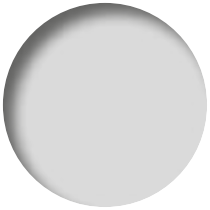
Institute for the Protection
and Security of the Citizen

JRC
EUROPEAN COMMISSION

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.

http://ipsc.jrc.ec.europa



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Institute for the Protection
and Security of the Citizen

10 years of research for your security

JRC
EUROPEAN COMMISSION

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Dear Reader,

The 10th anniversary of the JRC's Institute for the Protection and Security of the Citizen (IPSC) is a good opportunity to look at what has been achieved, what has changed and what lies ahead.

This booklet describes some of the most prominent IPSC success stories from the last ten years.

Ten years of research, ten stories: the examples shown in this booklet are representative of many more IPSC success stories from this period. The selection was not an easy task, but we have tried to condense into these few pages the essence of our work: developing tools and methods for more intelligent security and using the respective scientific knowledge to support EU legislation for the benefit of all citizens.

If you ever wondered what 'security and protection of the citizen' means in practice, you will find the answers here. The booklet demonstrates how IPSC research results support our daily life, making it safer and more secure.

From truck drivers to visually impaired people, from fishermen to people affected by natural disasters, ten years of research at IPSC have contributed to the security and protection of almost everyone.

I wish you an informative read.

Stephan Lechner
IPSC Director

IPSC celebrates its 10th birthday!

The Institute for the Protection and Security of the Citizen (IPSC), one of the seven research institutes of the European Commission's Joint Research Centre (JRC), marks its tenth anniversary in September 2011.

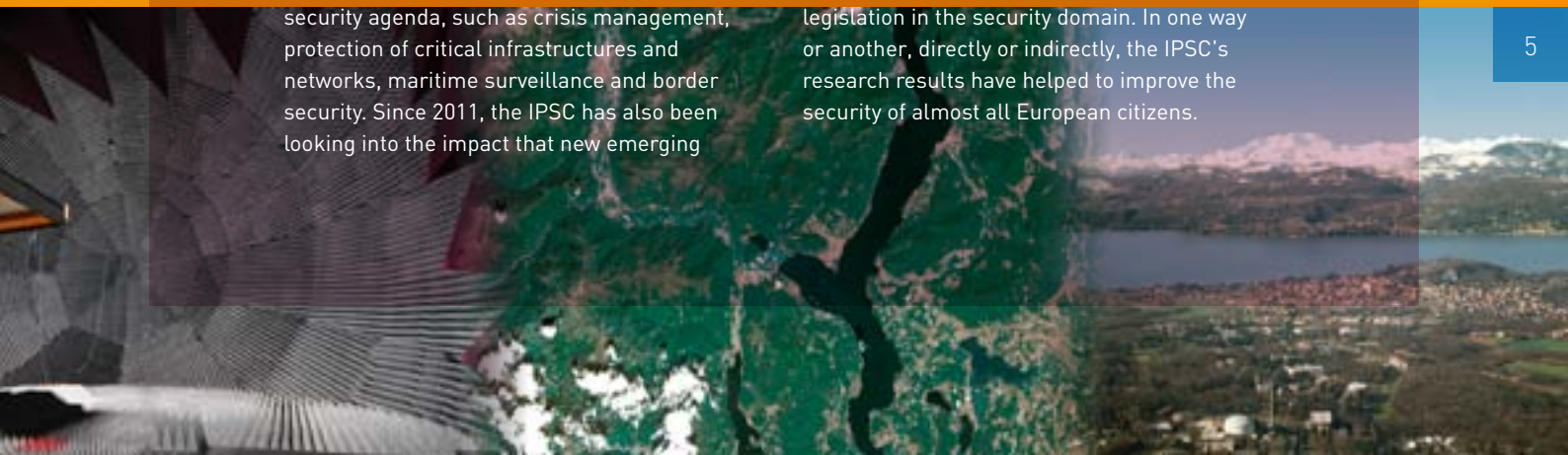
Today the IPSC is a modern research institute with a strong focus on information technologies applied to security. This is the result of a 10-year evolution during which the institute's skills were strengthened and constantly adapted to address new global challenges. But how did everything start?

