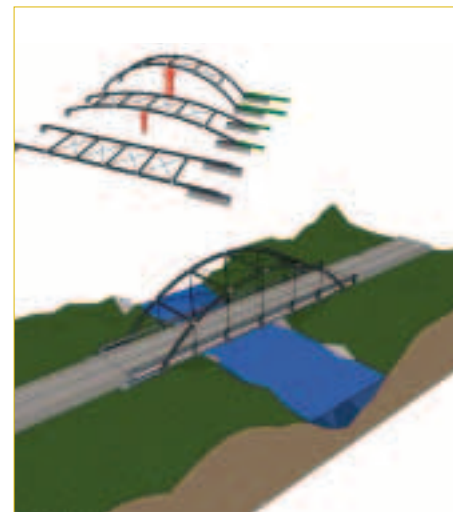
The newly established IAEA International Seismic Safety Centre (ISSC) suggested further challenging developments and implementations beyond the original target in order to comply with the mission and scope of the ISSC and better deserve the future activities of the Centre.

The current IAEA ISSC Database¹ includes tools for the management of international benchmarks and is at present used for the KARISMA benchmark (Kashiwazaki-Kariwa Research Initiative for Seismic Margin Assessment) intended to define fragilities of existing energy facilities and develop new safety standards for post earthquake assessment and operation of Nuclear Power Plants.

The Database was implemented at the IAEA-ISSC and will be operated and managed by the ISSC technical and informatics services.

Challenges for 2010 and beyond

Future challenges for the Action include setting up a JRC Buildings platform involving 5 JRC Institutes — a holistic approach for the building sector policies, considering: Single Market, Energy, Health, and Environment. The Action will also prepare and perform three reference testing campaigns at the ELSA Reaction-wall: pre-cast industrial building, modular deployable bridge made of Fiber Reinforced Polymeric materials, assessment and retrofit of existing reinforced concrete frame structures. Finally, the Action will carry out several tasks within the five competitive research projects where SAFECONSTRUCTION is partner.



Conceptual drawing of a modular deployable FRP arch-beam bridge system and generation of the arches

A New modular-deployable structural system for bridges

ELSA has proposed a new method for the installation of light-weight bridges. It is believed that this method will be particularly useful for the rapid installation of mid-length-span bridges. Such rapid installation systems could be most beneficial, not just from the reduced maintenance costs over their lifetime, but also whenever the increased costs of installing a standard bridge (incurred through traffic disruption) or the urgent replacement of structures damaged by earthquakes or floods, would merit the use of a so-called modular deployable structural system.

GLOSSARY

CEN European Committee for Standardisation

DG ENTR Directorate-General for Enterprise and Industry

ELSA European Laboratory for Structural Assessment at JRC-IPSC in Ispra (IT)

FRP Fiber Reinforced Polymers

IAEA International Atomic Energy Agency

ISSC International Seismic Safety Centre of the IAEA

KARISMA Kashiwazaki-Kariwa Research Initiative for Seismic Margin Assessment

MIC Monitoring and Information Centre of the European Commission

NPPs Nuclear Power Plants

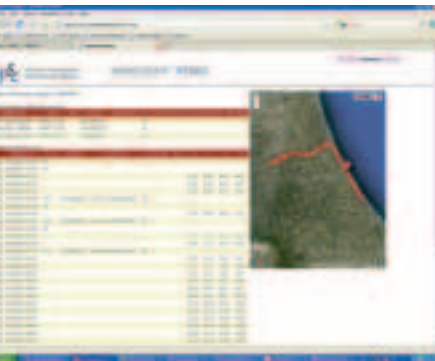
1. <http://issc.iaea.org>

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Integrated Geographic Information System/Animal Movement Monitoring System (GIS/AMMS) system

Different information layers can be associated and displayed in order to identify the possible risk of animal diseases spreading. In Fig.1 two layers only are merged together; the track route (red line) and a basic map. Multiple layers, indicating the location of farms, outbreaks of diseases, and further information can be easily added providing the end user (transporters as well as responsible body) with a real time management system.



The web interface displaying the integration between GIS and Animal Transport Monitoring System.

Monitoring, Control and Traceability in the Food Chain (CI-ANIMALS&FOOD)

The key task of the Action CI-Animals&Food is to provide customers with technical/scientific advice in order to improve the establishment of a safe traceability system of livestock and products based on the use of Radio Frequency Identification (RFID).

Traceability of livestock and animal products are elements linked together to more efficiently fight sanitary frauds and ensure food safety. Several animals crisis 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 promptly trace animals and products possibly contaminated, with the immediate consequence that consumer protection was not fully ensured. In this context, JRC-IPSC — in close collaboration with EU Member States — develops research projects aimed at demonstrating that new traceability technologies are appropriate tools to deliver safe information on the origin, the processing and storage of meat.

Major 2009 achievements

Social Network Analysis (SNA) applied to the animal movement

A number of research projects were implemented concerning the application of the Social Network Analysis (SNA) to the present animal trade. The aim of SNA-based projects is to develop a tool which processes data on livestock movements and enables the competent bodies to prioritise the veterinary measures in case of animal disease crises. One of the first steps was to use network analysis techniques to investigate the movement patterns of cattle in a EU Member State, describing the global structure of the livestock industry, the main trade flows and the relations between premises in relation to the potential spread of cattle diseases. Epidemic simulations were carried out on the network built out of movement data using a network-based meta-population model. The simulations showed the influence of the network structure on the dynamics and size of an epidemic and gave useful indications on the effects of targeted animal movement restrictions measures based on the centrality of premises within the network of animal movements.

Integration between DNA and electronic identification

Since January 2010 electronic identification (EID) has become a binding standard in Europe¹ and DNA-based techniques are becoming more promising tools in the traceability of the origin of animal products. The International Society for Animal Genetics and the Food and Agriculture Organization have proposed sets of DNA microsatellites as individual identification markers for the study of animal genetic diversity and for conservation purposes in different species. The Action carried out a study with the objective to develop an integrated EID/DNA system for traceability of cattle in both dairy and beef populations, as well as for their milk and meat. The system allows the codification of the microsatellite profile of each animal into an EID code, which would ensure a tamper-proof trace-back methodology. The explored approach has foreseen the design of a dedicated algorithm for converting microsatellite profiles of each individual animal to an EID, which mirrors the DNA sequence. Therefore, the DNA/EID codes can be used

1. Regulation 21/2004

2. Commission Decision 968/2006

as electronic identification of individuals as well as tracing-back methodology for the identity of animals, carcasses, meat cuts and milk samples, as demonstrated in the JRC-IPSC project with more than 1000 samples from 200 animals.

Accreditation of the RFID Laboratory

In 2009, the JRC-IPSC's RFID test laboratory, accredited according to ISO 17025 standard for the RFID tests foreseen by EU legislation², received full accreditation by UKAS (UK accreditation body). The JRC-IPSC's RFID Laboratory is officially recognised as an ICAR (International Committee for Animal Recording) test centre and is playing a key role in the ISO working groups concerning the technical aspects of animal electronic identification.

Monitoring of Animal Transport

In the context of the technical collaboration with the Directorate-General for Health and Consumer (DG SANCO) a number of studies were completed aimed at ensuring a smooth implementation of Council Regulation 1/2005 (Animal welfare over long journeys). In particular, the STAT project, concerning the temperature of animal transport, was completed in 2009. The study compares the temperature standards in force according to the EU legislation and the standards proposed by scientists (European Food Safety Agency - EFSA) with the actual practices of commercial transport in the EU. In one year, temperature and humidity records from 21 vehicles and 905 journeys were analysed. With temperature/humidity sensors at 4 different positions in the vehicles, differences were recorded between the highest and the lowest temperature at any given moment which exceeded in nearly 7% of cases 10°C. Overall for all journeys and all animal categories a relatively high percentage of non-compliant journeys can be observed when excluding tolerances regarding values or time. The temperature thresholds proposed by EFSA would result in general in a higher percentage of non-compliant conditions, more prominent for the lower threshold compared to the thresholds laid down in EC Regulation. The final project report was formally accepted by DG SANCO.

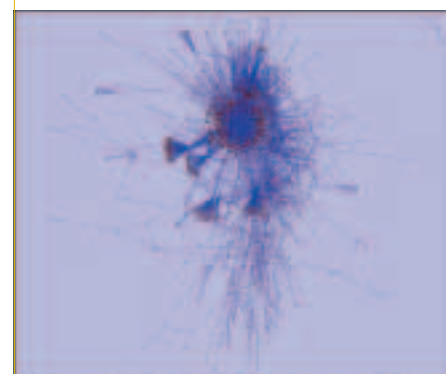
Challenges for 2010 and beyond

In the context of the CBRN policy, a major effort will be put in place for the development of additional techniques based on Social Network Analysis, in order to ensure the capability –at field level- of the establishment of fast and safe measures to detect and control animal diseases spread.

The future development of the animal movement monitoring system will concern the extension to integrate the developed system with the IDs of the EID tagged transported animals and with a dedicated Geographical Information System. This would provide the end user with a complete solution of transportation monitoring integrated into other animal health information layers (farms location, outbreak notification, etc.), which would definitively increase both the capability to monitor the possible spread of animal diseases and the efficiency of the corrective measures of the responsible bodies.

Social Network Analysis (SNA)

The SNA technique can be applied to a predefined network (such as the network made of animal farms) in order to predict where –according to a specified epidemiologic model and on the basis of the present animal movement- an animal disease may appear. This may help the responsible body to identify where to take appropriate measures first, thus increasing the efficiency of the protective measures.



The structure of the cattle movement in Italy, as developed by SNA based technique.

GLOSSARY

CBRN Chemical, Biological, Radiological Nuclear Threats

DG SANCO Directorate-General for Health and Consumers

DNA Deoxyribonucleic acid

EID Electronic Identification

GIS/AMMS Geographic Information System/Animal Movement Monitoring System

ICAR International Committee for Animal Recording

RFID Radio Frequency Identification

SNA Social Network Analysis



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 decision-making 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 including disaster risk reduction, conflict prevention, international disaster response, and reconstruction; global challenges such as non-proliferation, terrorism, and illicit trafficking. Some activities will be developed in support to the development of GMES services, in particular in the fields of emergency response and security.

CRITECH, ISFEREA, CONTRAFFIC

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.

FOODSEC

CRITECH

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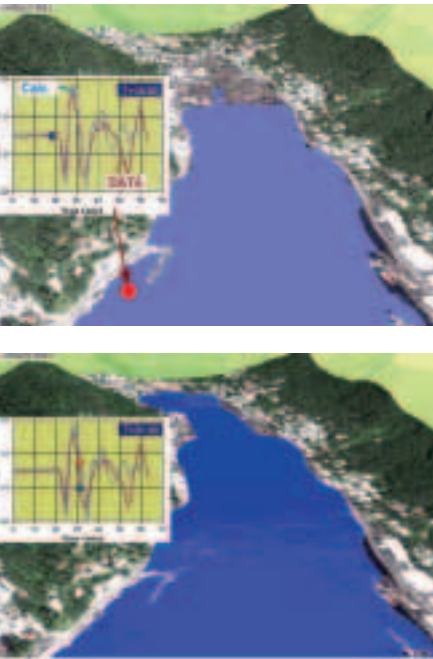


Fig. 1:

a) Flooding of the Pago Pago bay during the Samoa event Tsunami. The city was flooded by a 2.5 m wave, which was measured by the tidal gage measurement devices.
 b) Comparison of the measured and the calculated values. The 2 pictures represent the situation at 20 min and 30 min after the earthquake. The flooding was modeled with the HyFlux2 code, which was used for the first time for a real Tsunami inundation

Crisis Monitoring and Response Technologies (CRITECH)

The CRITECH Action focuses on the development and testing of solutions to enhance decision-making in crisis management, including experimenting with multiple-source information retrieval techniques, real-time data stream prioritisation / visualisation, numerical modelling systems, and visualisation/display systems. The solutions also include Web-based platforms for sharing, managing and disseminating crisis relevant information in a number of external environments that are involved in operational crisis management and related decision making. These solutions, including shared situational awareness, early warning and alerting systems, require key technologies such as Web 2.0 and Internet technologies, geo-information technologies (including GIS) and numerical modelling, which constitute the core scientific competences of the Action.

The aim of the CRITECH Action is to provide scientific support to EU policies concerned with crisis management, from humanitarian natural disasters and public health crises to conflict and political crises.

Major 2009 achievements

Global Disasters Alerts and Coordination System (GDACS)

The Global Disasters Alerts and Coordination System (GDACS) is a system jointly developed by the JRC-IPSC and the United Nations' Office for the Coordination of Humanitarian Affairs (UN OCHA). GDACS provides a near real-time alert chain through the automated processing of sensor data (e.g. seismological data) with physical hazard models and statistical risk models, converting scientific data into digestible reports and alert levels targeted for operational agencies and decision makers. Furthermore, GDACS aims at controlling the information flow after the disaster, including fast alerts, updated news, satellite maps and needs and relief related information. The number of GDACS users is constantly growing over time, with 10,000 users currently receiving alerts from JRC-IPSC.

Tsunami event in Samoa Islands

On 29 September 2009 at 17:48:11 UTC, an earthquake of magnitude 8 struck off-shore of the Samoa Islands and generated a large tsunami that destroyed several villages and caused fatalities. Near-real time calculations automatically initialised by GDACS correctly identified the severity of the event and indicated which islands were mostly affected; a maximum height indicated in the calculations was 3.8m in Fagamalo and Poloa and 3.1m in Fagasa in American Samoa, on the island of Pago-Pago. Post-event calculations were performed to describe the event and the affected locations in more detail. For the first time, flooding in the Pago-Pago bay was calculated by the JRC-IPSC using a more detailed model and the results were in good agreement with the measurements and the satellite-based information [Figure 1-a].

Global Flood Detection System

CRITECH further developed its satellite-based flood detection/monitoring system, in particular the performance of the data processing cycle was significantly improved. Daily flood maps with high temporal resolution and regional coverage are now created automatically, providing near real-time and complementary information to flood maps created from high resolution optical satellite imagery. Flood size can be estimated with less than 15% error. For well-chosen arbitrary monitoring sites, virtual hydrographs are calculated hourly, matching real flow and staging data accurately. For the 2009-2010 flood season, JRC-IPSC worked closely with the Namibian Government to set up a dedicated system for flood

early warning for the Northern areas of Cuvelai and Caprivi, providing up to 5 days lead time in flood warning [Figure 1-b].

Assessment of emerging public health threats

In 2009, CRITECH carried out a series of activities associated with the early assessment of emerging public health threats. With the worldwide spread of the 2009 H1N1 influenza virus, which first emerged in Mexico in March 2009, and the declaration of a pandemic by the World Health Organization (WHO) on 11 June 2009, several modelling-based crisis management approaches were implemented. Using mathematical modelling and statistical approaches it was possible to closely follow the pandemic and carry out a number of assessments and projections of the situation as the pandemic was unfolding [Figure 2]. The assessments were provided to the Directorate-General for Health and Consumers (DG SANCO) and taken into consideration in their decision making process. CRITECH showed that epidemiological modelling is a useful tool for the quantitative assessment of epidemics. It can provide insights into the major characteristics of the outbreak through analysis of the available data.

Challenges for 2010 and beyond

In 2010 CRITECH will develop a new model for the calculation of storm surges associated with tropical cyclones. In several tropical cyclones events, such as Myanmar in 2008, a large part of the fatalities and the damage was due to storm surge; the Action intends to develop a model that, based on meteorological data, estimates the storm surge along the coast.

Research on the flood monitoring system will focus on two topics. First, the dependence on a single satellite sensor will be reduced by integrating data from multiple sensors. This will also pave the way to use European Sentinel sensors to be launched in 2011. Secondly, CRITECH intends to integrate the JRC-IPSC system in various national or regional routine and operational flood monitoring systems, e.g. by combining information with ground-based sensor data, rainfall data and forecast models (in collaboration with JRC-IES).

In the field of crisis information management, CRITECH will take on new challenges to analyse the information flows and functional requirements in international crisis rooms. This understanding will be used to develop a new standard Crisis Room Model and, in general, target research efforts more accurately to customers' needs.

Finally, regarding the epidemiological activities CRITECH is testing new approaches to have the spatial components incorporated in the dynamics of the infectious disease transmission. Using models that describe the temporal dynamics of disease transmission we move to the development of new spatio-temporal approaches.

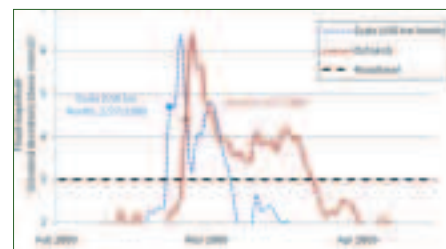


Fig. 2: The above chart represents the GFDL signal (blue curve) of a location 150 km upstream in Angola of highly populated location in Namibia (red curve). A flood wave propagates between the stations in 5 days. Using GFDL, the Namibian government can monitor rivers in Angola (without the need for instruments or agreements) and have flood warnings with 5 days lead time.



Fig. 3: Example of H1N1 situation map showing the extent and the timeline of the pandemic event. Weekly updates of these maps have been produced from April 2009 to January 2010.

GLOSSARY

DG SANCO Directorate-General for Health and Consumers

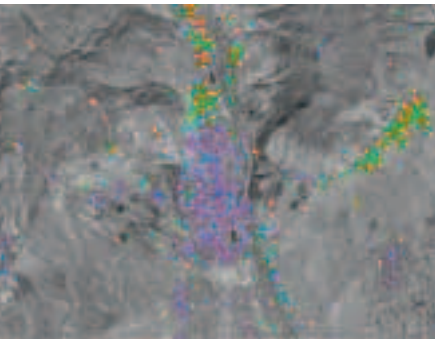
GDACS Global Disasters Alerts and Coordination System

UN OCHA United Nations' Office for the Coordination of Humanitarian Affairs

WHO World Health Organization

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Automatic recognition of post-conflict damage in human settlements using an inferential engine developed by ISFEREA and based on morphological image queries and spatial generalization techniques. Tests were carried out on realistic scenarios, including massive image data processing (1.92E+10 image elements were classified) and time-critical information release (in 30 minutes). The image shows the estimated density of damaged built-up structures in a subset of the scenario covering the city of Tchinvali, Georgia (2008) and surrounding villages, using 50-cm-resolution panchromatic image data input collected by the WW-1 satellite platform.

Geo-spatial Information Analysis for Global Security and Stability (ISFEREA)

The ISFEREA Action provides scientific support to EU external relations policies, specifically those concerned with global stability and crisis management. ISFEREA focuses on disaster risk reduction, conflict prevention, crisis response and support to post-crisis rehabilitation and reconstruction. The Action also cooperates with specific international partners of the external relations family such as the World Bank and the United Nations' (UN) agencies.

The Action develops, validates and applies innovative and robust 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. Computer-enhanced visual interpretation, automatic feature extraction and image understanding are the key technologies composing the scientific core competences of the Action. Information extracted from satellite data are then fused with other data sources in order to build end-user products and analysis by geo-spatial modelling and cartographic representation.

Major 2009 achievements

Automatic satellite image information retrieval

During 2009, ISFEREA consolidated its research in the field of automatic image information retrieval from the latest-generation satellite data in support to international crisis management. In particular, newly-defined or improved methodologies for automatic information retrieval from satellite sensors at meter and sub-meter spatial resolution were successfully developed and tested in realistic scenarios for:

- Automatic enumeration of built-up structures and population in refugee camps: an improved methodology based on statistical regression techniques from image morphological queries was successfully validated on realistic scenarios in Darfur and Sri Lanka in support to UN agencies.
- Automatic retrieval of information related to density of human settlements: for the first time the robustness of the new technique developed by ISFEREA, based on rotation-invariant anisotropic textural measures, was demonstrated over a globally representative set of 50 cities.
- Automatic retrieval of image information for human settlement patterns characterization. The new methodology developed by ISFEREA can extract information about the volume and size of built-up structures and open spaces without the need of expensive stereo image collection. The methodology was assessed in realistic scenarios in support to UN agencies working on reducing the urban divide and urban slum mapping.
- Automatic recognition of post-conflict damage in human settlements using a newly-defined inferential engine based on morphological image queries and spatial generalization techniques. The system has shown to be robust and effective in simulating the post-conflict damage assessment in Georgia 2008.