In 2001 the JRC's organisational structure evolved from discipline-based institutes to institutes focused on specific application areas. In this context, the IPSC was founded by merging the Institute for Systems, Informatics and Safety (ISIS) with a part of the Space Application Institute (SAI). Since then, the institute's expertise in information technologies, engineering, mathematical modelling, statistics, remote sensing and econometrics has been directed towards one single objective: to enhance citizens' safety and security.

Urged by European and international developments in the past decade, the IPSC has fine-tuned its research priorities in those fields that have emerged as key concerns in the EU security agenda, such as crisis management, protection of critical infrastructures and networks, maritime surveillance and border security. Since 2011, the IPSC has also been looking into the impact that new emerging technologies can have on the citizen. Simultaneously, its competences in nuclear safeguards and agriculture monitoring have been transferred to other JRC institutes, thus creating a renewed institute with a stronger focus on security and protection of citizens.

As the ten examples in this booklet clearly show, the IPSC's competences can be applied to a diverse range of areas: from disaster management, through fisheries and road safety to financial stability and beyond. In any of these application fields, the target of our research activities is to create better and more advanced security systems.

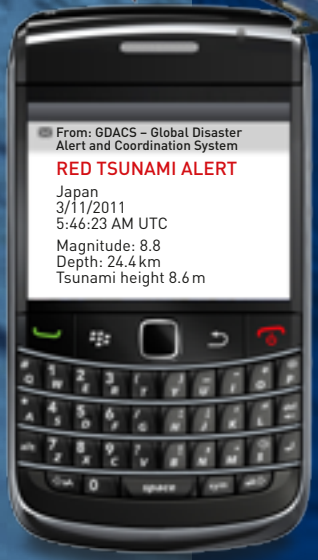
The past ten years have seen the IPSC achieve its success in cooperation with a number of research centres, universities, private companies and international organisations. During this time, several IPSC research activities have evolved from exploratory research ideas into mature prototype products ready to enter the market. Many others have formed the scientific basis for new or improved EU legislation in the security domain. In one way or another, directly or indirectly, the IPSC's research results have helped to improve the security of almost all European citizens.



1 GDACS

Dealing with disaster

From earthquakes and tsunamis to volcanoes and floods – crises are an unfortunate and unavoidable part of life. While they cannot be prevented, IPSC tools and support methods have helped to minimise loss by supporting efficient disaster management, from the early warning phase through to recovery and reconstruction.



Instant alerts for a rapid response

Immediate access to accurate information is vital in any crisis situation. That is why IPSC has developed the Global Disaster Alert and Coordination System (GDACS), a web-based platform that sends an automatic email or SMS message to its 14 000 users worldwide and instantly alerts them in case of disasters which will require international humanitarian intervention.

The system has been developed together with the United Nations and the European Commission Office for Humanitarian Aid to better coordinate the international response.

www.gdacs.org

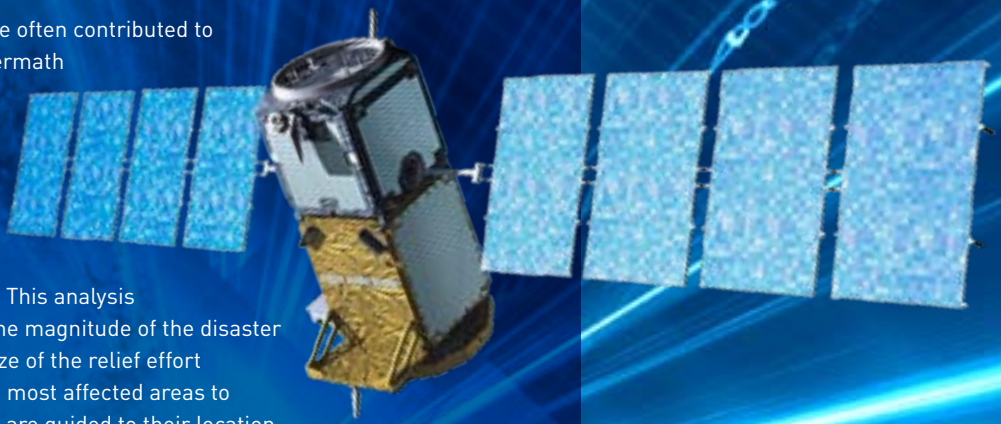
Tsunamis: alerting the last mile

In the event of an incoming tsunami wave, the Tsunami Alerting Device (TAD) developed by the IPSC can directly alert people at risk. When an earthquake occurs, innovative software automatically calculates within minutes the results of tsunami propagation predictions and activates a siren. Thorough testing of the prototype device began in 2011 in Setubal (Portugal), in collaboration with the local Civil Protection authorities.