Post Crisis Needs Assessment and Recovery Framework Programme (PCNA)¹

In 2009 ISFEREA participated jointly with the UN and the World Bank in 3 major Post-crisis Needs Assessments (PCNAs) missions in Namibia, El Salvador and Senegal, contributing to the findings and reports with satellite data and GIS

1. Instrument for Stability (Crisis Management) - Council Reg, EC 1717/2006.

analysis for detailed damage assessment and statistics and thematic geo-spatial information products. The PCNAs results were presented to the governments of the three affected countries, donor and development partners, including the EC. Moreover, geo-spatial methodologies available at JRC-IPSC for assessing the impact of disasters and conflicts were integrated in a joint Guide aimed at supporting decision-makers in the early stages of recovery planning and reconstruction.

Implementation of the Kimberley Process Certification Scheme in the EC²

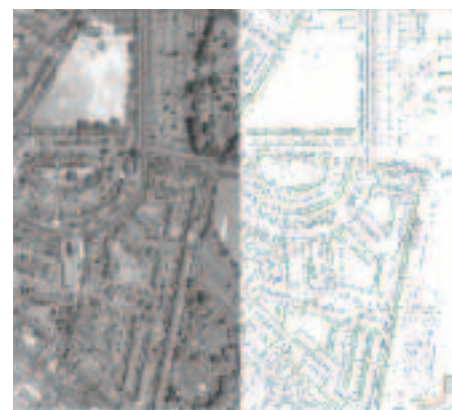
In support to the Kimberley Process Certification Scheme (KPCS), ISFEREA is providing scientific and technical support to the Directorate-General for External Relations (DG RELEX) on monitoring illegal mining activities via analysis of satellite data. ISFEREA has developed application specific methodologies based on change detection and volumetric analysis to verify and assess illegal and legal mine production dynamics and to estimate the volume of excavated material. The JRC-IPSC's support proved directly instrumental for EU and international action within the KP and at UN level, leading inter alia to a UN Security Council Resolution on a specific country still under sanction today and subject to independent, regular, satellite based monitoring by the JRC-IPSC in 2009.

Responding to crises

During the armed conflict in Gaza between December 2008 and January 2009, ISFEREA at the request of DG RELEX regularly provided situational updates of the extent and characteristics of the conflict related damage, based on the analysis of satellite data. The results of the analysis were aggregated in the form of maps, damage statistics and situation reports which provided DG RELEX with an independent assessment of the conflict related damage.

Challenges for 2010 and beyond

There are two main types of technical challenges that ISFEREA will address in 2010: 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 further 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 will 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 will be demonstrated.



Example of automatic characterisation of human settlements using new image information extraction techniques developed by ISFEREA. In the image (left) the signal recorded by the panchromatic sensors of the QuickBird satellite platform at 60-cm of spatial resolution. In the image (right) the markers of the built-up structures automatically detected by the ISFEREA image information mining technology, including the estimation of the number of floors (in color scale blue-green-red in the image) by taking into account sun elevation and azimuth at the time of the image data collection.

GLOSSARY

- DG RELEX** Directorate-General for External Relations
- GMES** Global Monitoring for Environment and Security
- GIS** Geo Information System
- KPCS** Kimberley Process Certification Scheme
- PCNA** Post Crisis Needs Assessment
- VHR** Very High Resolution

2. Council Regulation 2368/2008

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Container Traffic Monitoring (CONTRAFFIC)

The Action CONTRAFFIC started in 2009 with the main goal of performing intelligence gathering and risk analysis for the global containerised goods supply chain.

CONTRAFFIC is a unique technology developed at JRC-IPSC to screen data on global maritime container movements to detect potentially suspicious consignments. It automatically gathers container movements' data from a number of on-line sources and features facilities to target suspicious containers based on analysis of their itineraries. It is designed to complement other risk analysis by customs that focuses instead on data items in customs declarations.

CONTRAFFIC services are available through a web portal to authorised users from the European Anti-Fraud Office (OLAF) and customs authorities in Member States. It is also used on the occasion of joint customs exercises several times a year. CONTRAFFIC supports the Directorate-General for Taxation and Customs Union (DG TAXUD) and selected Member States (MS) customs authorities in the formulation of a European initiative for an alternative integrated technological solution for container security to meet the 100% inbound container scanning US requirement. The CONTRAFFIC project is being carried out in the framework of the Community Customs Cooperation¹. The EU legislation foresees that the Commission establishes and manages a "directory of data" on the international goods supply chain including transport, based on both public and private data sources. The Commission is also empowered to access and analyse such data for the purposes of operational and strategic analyses and also to make data and results available to competent MS authorities.

The main objectives of the Action are:

- Develop early warning for containers under surveillance.
- Run joint targeting exercises with customs (Single Administrative Documents data analysis).
- Follow discussion on European initiatives for container security from the EU perspective.

Major 2009 achievements

In 2009 CONTRAFFIC provided support of operational-level customs intelligence through container monitoring and route-based risk analysis. This was accomplished through the development of a new portal that includes a suite of applications: *Track&Trace* to trace back the latest movements of containers, *port2port* for statistics on routes and the detection of outliers (unusual itineraries), and *location-finder* to identify the last port of loading.

Concerning applied research on risk analysis, in 2009 CONTRAFFIC focused on advanced techniques to detect deviations from typical behaviour for given shipments. This led to the calculation of anomaly scores that, if combined with other indicators, can flag warnings for given shipments.

Early warning for containers under surveillance was enriched by the introduction of an automatic notification (alert) system for containers crossing the

1. Council Reg. (EC) 515/97 on mutual assistance between EU customs administrations.

The CONTRAFFIC system helps customs authorities to target suspicious containers based on the analysis of their itineraries.



Eastern EU borders. MS customs use systems for the automatic recognition of container-ids at the borders and feed data into the CONTRAFFIC database. This data is federated against other data available through Contraffic. This pilot exercise is expected to foster data exchange between EU customs and the Commission.

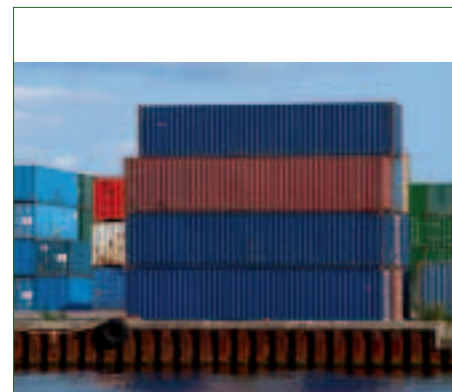
The first CONTRAFFIC workshop on “Container Tracing and Anomaly Detection” took place in JRC-IPSC in Ispra on 30 November 2009. The aim of the workshop was to provide a forum for discussing the interplay between customs authorities. A feedback from the Belgian customs on Single Administrative Documents (SAD) analysis proved the ability of CONTRAFFIC to target misdeclarations of origin. The workshop was crowned with success and some MS customs (Lithuania, Greece, Finland and Poland) showed a strong interest to participate in future SAD exercises.

Challenges for 2010 and beyond

CONTRAFFIC is expected to give ad hoc contributions on technology assessment and fact-finding for critical maritime routes to the Expert Support Facility (ESF) in the framework of the Instrument for Stability Programme led by the family of Commission Directorates-General dealing with external relations.

The Action will also work at the development of new methods for the calculation of anomaly scores for shipments based on its itinerary, container delay at port of loading and number of transshipments.

Single Administrative Documents (SAD) will continue to feed the CONTRAFFIC system from selected customs. The objective of such exercises is to identify false declarations of origin based on an analysis of electronic customs cargo reports such as SAD. Moreover, in 2010 non-European customs will participate in the exercise.



About 90% of the world's cargo is transported in maritime containers, but only 2% is physically inspected by customs authorities, opening the possibility for illicit activities, such as avoiding customs duties, circumventing quotas or smuggling nuclear materials and weapons.

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GLOSSARY

DG TAXUD Directorate-General for Taxation and Customs Union

ESF Expert Support Facility

OLAF European Anti-Fraud Office

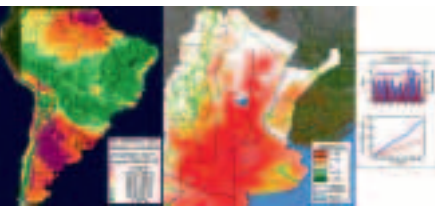
SAD Single Administrative Documents

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What is Food Security?

Food Security is a situation where “all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (definition of 96 UN’s World Food Summit). The multiple facets of food security are generally summarised in 4 dimensions: Food availability (i.e. the agriculture production), food access (i.e. the livelihood and the market prices), food utilisation (incl. nutrition, food quality and safety, health...) and stability...



Detection of the severe drought affecting South America

Relative differences compared to the last 10 years average for: (Left) cumulated precipitation from April to August 2009; (Centre) NDVI (SPOT VGT) in August 2009. (Right). Time profile of NDVI and cumulated rainfall for the current season (red) compared to 10 years average (blue).

Food Security Assessment (FOODSEC)

Food Security is a key issue for stability and development in the world and food insecurity is regularly the cause or the consequence of conflict or migration. The 1st Millennium Development Goal is to halve the number of people suffering from hunger between 1990 and 2015. But since 2007, soaring food price crises have pushed more than 100 Million people into extreme poverty, and more than 1 Billion persons are presently considered as chronically food-insecure in the world, with 10% at risk from acute food insecurity.

The EU is a leading international donor with a European Food Security Policy based on a number of instruments. As a response to the growing food security problems, the European Parliament and Council adopted an exceptional €1 Billion “Food Facility” in December 2008 to support agriculture and improve the food security situation in 50 priority developing countries.

FOODSEC expertise is based on improved crop monitoring using earth observation and agro-meteorological models, which allow to provide timely objective and independent information to the EuropeAid Co-operation Office (AIDCO), the Directorates-General for Humanitarian Aid (ECHO) and for Development (DG DEV) and EU Delegations. This activity focusing on food availability was extended in 2006 – through an Administrative Arrangement with AIDCO – to the food access with socio-economic aspects such as livelihood, coping strategies, resilience.

Major 2009 achievements

Crop Monitoring and Early Warning crop monitoring bulletins

In 2009, more than 40 Food Security bulletins were produced and disseminated to specific lists of recipients, including EC Directorates-General, ECHO EU Delegations, UN Agencies, and various National or Regional stakeholders.

FOODSEC bulletins provide, in near-real time during the season, early warning based on satellite and meteorological data, identifying hot spots where crops or rangeland conditions could result in food/feed insecurity. In the second half of the season, yield forecasts are obtained by statistical models using specific predictors derived from remote sensing and water satisfaction models:

- The monthly South-America bulletins are regional (MERCOSUR countries + Bolivia) and comprise both emerging countries, acting on the global market (Brazil, Argentina) and food-insecure areas (Bolivia, Nordeste region of Brazil). In 2009, long lasting drought was detected in agricultural areas of Argentina (and part of Uruguay), which almost halved the yields of both summer and winter crops (Fig. 1).
- The Bulletins on the Horn of Africa are monthly and national (27 bulletins in total in 2009 on Eritrea, Ethiopia, Kenya, Somalia and Uganda. Sudan Bulletins are produced by EC funded projects). In 2009, all these countries were affected, with different severity, by regional droughts linked to an El Niño event. This resulted, for instance in Kenya, in a declaration of a National Food Security Emergency. The forecast by FOODSEC of 1,8 Mio tons Maize national production represents a decrease of 15% on the last 10 years’ average and was later confirmed by Kenyan statistics.
- 2 FOODSEC Bulletins were issued on the Democratic People’s Republic of Korea (DPRK) - Northern Korea, monitoring both the Rice and the Maize crops, and 2 regional bulletins were issued for Central Asia.

Capacity Building

FOODSEC supports the overall capacity building of national and regional information systems in the field of crop monitoring with a specific attention to EC funded projects.

Crop monitoring and modelling with remote sensing is indeed an important opportunity for innovation, as 20 years of scientific development led to mature products which need to be fully integrated with other sources in own assessment and decision making processes.

A perfect example of a successful capacity building is the Joint Climatic Update on Somalia, which is now produced by the Food Security and Nutrition Assessment Unit (FSNAU), thanks to an intense collaboration allowing an efficient transfer of most of know-how developed at JRC-IPSC through nearly 10 years of monthly monitoring. FOODSEC will continue to provide scientific support for the 2 yearly seasonal assessments.

The African Post Harvest Losses Information system (APHLIS)

Following the successful users' training of the study carried out in 2008 and the positive feedback from main users (FAO, WFP, World Bank), FOODSEC launched a complementary study to improve the components of the system (database, website and losses calculator) and identify solutions and partnerships for its long-term sustainability.

At the current stage APHLIS provides transparent estimates of weight losses of cereal grains in Eastern and Southern Africa by country and by province (Fig. 2).

The Global Monitoring for Environment and Security (GMES) initiative and Africa

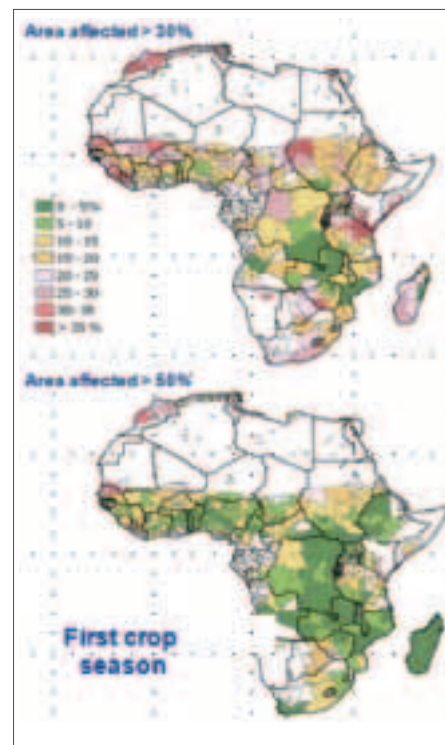
In the context of the GMES and AFRICA initiative, FOODSEC contributed to the technical work programme and roadmap with the chapter on "Food Security and Rural Development".

Challenges for 2010 and beyond

Signed in October 2009 for 5 years, the new Administrative Arrangement with AIDCO foresees a geographic extension of the activities to the whole Sub-Saharan Africa, and a stronger presence in the Horn of Africa, by the secondment of a JRC expert, to support closely the national Food Security Information Systems and the Integrated Food Security Phase Classification (IPC) implementation.

Regarding the indicators to monitor the Food Security Programme, FOODSEC will provide crop monitoring indicators integrated in the Country Briefs published 4 times per year by FAO's on the countries targeted by the EU "Food Facility" programme. In 2009, 30 priority countries will be covered before an extension to all the 50 countries. Moreover, in 2010 FOODSEC will finalise a working document and recommendation on the use of Food Security Indicators in the management of EC programmes.

Research is expected to be developed in areas such as vulnerability assessment (in collaboration with WFP), better characterisation of occurrence and severity of drought on agriculture, impact of climate change (in cooperation with the AGRI4CAST action).

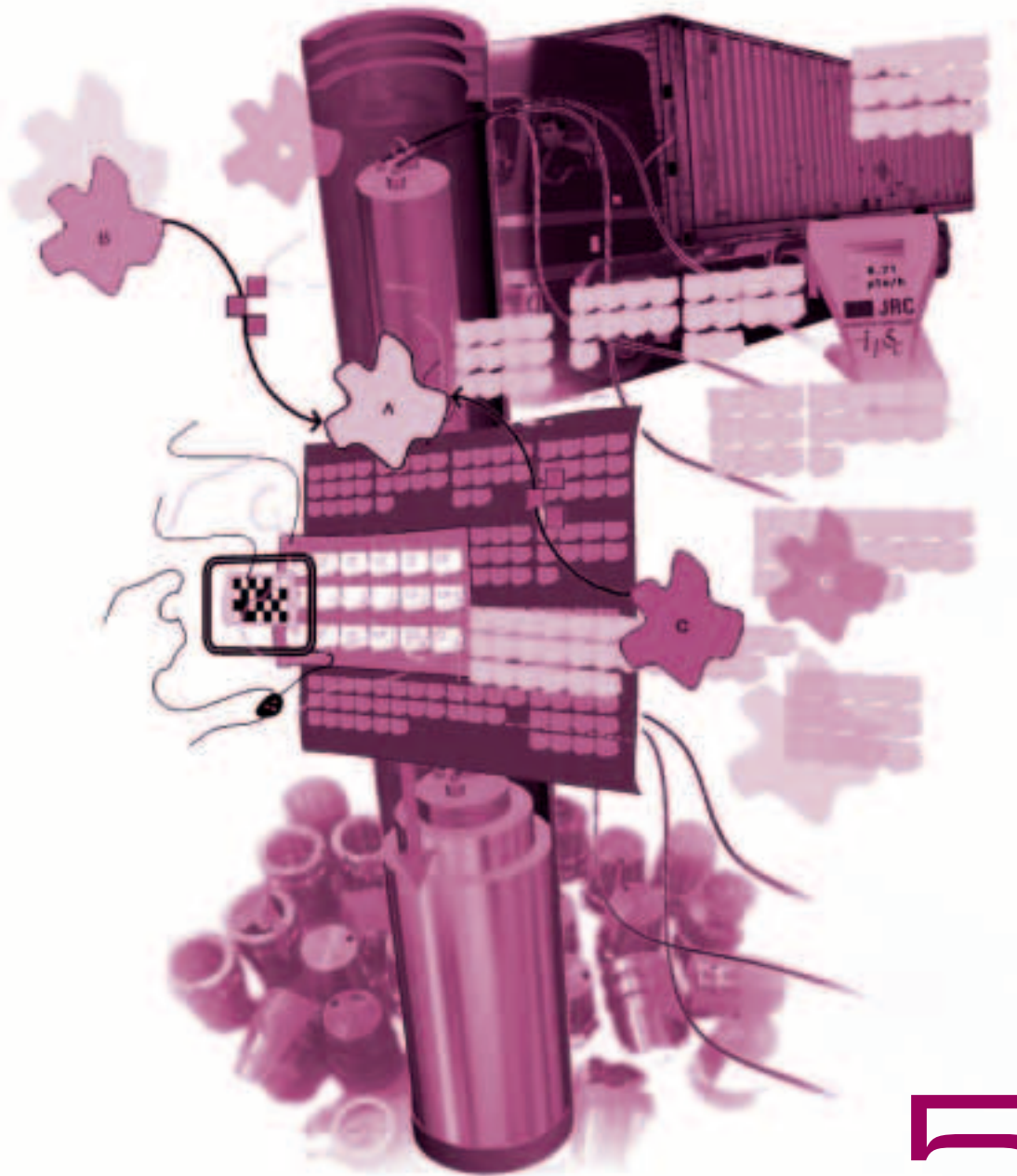


Example of output of APHLIS

Estimation of the post harvest losses after harvest for 2007 and 3 main crops. See also the interactive web site at <http://www.phlosses.net>

GLOSSARY

- ACP** African, Caribbean and Pacific Group of States
- AIDCO** Europe Aid Co-Operation Office
- APHLIS** African Post Harvest Losses Information system
- DG DEV** Directorate-General for Development
- ECHO** Directorate-General for Humanitarian Aid
- FAO** Food and Agriculture Organization
- FEWSNET** Famine Early Warning System (of United States Agency for International Development)
- FSNAU** Food Security and Nutrition Assessment Unit
- GMES** Global Monitoring for the Environment and Security
- IPC** Integrated food security Phase Classification
- NDVI** Normalised Difference Vegetation Index
- WFP** World Food Program



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, NUVER, IANUS,
NUTRASEAL, NUSIM

* Only those agendas of JRC Multiannual Work Programme involving IPSC's actions are mentioned.