Analysing damage

IPSC research results have often contributed to recovery efforts in the aftermath of a disaster.

The institute has developed innovative techniques for analysing high-resolution satellite and aerial images of areas affected by disaster. This analysis can be used to calculate the magnitude of the disaster in order to estimate the size of the relief effort necessary. It pinpoints the most affected areas to ensure that relief workers are guided to their location.



Damage assessment in action

In the days following the Haiti earthquake in January 2010, the IPSC produced a preliminary rapid damage assessment based on the analysis of pre-earthquake satellite data and post-earthquake aerial images. This assessment ensured that relief efforts were concentrated in the most badly affected areas.

→From research to legislation

The IPSC's research helps the EU to react promptly at times of crisis, improve its preparedness and also reduce its vulnerability.

2

SESAMONET

Safe mobility for the visually impaired

http://sesamonet.jrc.ec.europa.eu

We all have the right to move around securely and independently, but some face more obstacles than others. That is why the IPSC has developed SESAMONET, a secure and safe mobility network designed to improve ease of movement for visually impaired people.

How does it work?

Micro-chips are embedded in the ground along a path through a specific area, for example in a park or shopping centre.

1

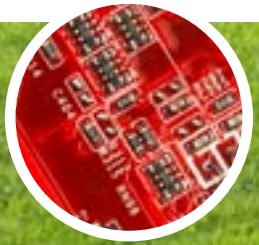
The user walks along this path using a specially designed walking stick that can read the information recorded in each micro-chip, including signals on the user's position and other useful details about the path, like location of shops, pedestrian crossings, bus stops, etc.

2

The signals are converted into audio instructions (a synthesised voice) and communicated by the walking stick to a smart phone. Through a headset, the user listens to the messages and is safely guided along the route.

3

The micro-chips used for SESAMONET are resistant to atmospheric agents and they do not need any electric power supply.



SESAMONET in action

A two kilometre SESAMONET pathway has been developed along the lake shore in Laveno Mombello, Italy, in collaboration with the municipal authorities. The trail has been equipped with micro-chips wrapped in ceramic cells and embedded at 65 centimetre intervals. This first path has been used as a demo, helping the IPSC to make SESAMONET known to the wider public and to open the way for other SESAMONET installations.
This prototype also led to a licence agreement being signed with the Italian Blind Union in January 2011.

→From research to legislation

SESAMONET is a small step towards achieving 'smart and inclusive growth' in Europe. It is also a concrete example of how innovative technologies develop from a scientific origin into a real-world application.

3

EUROPE MEDIA MONITOR

An eye on the press!

http://emm.newsbrief.eu/overview.html

Media output nowadays is so constant and abundant that it is difficult for us to keep track of all topics of interest from every source and in every language!

Yet media monitoring is crucial to understanding world trends and helping to detect the early signs of crises.

That is why the IPSC developed, and now maintains and runs, the Europe Media Monitor (EMM), a far-reaching live media monitoring system that gathers reports from online news portals worldwide in many languages.

How does it work?

EMM aggregates and classifies articles, analyses news and presents the information in user-friendly formats. EMM nevertheless is not a search engine. Its capacity to analyse and compare texts in several languages is totally unique. Text analysis tools developed by IPSC scientists allow for an automatic extraction of information from texts. For example, EMM can identify people mentioned in the news, even if their names are spelled in different ways. It can also detect disasters or violent events in the news and extract information on the victims, the type of event, as well as the time and place of the event. All these features are of great help to intelligence organisations.

EMM facts and figures

Monitors **2300** key news portals worldwide, **20** commercial newsfeeds and more than **350** specialist sites.

Retrieves approximately **100000** reports per day in **50** languages.

Runs **24** hours per day, **7** days a week.

Updated **every 10 minutes**, the site groups related news and displays the biggest stories first.

NewsBrief, NewsExplorer and MedISys, which are powered by the EMM engine, attract up to **1.2 million** hits per day.

→ From research to legislation

By monitoring and analysing multilingual information available in online media, EMM helps understand trends and thus contributes to the implementation of EU security policies.

NEWSBRIEF: WHAT ARE THE HOTTEST TOPICS IN THE PRESS RIGHT NOW?