NUMAMET

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14-MeV neutron generator with and without W liner

Nuclear Materials Measurement Techniques (NUMAMET)

Nuclear measurement techniques are essential tools for nuclear safeguards and nuclear security; especially the non-destructive measurement techniques are indispensable for activities like combating illicit trafficking, non-proliferation issues and disarmament. Both the EU and the International Atomic Energy Agency (IAEA) apply such methods when they follow their obligations, the implementation of the EURATOM treaty and the Non-Proliferation Treaty (NPT), respectively. The Action NUMAMET focuses on gamma spectrometry, correlated neutron counting and pulsed neutron techniques, both for detection and quantitative assay, of nuclear and radioactive materials, qualification of plant specific Non Destructive Assay (NDA) equipment, data integration of nuclear measurements, and the on-site assistance and provision of training for EURATOM and IAEA inspectors.

The JRC-IPSC's Performance Laboratory (PERLA) is equipped both with the necessary nuclear material and radiation sources and with measurement equipment for research and support to the above mentioned organisations. Basic research is made at the JRC-IPSC's key experimental facility PUNITA (Pulsed Neutron Interrogation Test Facility): experimental work in this laboratory concentrates on the application of the most modern, not yet standard, techniques for the detection / identification of contraband material, especially fissile material.

Major 2009 achievements

Basic research for future nuclear security applications - Optimisation of the neutron flux in PUNITA

The research facility PUNITA aims at the detection and the quantitative assay of small amounts or well shielded nuclear material. As an active method, it complements passive detection methods. In PUNITA, a 14-MeV (D-T) neutron generator sends short neutron pulses of fast neutrons directly on material samples to be examined and the results of the interrogation between the fast neutrons and the sample can be observed with different detectors. The same flash of fast neutrons enters also the moderating walls of the sample cave, from where they return after the end of the fast neutron flash as thermal neutrons, and now their interrogation with the sample can be detected.

A step forward was the implementation of a tungsten liner around the neutron generator. The 14-MeV neutrons induce here (n, 2n) and (n, 3n) reactions, i.e. the number of fast neutrons increases. In addition, the mean neutron energy emitted from the generator/tungsten assembly is reduced to about 1 MeV. Both these effects increase the thermal neutron flux in the sample cavity. A paper¹ describes the experimentally observed advantages of the tungsten liner with respect to increase of thermal flux — after all a factor of two —, and better shielding capabilities of the nearby gamma and neutron detectors.

Supervision of ²³⁵U in UF₆ drums in Gas Centrifuge Enrichment Plant (GCEP) facilities

The IAEA asked for support with the problem to supervise the mass of the isotope ²³⁵U in large containers, containing 12 tons of UF₆. The study, whose results are now also published in *Nuclear Instruments and Measurements*², gives an over-

1. Rennhofer H, Pedersen B, Crochemore, *AIP Conference Proceedings*. Vol. 1194. American Institute of Physics; 2009. p. 36-42. JRC52792

2. Mortreau P., Berndt R., Franke E., *NIM A* 612 (2); 2010. p. 309-319. JRC52993

view over existing possibilities with different gamma and neutron techniques, showing how the problem can be tackled with passive neutron measurements. In this case, the internal absorption combined with strongly differing internal distributions of the material cause serious measurement problems. They could be overcome to an extent that the proposed method, as an independent tool, becomes interesting to complement mass determination with a balance; the latter is very precise, but can not verify the type of material on the balance.

Scientific support to EURATOM

An important nuclear safeguards task of the European Union is the supervision of the Pu production at the reprocessing plant La Hague in France. Here, unattended nuclear measurement systems of EURATOM are working permanently and observe the product streams. A comprising study³ described how the measurement stations have to be upgraded to meet the demands of the next decade with respect to changes in the production, especially the expected change in the isotopic composition of the material.

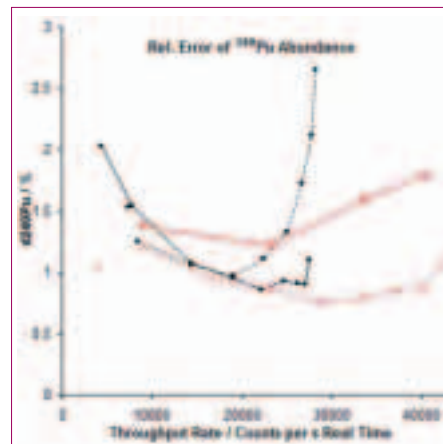
Another task aimed at the implementation of a better measurement technique with the JRC Waste Drum Monitor. The instrument was re-designed, de-mounted and re-built with practically the double efficiency for neutrons. Now, with the increased efficiency, the instrument can be operated in the multiplicity counting mode instead of the traditional correlated neutron counting. This technique allows the determination of one or more parameters, e.g. the efficiency. The result is that the measurements can be made for waste packages with very different contents and weights and heterogeneous source distributions, for which no calibration exists. This instrument will supervise a nuclear waste stream in Belgium.

Challenges for 2010 and beyond

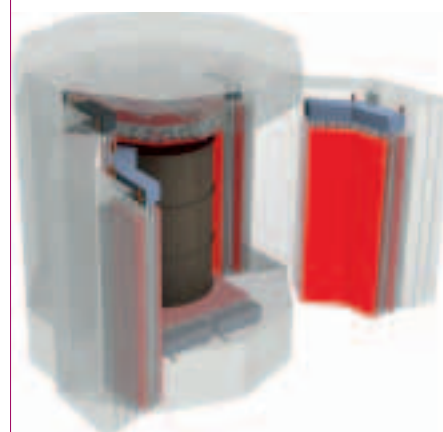
Challenges for non-destructive nuclear measurement methods come from the side of the in-field use. The number of unattended measurement systems is growing, both with nuclear safeguards applications and with nuclear security. Research has to follow with reliable and robust methods for an unattended data evaluation and finally automated decision making.

Conventional and nuclear measurement methods have to be integrated; the process monitoring at new Gas Centrifuge Enrichment Plants is an example where access to and the use of operator process data of non-nuclear data can make safeguards more efficient, provided it is complemented with some unattended nuclear measurements. The challenge for the near future is: could the passive neutron measurement technique as described above for the supervision of the contents of UF₆ drums be integrated in the filling stations of an enrichment plant, as a continuous measurement which could replace a too complicated enrichment monitoring on the product tubes?

A far reaching challenge exists at the back end of the nuclear fuel cycle; non-destructive measurement methods have to be identified and / or developed with the aim to contribute to a reliable and complete characterisation of all spent nuclear fuel that will be brought into final storages. The aim must be that the results of those methods can be considered trustworthy also in many years from now.



Measurement errors for different tested gamma spectrometers to be used in future at the reprocessing plant La Hague.



JRC Nuclear Waste Drum Monitor with increased efficiency

GLOSSARY

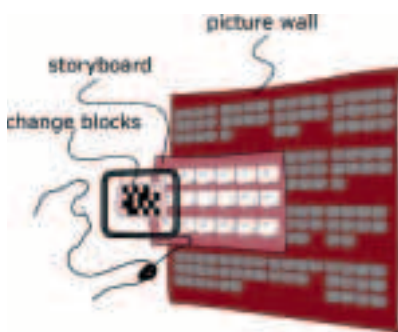
- DG TREN** Directorate-General for Energy and Transport
- GCEP** Gas Centrifuge Enrichment Plant
- IAEA** International Atomic Energy Agency
- NDA** Non-Destructive Assay
- NPT** Non-Proliferation Treaty
- PERLA** Performance Laboratory at JRC-IPSC in Ispra
- Pu** Plutonium
- PUNITA** Pulsed Neutron Interrogation Test Assembly at JRC-IPSC in Ispra
- U** Uranium

1. Berndt, R., *Upgrade of the unattended gamma detection systems at La Hague*; 2009. JRC55104

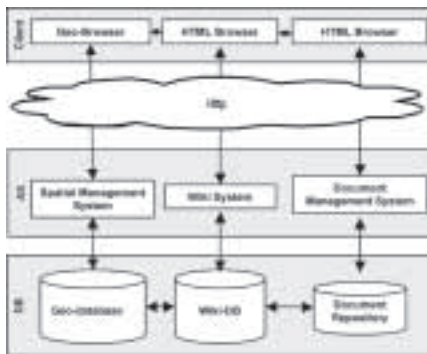
NUVER

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Safeguards Review Station: its interface allows the user to browse thousands of images by levels of abstractions -from change blocks, to sketches, to photographic details



Information Integration Platform: High Level Architecture

Nuclear Facilities Verification (NUVER)

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

Major 2009 achievements

Commission Recommendation on Nuclear Material Accountancy and Control (NMAC) Quality Assurance

The European Commission, after discussions with EU Member States, published in February 2009 an official Commission Recommendation for quality assurance of operators' Nuclear Material Accountancy and Control system¹. These guidelines, based on NUVER direct work, represent an important milestone in the ongoing dialogue between EU Member States and the Commission on the objectives of audit and its role in the Euratom safeguards system. The characteristics of operator NMAC are also important for the discussions between the EU and the International Atomic Energy Agency (IAEA) regarding the application of Integrated Safeguards within the EU.

3D Laser based Verification Systems

The IAEA closely monitors nuclear activities and material – particularly when fuel cycle activities could yield material readily available for weaponization such as highly enriched uranium (HEU). Therefore, the application of robust safeguards measures at nuclear facilities enriching/depleting and processing uranium is of vital importance to the IAEA. One component of an enhanced approach is the systematic tracking of UF₆ cylinders between process and storage areas as well as between different process areas and workstations. The main challenges are the means of tracking the cylinders reliably and with a minimum of operator involvement. The L2IS: Laser Item Identification System, developed by NUVER to the IAEA for systematic tracking of UF₆ cylinders, and not requiring intervention from the Operator, commenced a full trial and development phase in 2009 at an Enrichment Plant (GCEP) in Japan.

Under request of the Directorate-General for Energy and Transport (DG-TREN) and in agreement with the French authorities, NUVER has demonstrated the use of the 3D Laser Verification system on the site of AREVA NC Pierrelatte, France. This was the first use of the technology on Euratom Facilities. The technique has been found very effective in improving the efficiency of the physical verifications and did contribute to a reduction of the dose uptake by inspectors and operator. Based on the success of the demonstration the French Authorities and Operator agreed to use this method for verification during the Physical Inventory Verification (PIV) in covered storage areas and resume the discussion about testing the technique for Design Information Verification (DIV).

Safeguards Review Station

To review large streams of surveillance images, NUVER designed and implemented a layered architecture of image data information, ranging from 'scene

1. C(2009) 785 (2009/1 20/Euratom)

change detection blocks', to sketches as visual summaries in a 'storyboard', ending with the highest photographic detail of single images visible on a 'picture wall'. The user can navigate this information space by zooming in and out of these conceptual layers, moving from context-related image data information to details as required. The goal of the tool is to assist safeguards inspectors in the review of video surveillance data by focusing their attention to the relevant parts of the image stream.

Information Integration Tools

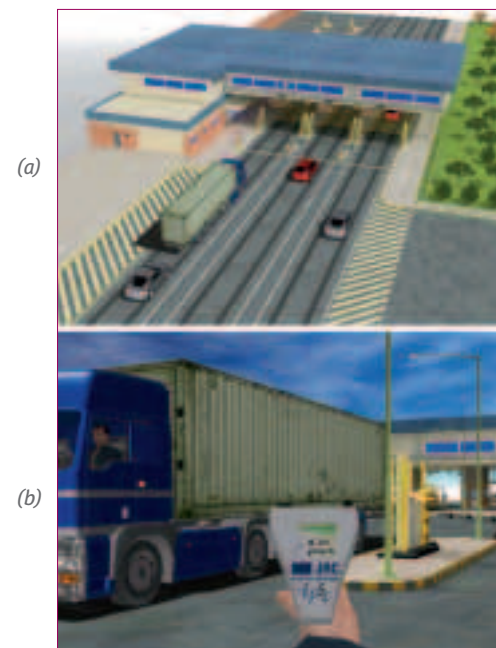
The information, which needs to be managed and analysed in Nuclear Safeguards has drastically increased over the last years in terms of quantity and variety. Hence, relevant organizations require supporting tools for integrated information analysis. Within the LIMES project, NUVER continued its research in this domain, focusing on the needs of the non-proliferation analyst. The concepts and the demonstrator developed within the project were presented to the Safeguards community and feed directly into design of equivalent systems at organizations like IAEA, EUSC and DG TREN.

Virtual Reality (VR) tools applied to Safeguards

NUVER expertises in Virtual Reality related tools were successfully applied on several developments in Safeguards. A good example is the Design and Simulation prototype to assist the design and deployment evaluation of Containment and Surveillance equipment. Further to these developments and within the framework of the Nuclear Security Training Centre, NUVER developed a demonstrator illustrating the use of VR based tools for the effective training of custom and security officials in detecting nuclear materials in trucks at a customs station. Apart the reduction in training costs, this VR based approach minimises the utilisation of radioactive sources which are associated to major management and security concerns.

Challenges for 2010 and beyond

The Additional Protocol provides the legal framework for a new investigative role for the nuclear inspector. This constitutes a new challenge for the coming years and includes incorporating the principles of ambient intelligence systems into future safeguards systems design. Indeed, to improve effectiveness in this role, the inspector needs to be equipped with a new generation of tools and instruments allowing on-the-spot measurements, augmenting her/his verification skills, as well as the capability to access relevant Safeguards data and information in the field in a seamless way. Information requirements cannot be exhaustively planned before the inspection as the focus of the inspection needs to adapt dynamically to local findings. This framework requires the ability to relate what is "seen and measured locally" with information existing in headquarters' databases, remote sites and on-line services. The approach to be followed relies on the combination and seamless integration of technologies that are tailored to inspection needs (e.g., virtual and augmented reality, mobile communications, indoor and outdoor positioning devices, etc.).



The pictures represent the different phases of the Virtual Reality demonstrator for Nuclear Security training of customs officers.

(a) Customs environment

(b) Customs officers are trained to use portable radiation detection equipment to further investigate the presence, type and location of the sources

GLOSSARY

DG TREN	Directorate-General for Energy and Transport
DIV	Design Information Verification
EUSC	European Union Satellite Centre
GCEP	Gas Centrifuge Enrichment Plant
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
LIMES	Land and Sea Integrated Monitoring for European Security (FP6 project)
L2IS	Laser Item Identification system
NMAC	Nuclear materials accountability and control
PIV	Physical Inventory Verification
QA	Quality Assurance
UF6	Uranium hexafluoride
VR	Virtual Reality

IANUS

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Fig. 1: Trade analysis applied for testing a hypothesis on a nuclear undeclared activity. In this illustrative example aimed at spotting 'oddities' in trade, country A is supplied regularly of a certain commodity from country B. Country C provided to Country A an isolated high quantity supply of the same commodity, which may call for further investigations



Fig. 2: Interface of the software demonstrator developed by JRC-IPSC to support trade analysis activities

Information Analysis for Nuclear Security (IANUS)

Information collection and analysis play an increasing role in nuclear security and safeguards. The Action IANUS considers different types of information and data to deal with nuclear security and proliferation threats and issues, mainly at State and global level, resulting from State and non State actors.

Motivated by the EU Council Regulation Setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items¹, IANUS focuses on the one side the identification of information and trade data sources for supporting export controls and non proliferation studies, and, on the other side on the design and development of tools to analyze these data. These information sources and tools can be of value also for the verification activities carried out by the International Atomic Energy Agency (IAEA) on the correctness and completeness of State declarations under the Additional Protocol.

Commission services and stakeholders deem for technical support and call for unbiased technical information on nuclear security threats. IANUS contributes to this need by regularly monitoring news and events of relevance to nuclear security and by compiling, on customer demand and on the basis of open source information and internal technical knowledge of the nuclear fuel cycle, Nuclear Country studies and regional profiles, as well as topical non proliferation studies on the technical characterization of emerging proliferation threats and networks.

Major 2009 achievements

Trade Analysis and Export Control

As a result of the EC Support Task to the IAEA "Improving the Analysis of Covert Nuclear Trade", open source databases on the world trade are proving to be useful in supporting a range of IAEA safeguards verification tasks. These tasks include the verification of the correctness and completeness of Member States declarations as well as the testing of hypotheses on possible undeclared activities by trade analysis. Figure 1 illustrates the concept of trade analysis as applied to safeguards verification activities.

To further support nuclear trade analysis, a software demonstrator was developed by IANUS in 2009 and installed at IAEA to facilitate trade analysis tasks by: (i) searching on documents and handbooks on list of controlled items (e.g., single or dual-use items); (ii) providing correspondence tables between controlled items and Harmonized System codes, the latter being needed to retrieve data from open source trade databases. The demonstrator is used daily at IAEA by Agency's trade analysts. Figure 2 gives an overview of the main interface of the software demonstrator developed by IANUS.

In the area of technical support to export control issues, since 2007 an informal collaboration started with the United States Department of Energy, National Nuclear Security Administration (US-DoE-NNSA). The joint seminar "Role of Technical Experts in the Assessment of Proliferation Risk Using End-Use End-User Analysis", hosted at JRC-IPSC on 20-21 January 2009, was attended by licensing authorities from 13 different EU countries and by participants from three different EC Directorates-General. The seminar was followed by a dedicated third day in which EU Member States licensing authorities officers discussed the role of technical assistance in export control.

1. COUNCIL REGULATION (EC) No 428/2009, of 5 May 2009, setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items (Recast).

Open Source Information Analysis and Non-Proliferation Studies

Daily news and information are regularly monitored and collected, from open sources, for several issues of nuclear security relevance. In order to support this task, use is also made of the Europe Media Monitor (EMM) tool, developed by the JRC-IPSC's Action OPTIMA. To this aim, a special category of keywords, named JRC Nuclear Security, is defined and maintained by IANUS. Other specific information sources are also considered. In 2009 IANUS started to issue a Nuclear Security Newsletter for internal EC use. The newsletter is a factual base compilation of open source retrieved information grouped for topical areas.

In 2009 the activity on non-proliferation studies focused on a reduced number of countries and topics and targeted studies and comments have been delivered for internal JRC and EC services use. To this aim, open source information is collected and technically assessed and internal reports are issued on topics where JRC technical added value can be provided.

Challenges for 2010 and beyond

On the side of trade analysis in support to verification activities, the work will continue in close collaboration with IAEA. The software prototype developed to support trade analysis will be consolidated and new features will be identified. A dissemination effort will be done by jointly publishing with IAEA some of the main findings from this activity.

In the area of technical support to export control, a new event will be organised jointly with US-DoE and European Union Member States in May 2010, and an enlargement and integration workshop is foreseen for Autumn 2010. R&D activities will be also identified for collaborative projects.

Concerning open source intelligence, the monitoring of nuclear security events will continue to be carried out. Specific information sources of relevance for nuclear security and non-proliferation studies will be added to the information sources targeted by EMM. Collaborations are foreseen in this area with IAEA which has expressed an interest in the EMM system for assessing its functionalities with respect to its internal needs.

The work on non-proliferation studies will continue on topics already identified and on new ones that will be identified in the course of the year. The main challenge will be to complete the staffing of the activity and the timely production and dissemination of IANUS technical reports to targeted customers.

The efficient generation of non-proliferation studies requires a dedicated knowledge management infrastructure for the collection, management, analysis and archival of the related information. Therefore, a dedicated infrastructure will be developed in 2010 to support multiple types of data and to ensure the protection of sensitive information while enabling collaborative work.