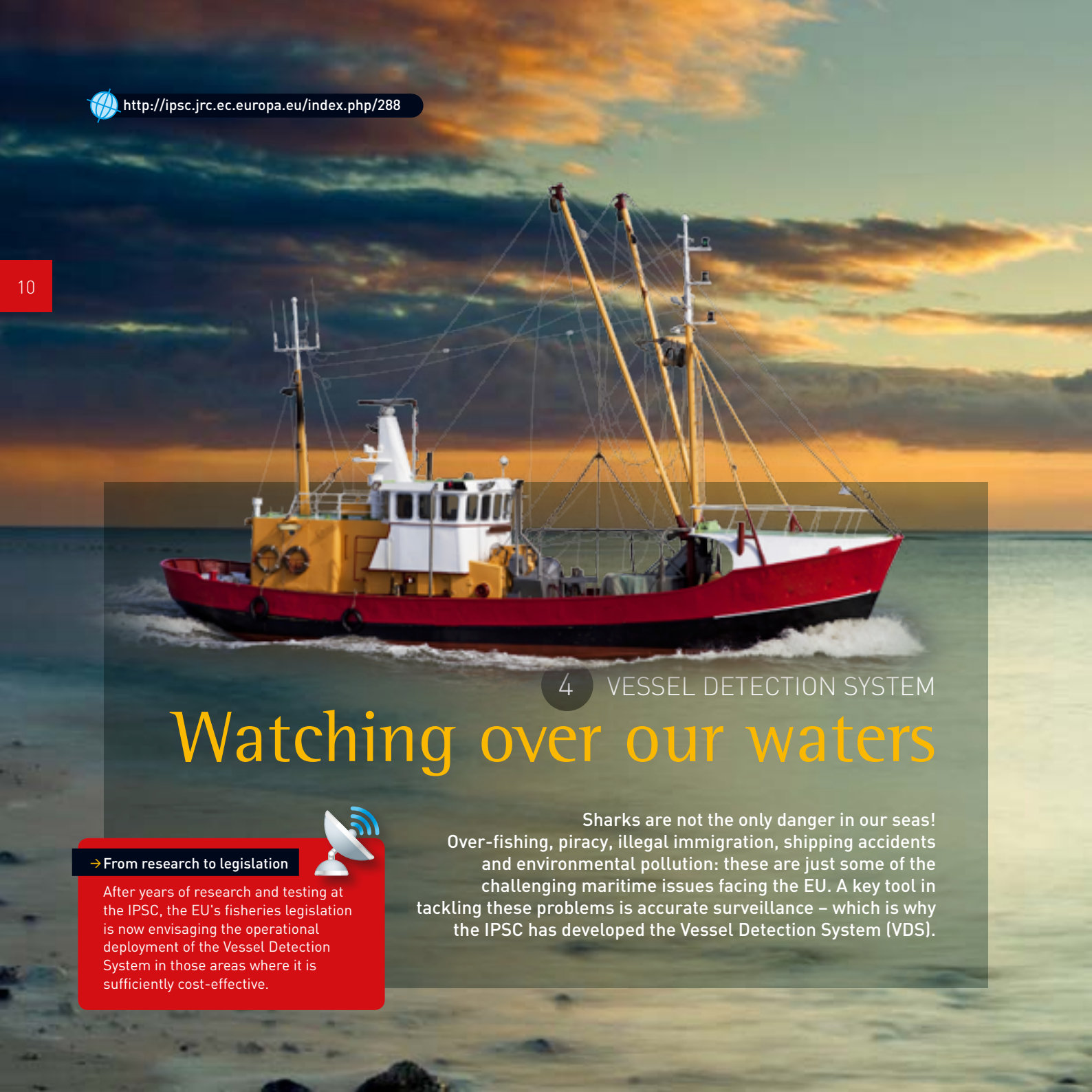
NewsBrief displays the top stories discussed at the moment across multiple news sources in various languages.

NEWSEXPLORER: AN IMPARTIAL OVERVIEW OF WORLD NEWS

The way events are reported differs from country to country. For this reason, at the end of each day, NewsExplorer groups all news articles that focus on the same subject. The system analyses 20 different languages.

MEDISYS, MEDICAL INTELLIGENCE SYSTEM

MedISys helps to rapidly identify potential threats to public health. Statistical modelling techniques help to distinguish topics that appear regularly in the news from those that are suddenly reported, meaning that advance warning can be given if a topic of concern arises.