Fig. 3: Nuclear Security studies. Timeline of operations, of the DPRK 5 MWe Yongbyon reactor and related events, reconstructed from open source information



Fig. 4: The seminar "Role of Technical Experts in the Assessment of Proliferation Risk Using End-Use End-User Analysis" was attended by licensing authorities from 13 EU countries

GLOSSARY

- EMM** Europe Media Monitor
- IAEA** International Atomic Energy Agency
- R&D** Research and Development
- US-DoE-NNSA** United States Department of Energy, National Nuclear Security Administration

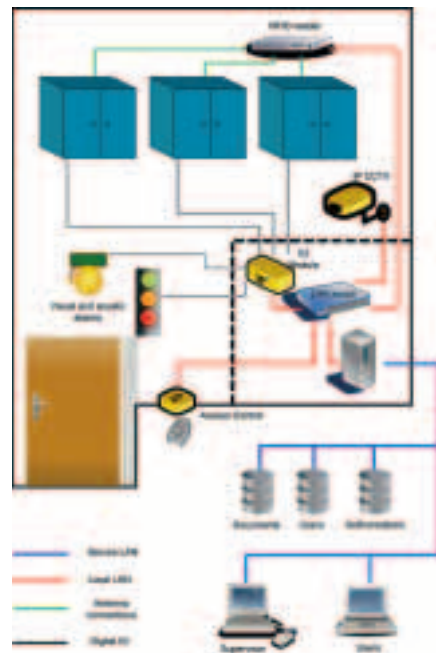
NuTraSeal

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JRC-IPSC seals passed the vulnerability tests carried out at Sandia National Laboratory (US) and consequently the IAEA classified them as "Available for operation"



Implementation of the electronic security system for document management

Nuclear Traceability and Sealing Systems (NuTraSeal)

Nuclear Safeguards applications require highly specialised and secure systems for identification, sealing, tracing and tracking and, more in general, providing continuity of knowledge in safeguarded installations. New solutions and improved designs are continuously requested by the inspection agencies.

The Action NuTraSeal provides support to the Directorate-General for Energy and Transport (DG TREN) and — within the framework of the EC Support Programme — to the International Atomic Energy Agency (IAEA) in the form of R&D, prototype equipment, training, calibration and services. It assists them also for Vulnerability Assessment and tests on in-house products, as well as commercially available or specially developed equipment in safeguards applications.

Major 2009 achievements

All Cernavoda Unit-I underwater storage pond sealed by JRC-IPSC

The Action has developed for the IAEA an ultrasonic sealing system called JCS (JRC Candu Seal) to be used in replacement of the obsolete Canadian ARC seals for the Cernavoda Unit-I (Romania). In 2007, the first JCS seals were applied in the pond and tested by IAEA inspectors during a one year field trial. In 2008, the IAEA - based on our vulnerability assessment - classified them as Category A, which means "Available for operation" and replaced all ARC seals in Cernavoda Unit-I by JCS ones. In 2009, the Action delivered a set of handling tools and manufactured seals and reading system for Cernavoda Unit-II.

External Vulnerability Assessment of JRC Ultrasonic Bolt Seals

The IAEA requested to Sandia National Laboratory (USA) a Vulnerability Assessment (VA) on the JRC-IPSC ultrasonic sealing systems.

The Action supplied 100 seals and 2 reading systems including inspection software, as well as inspection procedures. Sandia performed intensive testing on the seals and sealing systems: more than 30 seals were destroyed in a way or another, more than 400 readings were performed, and several attempts to repair seals or substitute part of seals were done (see in Figure 1 some samples of tested seals). The material successfully passed the tests: after one year and a half of in-depth testing, IAEA has confirmed the classification of the JRC-IPSC system as category A (Available for operation), extended the use of this system for Cernavoda unit 1 and 2 (Romania), decided its implementation in Kanupp (Pakistan), proposed it for Darlington (Canada) and started discussion for Atucha (Argentina) together with the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials.

First shipment of SILab sealing material to Pakistan

Following the successful application of JRC sealing system in Cernavoda (Romania) and the positive feedback from the external vulnerability assessment performed by Sandia National Lab, the IAEA requested JRC-IPSC to adapt its design to Kanupp (Pakistan) Candu type underwater storage racks.

Within the EC support Programme, JRC designed a new version of the seal, the ad-hoc sealing accessories and the associated remote handling tools. In summer 2009, the IAEA ordered seals, reading systems, handling tools and accessories to seal a first batch of 15 racks.

NuTraSeal shipped to Vienna the first components necessary to build the first two racks, four boxes will be welded on two racks and four centering pins will be

used to center the covers (locally manufactured by Pakistan). The first sealing operations are planned in early 2010.

Electronic security system for classified document management

A system prototype for the secure management of classified document has been finalised and demonstrated to DG TREN. The system aims at managing access permission to documents classified according to the EU document classification system (Top Secret, Secret and Confidential) and at helping in the archive management, providing a tool for immediate inventory of large document repository and for immediate detection of anomalies such as document or even a single page missing. The system integrates innovative RFID technology, allowing document trace at the level of a single page, and access control techniques, like user identification through fingerprint, camera monitoring with motion detection, etc.

Challenges for 2010 and beyond

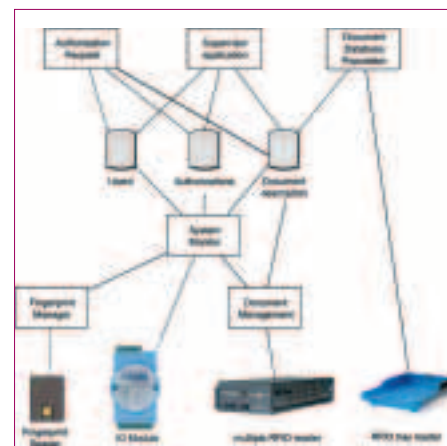
The need of reliable technological solutions in the Nuclear Safeguards domain will remain pressing also in the future.

The Action foresees to modify the ultrasonic bolt sealing system in order to comply with the new customer requests for:

- **Long-term dry storage:** as the ultrasonic bolt seals are not sensitive to high radiation, they are a good candidate to seal highly radioactive long-term depository containers. Special attention has to be taken on the possibility of reading the seal without physically climbing on the top of the container to limit the exposure of the inspectors.
- **Remote (from the agency headquarter) inspection of underwater storage:** as travelling is more and more expensive and time consuming, the agencies ask about possible remote control of the seal reading.

Moreover, NuTraSeal will investigate the possibility of introducing new technologies in Nuclear Safeguards application. For example, the Action intends to develop an active RFID seal adapted to nuclear conditions, with increased anti-tampering features on the seal (called anti-evidence features) and on the closing cable (optical fiber randomly checked).

Finally, regarding the management of secure document archives, the Action will demonstrate the RFID system developed in our laboratory under operational conditions, including reading and authentication of personnel, verification of access rights, selection of authorised actions (photocopies, scanner...), registration of computed actions, management of information database, according to specific needs that will be indicated by DG TREN.



Software architecture of the electronic security system for document management

GLOSSARY

- ARC** AECL Random Coil (AECL: Atomic Energy of Canada Ltd)
- CANDU** CANada Deuterium Uranium is a registered trademark of the Atomic Energy of Canada Ltd
- DG TREN** Directorate General for Energy and Transport
- IAEA** International Atomic Energy Agency
- JCS** JRC CANDU seals
- RFID** Radio Frequency Identification
- SILab** Sealing and Identification Laboratory at JRC-IPSC
- TEMPEST** Thermal, Electro-Magnetic, Physical Equipment Stress Testing Laboratory at JRC-IPSC

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Radiation Portal Monitor for detection of nuclear/radiological material in vehicles at the SeTraC facility

Nuclear Security training

The fight against the illicit trafficking of nuclear and other radioactive materials is at the top of the international political agenda. Detecting illicit movements of nuclear and radioactive materials is of crucial importance to counteract possible nuclear terrorism and protect the population and the environment against the spread of radioactive substances. JRC-IPSC is establishing a training centre to support law enforcement community in charge of the detection at borders and other crucial nodal points. With the support of its international partners in the field (IAEA and the US Second Line of Defence program), the nuclear / radiological Security Training Centre (SeTraC) hosted its first pilot session for the Irish Shannon Airport Police on September 21-25, 2009. Theoretical lectures alternated with hands-on practical exercises where officers are put in real situation with real nuclear materials and radioactive sources. SeTraC hosted also a Train-The-Trainers course for Lebanese customs on October 19-23, 2009.

Nuclear Fuel Cycle Simulations (NUSIM)

JRC-IPSC has a long tradition of scientific and technical support to the implementation of nuclear safeguards. More recently an evolution of the JRC-IPSC expertise in this field has been driven by increased political and social concerns about security in general and nuclear security in particular. New projects focus in the anti-terrorism field to the detection of illicit trafficking of nuclear and other hazardous materials. Safeguards approaches are moving towards an increased use of monitoring to automatically control nuclear activities in facilities such as reprocessing or enrichment and to follow processed nuclear materials. It can reduce requirements for inspector presence and increase safeguards effectiveness both in terms of timeliness and sensitivity.

Concerning the new applications on nuclear security, NUSIM is focusing in the field of detection and activities cover the improvement of metrology (through better discrimination of real and innocent alarms), testing and qualification of detection equipment and training.

This Action contributes to the development of methods for the evaluation of nuclear safeguards effectiveness, proliferation resistance of existing and advanced nuclear energy systems. The Action is closely connected to the Generation IV International Forum (GIF) through the participation in the Working Group for "Proliferation Resistance and Physical Protection" (PR&PP).

Finally the Action supports networking and international associations namely the European Safeguards Research and Development Association (ESARDA).

Major 2009 achievements

Process monitoring in reprocessing plants

NUSIM provides a comprehensive support to the Directorate-General for Transport and Energy (DG TREN) and the International Atomic Energy Agency (IAEA) nuclear inspections in reprocessing facilities. This is achieved by:

- developing software tools for process monitoring (such as the DAI system),
- installing and implementing monitoring systems in plants
- helping the inspectors in the data analysis and interpretation

In the recent years most of the work has focused on the THORP plant in Sellafield (UK) and on the Rokkasho plant (Japan). Training is also part of the support given to DG TREN and IAEA inspectors.

Process monitoring in Gas Centrifuge Enrichment Plants (GCEP) facilities

NUSIM has recently started to extend the process monitoring technologies to enhance the inspection verifications in Gas Centrifuge Enrichment Plants. The basis is the development of a concept of material flux monitoring within the cascade hall through the continuous acquisition of data from load cells in the feed/withdrawal stations. Up to now the concept has been studied on a theoretical point of view, but recently, after a signature of a confidentiality agreement with URENCO, real operational data from an enrichment plant have been provided to NUSIM, which will enable the validation of the method in realistic conditions.

Neutron counting and Monte Carlo modelling

During the 2009 the ESARDA Multiplicity Benchmark was concluded and the final report published on the ESARDA Bulletin. The benchmark allowed validating Monte Carlo simulation of neutron counters, testing novel electronics in data processing based on LIST-mode acquisition and comparing software for time-stamped data post-processing for the development of next generation neutron counters.

NUSIM started the development of a neutron counter simulator for testing and training purposes. The system will compute the expected neutron production and detection in the counter as a function of sample and detector characteristics; then it will produce a sequence of pulses as those generated by the instrument. This will allow simulating the operation of a neutron counter in absence of nuclear material.

Nuclear Security

Under an administrative arrangement with the Directorate-General for Justice, Freedom and Security (DG JLS), NUSIM has started the development of a Nuclear Security Training Centre (see details in the box). During 2009 some equipment was procured: a radiation portal monitor for vehicles and one for pedestrians, two radio-isotope identifiers, several radiameters and neutron/gamma sensitive pagers. The course curriculum was developed and two pilot courses were held, one for front-line officers and one for trainers.

Another administrative arrangement was signed with DG JLS in the field of equipment testing. The ITRAP+10 project will aim to develop and test certification procedures to assess the performances of commercial equipment used for detection of radio/nuclear materials and to verify their conformity to international standards.

Safeguards by Design, Proliferation Resistance & Systems Analysis studies

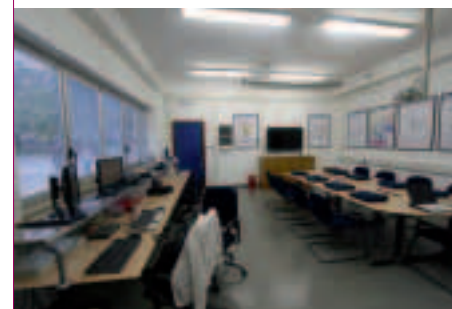
JRC-IPSC represents Euratom in the Proliferation Resistance and Physical Protection Working Group (PR&PP-WG) of Generation IV International Forum. In 2009 the final report of the development case study, dedicated to the application of the PR&PP Methodology to a notional Generation IV Sodium Fast Reactor, has been completed and delivered to GIF. JRC-IPSC was responsible for the proliferation resistance analysis of the Misuse threat. The collaboration among the PR&PP WG and the Generation IV systems designers has been continued and white papers on the PR&PP aspects of all Gen IV concepts have been initiated.

Closely connected to proliferation resistance and advanced safeguards is the topic of safeguards by design, aiming at introducing safeguards early in the design of new facilities. NUSIM is contributing to this topic within a dedicated support task to the IAEA in collaboration with DG-TREN. In the area of systems analysis NUSIM has participated in the international "Open-PSA" aiming at developing interoperability standards for exchange of Probabilistic Safety Analysis models among different PSA codes. Testing reports have been produced on this activity, as well as on the further testing of the proprietary JRC ASTRA-3 code for fault tree analysis especially designed for safety and security applications.

Challenges for 2010 and beyond

The two main lines for future developments can be synthesised as follows:

- towards a better and more efficient metrology (new sensors with enhanced performances or capabilities and optimisation of human effort through automated data analysis).
- integrate and fuse information for intelligent detection.



SeTraC training room.

GLOSSARY

- DAI** Data Analysis and Interpretation
- DG JLS** Directorate-General for Justice, Freedom and Security
- DG TREN** Directorate-General for Energy and Transport
- ESARDA** European Safeguards Research and Development Association
- GCEP** Gas Centrifuge Enrichment Plants
- GIF** Generation IV International Forum
- IAEA** International Atomic Energy Agency
- ITRAP+10** Illicit Trafficking Radiation Assessment Programme
- PR&PP** Proliferation Resistance and Physical Protection
- PSA** Probabilistic Safety Assessment
- SeTraC** Security Training Centre

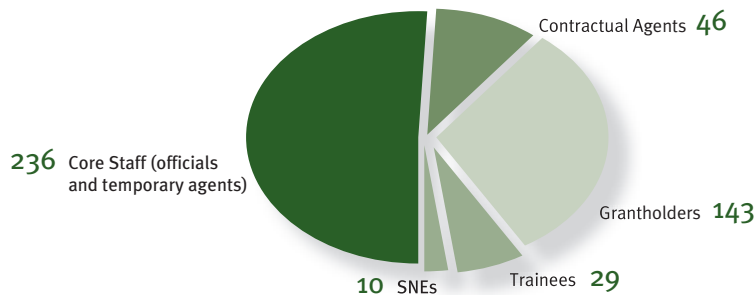
IPSC in figures

Staff

As of 31 December 2009 JRC-IPSC employs 464 staff of which 236 are European Commission officials and temporary agents, the others being contractual agents, trainees and seconded national experts (SNEs). Women represent 30% of the total staff figures.

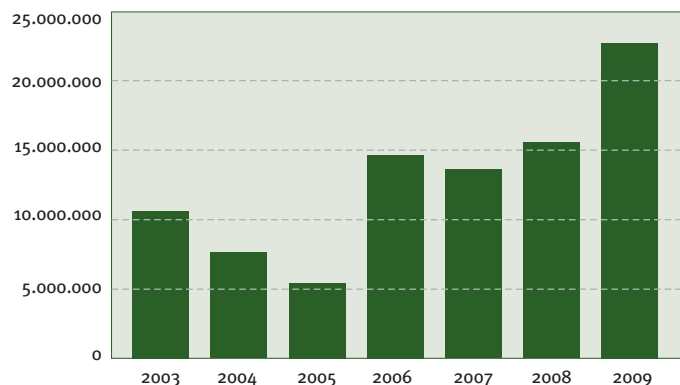
Of the 464 total, approximately 394 staff members are working on scientific projects in support to customers and 70 staff members are doing administrative or support work.

Staff breakdown - December 2009

**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 Programmes (Indirect Actions, IND) or from work performed for third parties (TPW). In 2009 JRC-IPSC has cashed 22,7 million euro exceeding the targets set by more than 95% for the fourth year in a row.

IPSC competitive income cashed from 2003 to 2009 (in EURO)



In total 65 new competitive projects were started in 2009, representing a total value of 22,265 millions of euros.

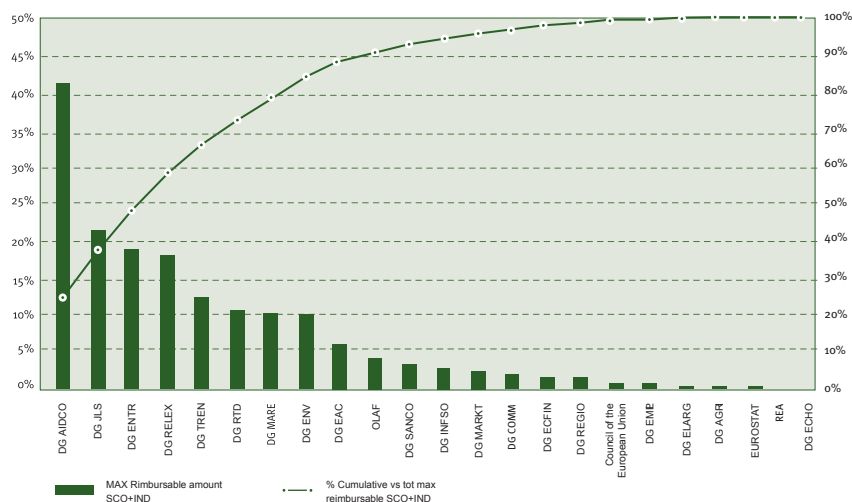
The EU Framework Programme for Research and Technological Development (FP7) started in January 2007. During the year, 27 proposals were submitted as partner in Indirect Actions, the biggest proportion in calls within "Security" and "Information and Communication Technologies".

Here below the 2009 income by customer in support to Directorates General of the Commission (SCO), and from participation in EU Framework Programme (Indirect Actions, IND):



The report *Risk management and agricultural insurance schemes in Europe* published in September 2009 reviews the agricultural risk management systems in Europe

Generated Competitive income by EU clients and accumulated % of clients contribution in 2009



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 JRC-IPSC partners is quite broad and well distributed in the different areas of competence of the EC.

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

Publications

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

In 2009 JRC-IPSC published the reference report "Risk management and agricultural insurance schemes in Europe". The report reviews the agricultural risk management systems in the European Union, providing a comprehensive state of the art of the agricultural insurance schemes and public intervention in risk management in the different countries

The full list of JRC-IPSC publications in 2009 is available on <http://ipsc.jrc.ec.europa.eu/publications.php>

Category	2009 IPSC publications
Monographs and articles	148
JRC Scientific and Technical Reports	150
Contributions published in Conference Proceedings	122
Special Publications (e.g. PhD theses, maps)	5
TOTAL	426

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 a maximum of 2 years, is not necessarily focused towards responding to the needs of customer Directorates-General, 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 2009 nine projects were carried out in different areas, ranging from modelling the failure of laminated glass during explosions, to preventing spoofing of biometric identifiers.



A full description of the IPSC 2009 Exploratory Research Projects is available in the report EUR 24164 EN, also available on line at <http://ipsc.jrc.ec.europa.eu/publications.php?id=2>

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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 2009. An overview is given of IPSC mission and its implementation, the scientific activities and the relations with the outside world.

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the Joint Research Centre 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.