4 VESSEL DETECTION SYSTEM

Watching over our waters

Sharks are not the only danger in our seas! Over-fishing, piracy, illegal immigration, shipping accidents and environmental pollution: these are just some of the challenging maritime issues facing the EU. A key tool in tackling these problems is accurate surveillance – which is why the IPSC has developed the Vessel Detection System (VDS).

→From research to legislation

After years of research and testing at the IPSC, the EU's fisheries legislation is now envisaging the operational deployment of the Vessel Detection System in those areas where it is sufficiently cost-effective.

What is the VDS?

The VDS is a system which detects vessels at sea using satellite images. It was developed by the IPSC to complement other reporting systems, such as the Vessel *Monitoring* System (VMS) and the Automatic Identification System (AIS).

Worldwide, EU fishing vessels of more than 15 metres in length are monitored by the Vessel Monitoring System (VMS). However, VMS cannot identify vessels that do not have a VMS installation or whose system is switched off or malfunctioning. This is where the VDS steps in.

How does it work?

The VDS uses polar orbiting satellites carrying Synthetic Aperture Radar (SAR) instruments. These can detect vessels at sea under most conditions – day and night and through cloud.

Once a vessel is detected, its position is compared with vessel positions from other reporting systems. Suspicious results are sent in near real-time to the fisheries authorities that can direct their inspections accordingly.

The VDS in action

In the summer of 2008, a large campaign using the IPSC's VDS was organised in the Mediterranean to support the monitoring of blue fin tuna fisheries by the European and national inspection authorities. The aim was to prevent overfishing during the most intensive fishing period. The VDS successfully detected towing vessels and the number of cages they were towing, thus helping authorities to better target inspections.

5

ULTRASONIC SEALS AND LASER-BASED SYSTEMS

Nuclear safeguards

http://itu.jrc.ec.europa.eu

Can you imagine how hard and critical it is to spot all the minute signs of change in a big nuclear power plant? Nuclear inspectors need advanced technologies to help carry out this challenging task! Thankfully, over the years IPSC scientists have developed tools and methods, such as ultrasonic seals and laser-based verification systems[1], to make nuclear inspectors' jobs much easier and contribute to more effective nuclear safeguards.

Sealing forever

Containers used for the storage of fissile materials need to be monitored over a period of several years to make sure that their content has not been used for destructive purposes. The IPSC has developed and patented the 'ultrasonic sealing system' for underwater and dry storage. By providing each seal with a unique identity and integrity feature, the system allows inspectors to immediately verify that the container has been properly locked and check whether it has been opened or tampered with.

→From research to legislation

Nuclear safeguards have formed a key part of European Union policy since its inception and are laid out in the EURATOM Treaty. Technologies developed by IPSC help the EU and the International Atomic Energy Agency (IAEA) to ensure that nuclear material is only used for peaceful purposes.

Ultrasonic seals in action

The JRC Candu Sealing System (JCSS) for underwater storage is now implemented in Romania (Cernavoda), Pakistan (Karachi) and Canada (Darlington), while its application for dry storage is being field-tested.

Spot the change: 3D Laser-based Verification System

One of the tasks of nuclear inspectors is to check that nuclear facilities are built exactly as they were officially declared and that from one inspection to another no undeclared activity has taken place. The IPSC scientists have developed a laser-based system that creates accurate 3D models of nuclear facilities, both indoor and outdoor, which can detect any change to the nearest millimetre.

Laser-based verification in action

The 3D Laser-based Verification System has been extensively used in the Rokkasho reprocessing plant in Japan and is now being deployed in other facilities in Europe.

Based on the same technology, the L2IS – Laser Item Identification system – developed by IPSC scientists can uniquely identify drums containing enriched uranium. Designed to be completely autonomous and require no intervention by the plant operator, a pilot L2IS system is now installed at an enrichment plant in Japan.

1. Since January 2011 these activities have been carried out within the JRC's Institute for Transuranium Elements (ITU).

6

MARS

http://mars.jrc.ec.europa.eu

Invisible eyes to monitor EU agriculture

From the pastures of Portugal to the fields of Finland and rural Romania, imagine trying to keep track of all of the farms in Europe! Not an easy task – that is why the EU relies on the scientific and technical backing of the IPSC to better manage its Common Agricultural Policy (CAP).

Checking EU agricultural subsidies

The Monitoring of Agriculture with Remote Sensing (MARS)[1] project, developed by the IPSC, provides a range of technical support services to help manage the CAP.

By monitoring the all-important CAP subsidies MARS has a huge impact on European farmers although they may not even be aware of it.

HOW DOES IT WORK?

With rural areas covering 90% of EU territory and farmed land being half of this, it is not surprising that Member States seek support to ensure that EU funds for farmers are distributed correctly and irregular claims are spotted.

All requests for subsidies are subject to administrative checks, but the real challenge for Member States lies in the 5% of requests that are also subject to annual on-the-spot checks – this is where an eye in the sky can help enormously. Every year, IPSC technology is used in all 27 Member States to analyse in a harmonised way very high resolution satellite images covering more than 200 000 km^2 of land. This considerably reduces the need for physical checks on farms and lessens the work on the ground for the Member States.

Crop Forecasting System

During the growing season, the IPSC's Crop Forecasting System, based on satellite remote sensing and mathematical models, analyses the impact of weather conditions on the main crop yields and contributes to the evaluation of global production to support CAP management decisions.

1. Since January 2011 these activities have been carried out within the JRC's Institute for Environment and Sustainability (IES).

→From research to legislation

Tools and methods developed by the IPSC for better management of the Common Agricultural Policy are now fully implemented in EU legislation and serve as a standard reference for the EU Member States.

7 THE DIGITAL TACHOGRAPH

Towards better

Are professional drivers well-rested and alert when they drive large lorries or carry passengers along our roads day after day? Are they pushed to drive extra hours exceeding legal limits? Can road operators develop their business within a framework of fair competition?

To address these questions, the digital tachograph, an improved control device for commercial road vehicles, became mandatory in 2006 on all newly registered commercial trucks and buses across the EU.

Since 2004 the IPSC has been successfully involved in the design and implementation of the digital tachograph. Currently, as a result of its early commitment, the IPSC is responsible for two essential services: the European Root Certification Authority (ERCA) and the Laboratory for Interoperability Certification (DTLab).

What is the Digital Tachograph?

The digital tachograph is a mandatory electronic recorder of the professional drivers' activities, i.e. rest, driving hours and speed. It provides reliable information to the inspectors responsible for enforcing EU policy through road and company checks.

road safety

The role of the IPSC

EUROPEAN ROOT CERTIFICATION AUTHORITY (ERCA)

The ERCA, managed by the IPSC, generates the top-level secret code for the digital tachograph, the so-called 'European encrypted root key' used in authentication processes. The ERCA also certifies the keys of national authorities, and generates the keys used in motion sensors, workshop cards and vehicle units. All these keys are needed to guarantee the security of the tachograph system, particularly the data-origin and authentication aspects. The ERCA service is central to ensuring the trustworthiness of the data recorded. It also ensures that any controller in any country can check any tachograph with any driver card inserted.

The ERCA also reviews and approves the Member State Authority security policy, guaranteeing that all new Member States fully adhere to the security principles of the tachograph system and have taken the adequate technical and organisational provisions to comply with them.

LABORATORY FOR INTEROPERABILITY CERTIFICATION (DTLAB)

The IPSC manages the only existing Laboratory for Interoperability Certification, which is responsible for carrying out thorough test procedures on the digital tachograph and for issuing one of the three certifications needed for it to enter the market. This laboratory is the reference point for equipment producers, authorities and drivers who use its regularly updated website as an instant source of information on the latest equipment and model certifications, public certificates (ERCA keys), ongoing field tests and new country codes.

→From research to legislation

The technical requirements of the digital tachograph and consequent updates over several years were introduced into EU legislation after validation by IPSC scientists.

8

SYMBOL

http://ipsc.jrc.ec.europa.eu/index.php/574

Spotting the signs of banking trouble

The financial crisis has hit European citizens hard and many of us continue to suffer its effects. That is why the IPSC, in cooperation with European Commission services and academia, has developed SYMBOL, a model to help estimate the impact of countermeasures before they are applied.

What is SYMBOL?

SYMBOL is a **SY**stemic **M**odel of **B**anking **O**riginated **L**osses which estimates the impact of planned banking regulations and helps build a stronger financial system for the future.

SYMBOL is unique because it takes into account the cumulative effects that different legislative measures can have on the banking system such as regulations on how banks must handle their capital, on the level to which a bank must protect depositors from losses in the event that it cannot pay its debts, and on funds to facilitate the resolution of failing banks in an orderly manner. This gives policy-makers something that they desperately need to make informed decisions – a holistic picture of the potential impact of proposed legislative changes.

SYMBOL in action

In 2011, the European Commission proposed to the European Parliament and the Council more stringent requirements for banks using analysis based on the SYMBOL model.

SYMBOL was used to analyse the long-term implications and costs/benefits of this proposal and found that the new rules would lead to a reduction in the risk of crisis of at least 29%, and up to 90% for some Member States.

The EU has also used SYMBOL to support other initiatives, such as the development of a framework for financial crisis management and the definition of a tax on financial transactions and/or financial activities.

→From research to legislation

The impact of the new EU rules on banks' capital requirements and deposit guarantee schemes has been assessed by the IPSC model SYMBOL.

9

COMPOSITE INDICATORS

http://composite-indicators.jrc.ec.europa.eu

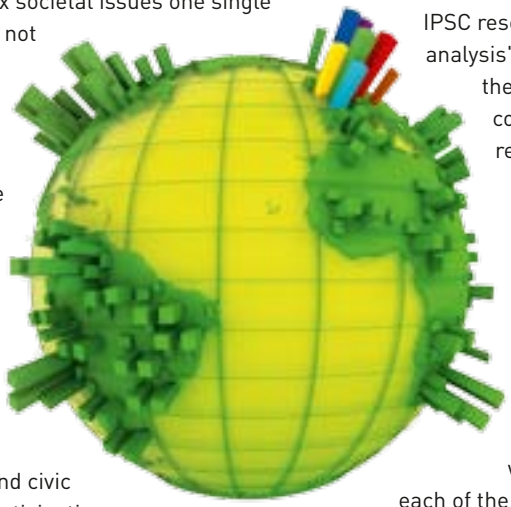
Taking the pulse of EU policy

Everything can be measured, maybe even happiness. Measuring innovation, competitiveness, environmental performance, education and other complex matters is crucial for the EU to shape effective policies and to be able to monitor their progress.

That is why IPSC scientists have developed methodologies to construct 'composite indicators', that can provide decision-makers with the 'big picture' of all these complex, yet important, issues.

What is a composite indicator?

An indicator quantifies and simplifies information, helping us to understand challenges. But when you deal with complex societal issues one single indicator is simply not enough: you need to combine several indicators into one single entity, the so-called 'composite indicator'. The IPSC has developed and analysed composite indicators in a diverse range of fields, from lifelong learning and flexicurity to regional innovation, regional competitiveness and civic participation.



Are composite indicators reliable?

But can we rely on composite indicators? This is where another IPSC research area comes into play. The 'global sensitivity analysis' method developed by IPSC scientists helps to improve the quality of mathematical models and ensures that composite indicators are constructed in a sound and reliable manner.

Composite indicators in action: measuring regional competitiveness

In 2010 the IPSC, together with other European Commission services, developed a new composite indicator, the 'Regional Competitiveness Index', which measures the strengths and weaknesses of each of the 271 EU regions. This new index can assist EU regions to set the right priorities to further increase their competitiveness.

→From research to legislation

Research work into statistics and econometrics carried out by the IPSC is helping to measure the impact of EU policies.

10 EUROCODES

Improving safety standards in construction

While most of us spend our days indoors, we rarely think about the safety of the buildings we stay in. Fortunately, the IPSC does, and its research work in this area has contributed to the development of the Eurocodes, a set of European standards for the construction sector.

What are the Eurocodes?

The Eurocodes are a set of European standards for the design of buildings and other civil engineering works and construction products. Since 2010 they have replaced all national standards, meaning that public buildings and other civil engineering structures across the EU are now constructed with equal levels of structural safety.

→From research to legislation

Since 2010 the Eurocodes have replaced national construction standards in all EU Member States. The IPSC's research work on the structural behaviour of buildings has contributed both to the EU Construction Products Directive and to the EU Public Procurement Directive, as well as to European standardisation.

The role of the IPSC

Research by the IPSC's European Laboratory for Structural Assessment (ELSA) greatly contributed to the development of the Eurocodes. ELSA used its unique Reaction Wall and 'Hopkinson Bar' combined with mathematical modelling, to assess buildings and civil engineering structures for risk mitigation under both natural and man-made hazards, such as earthquakes and explosions.

THE REACTION WALL – HOW DOES IT WORK?

The IPSC Reaction Wall, one of the three largest in the world, consists of an extremely stiff vertical wall and a horizontal floor rigidly connected together to test the vulnerability of buildings to earthquakes and other hazards.

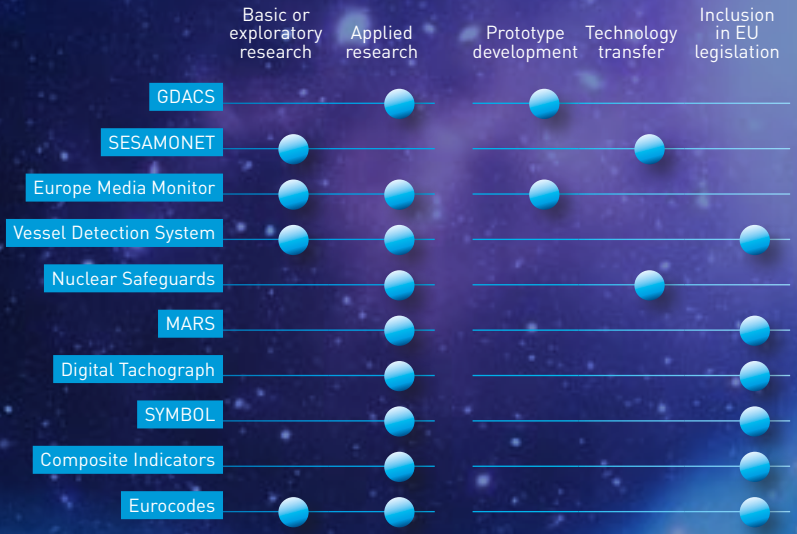
The structure to be tested, generally a full-scale building, is fixed to the horizontal floor. Once the 'test structure' is in place, the force that an earthquake would generate is applied through hydraulic jacks acting between the structure and the vertical wall, subjecting the structure to loads equivalent to those caused by the earthquake. For the purposes of testing – so-called 'pseudo-dynamic' testing – the earthquake experiment takes place in extreme slow motion, one to two hours rather than the 10 to 30 second duration of a real earthquake, allowing progressive damage and structural deformations to be accurately observed and recorded.

Good news for European business

The Eurocodes are good news for the construction and construction products industry which is one of the largest industrial sectors in Europe. They are a necessary tool for the successful implementation of the Internal Market for construction products and services, and a well-functioning Internal Market could see trade increase by between 15 and 30%.

The 10 years to come

Things keep moving and IPSC will continue to stay ahead. But what are the challenges in the years to come?



According to their stage of maturity, IPSC projects can be placed along a linear path from basic research (left) to 'finished product' (right), where a 'finished product' may be our contribution to EU legislation or the development of new applications.

In the years to come we will witness a gradual evolution from left to right: some projects will proceed towards the end of the pathway, while new projects will enter it, starting the process from the beginning: from ideas, through research, to new results.

New activities

A significant number of new IPSC projects has been started. These are currently at the early stages of maturity and they are expected to deliver within the next 10 years.

In the years to come our **statistical, numerical and analytical models**, which we deploy in several very diverse fields, from finance to natural events to the physical world, will be further enhanced so that, in the future, models will give us the answers we need, while laboratories will carry out the crucial step of validation.

Coming soon...

These two examples will give you an idea of what results you may expect from IPSC in the next decade.

Our research work on the **genetic identification** of fish species will contribute to determining the true species and origin of fish beyond any doubt, and as a result reduce fraud in the fisheries sector. We, as consumers, will benefit from scientific advances in this field, as will those fishermen who fish responsibly and abide by the rules.

Ever heard of **geomagnetic storms**? These extreme phenomena caused by solar activity can have a serious impact on modern technological infrastructures such as electrical power grids, telecommunication, global satellite navigation (GNSS) and even banking. IPSC scientists have started a research project on how to secure critical infrastructures when a storm hits.

European Commission – Joint Research Centre – Institute for the Protection and Security of the Citizen

Europe Direct is a service to help you find answers to your questions about the European Union

Freephone number (*):
00 800 6 7 8 9 10 11

(*) Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

A great deal of additional information about the European Union is available on the Internet. It can be accessed through the Europa server (europa.eu)

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