

# SAFER - Services and Applications For the Emergency Response GMES in action: first operational results of emergency response services

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**Abstract** – Every year, fires, floods, earthquakes and volcanic eruptions, landslides and other humanitarian crises claim the lives of thousands of citizens in Europe and around the world. With climate change, the frequency or intensity of such events may even increase. With the SAFER project, cofunded by the European Commission<sup>1</sup>, GMES Emergency Response Services are moving one step closer to full-scale operational deployment. SAFER is a large European project funded in the frame of the GMES initiative.

Started in January 2009, the SAFER project is preparing and paving the way for operational implementation of the GMES Emergency Response Service, reinforcing the European capacity to provide efficient support in case of natural crises and humanitarian disasters. SAFER has already delivered services at full-scale in response to real emergency situations, in Europe or abroad, as well as during specific exercises. Recent activations results demonstrate the performance and the validity of the model. This first return of experience brings useful knowledge for the future operations in Europe and worldwide.

**Keywords:** GMES, emergency response, crisis management, core service, rapid mapping, reactive imagery, civil protection, humanitarian aid

## 1. INTRODUCTION AND RATIONALE

### 1.1 Providing more effective response to emergencies

Efficient emergency response is highly ranked on the political agenda. Recent major disasters in Europe, in Africa and worldwide (either natural, man-made, or complex humanitarian crisis) such the forest fires near Athens in Greece, the Klaus storm in France and the earthquake in Italy have stressed again the need to improve the European disaster response capacity.

The role played by the European Union in emergency response and disaster relief is two-fold: the first mission is to protect lives and assets of European citizens. The second one, as part of the European solidarity, is to provide effective disaster and humanitarian assistance in other parts of the world.

In December 2007, the European Parliament and the European Council recommended to strengthen the Community's Civil Protection mechanism and the co-operation between Member States in order to improve the effectiveness of emergency response in case of major disasters.

In a similar way, the European Parliament and the European Council have signed in December 2007 the European Consensus on Humanitarian Aid for improved delivery of assistance.



Figure 1 - The crisis cycle and the response

### 1.2 Similar needs inside and outside Europe

Disasters have more and more a cross-border nature. Their mitigation requires coordinated responses. Key criteria are speed, effectiveness and cost-efficiency and require a managed, coordinated and integrated response. The same instruments – in particular civil protection assets – are deployed by the Community and Member States to respond to the same needs within the Union and beyond EU borders, either as a stand-alone disaster response contribution or as a complement to humanitarian aid.

### 1.3 A clear but challenging expression of needs

Accurate and comprehensive information makes better decision-making. The users needs, expressed both by civil protection and by actors in charge of humanitarian assistance have been reported and further detailed in 2006 by the Emergency Response Core Service (ERCS) GMES implementation group and confirmed in September 2008 during the Lille conference. The targeted crisis situations are:

- Meteorologically-driven hazards (e.g. storms, fires, floods),
- Geophysical hazards (e.g. earthquakes, tsunamis, volcanic eruptions, landslides and subsidence),
- Man-made disasters, either deliberate or accidental (e.g. urban fires, chemical incidents on industrial sites),
- Humanitarian disasters.

### 1.4 Fast delivery for decision makers and in-field operatives.

The key service requirements to be implemented by SAFER are:

- Geographical scope: inside and outside Europe.

<sup>1</sup> SAFER project has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 218802 (GMES services)

- Includes reference mapping, assessment (rapid mapping) and situation mapping, crisis follow-up products, from data acquisition to delivery to the final users. Specific thematic products, depending on the type of event (floods, volcanoes, etc.) can bring additional specialised information.
- Reference maps shall be delivered in less than 6 hours. This requirement can only be met by preparing and maintaining in advance a “library” of reference maps on the world areas subject to natural or humanitarian crises.
- Optimised operational processes, including anticipation of data acquisitions.
- Information delivery to decision-makers and to in-field operatives.

The most challenging requirement is the end-to-end service delivery time: the first reference maps shall be delivered within six hours and the assessment maps shall be available in less than 24 hours for Europe and the Mediterranean basin (36 hours elsewhere).

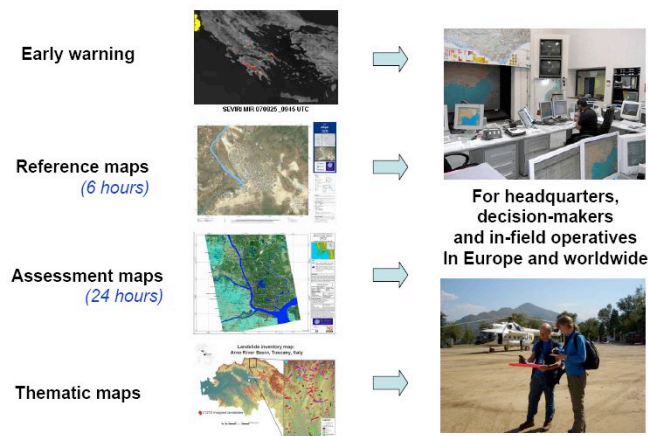


Figure 2 - The SAFER product portfolio

## 2. SAFER, FROM BEST EFFORT TO OPERATIONAL SERVICES

### 2.1 Main objective: prepare the operational services

The main objective of SAFER is to prepare the implementation of operational versions of the GMES Emergency Response Core Service. SAFER is a key contribution for the transition from pre-operational demonstrators to a fully operational and independent emergency response capacity in Europe. SAFER aims at reinforcing the European capacity to respond to emergency situations: fires, floods, earthquakes, volcanic eruptions, landslides, humanitarian crisis. The main goal of SAFER is the upgrade of the core service and the validation of its performance with 2 priorities:

- The first priority is the short term improvement of response when crisis occur, with the rapid mapping capacity after disastrous events, including the relevant preparatory services (reference maps). For validation purposes, the project will deliver, as early as 2009 a full scale service for real events or during specific exercises. The main performance criterion is the response time. Work addresses technical, operational and organisational issues.

- The second priority is the extension to core service components before and after the crisis. It targets the longer term service evolution, through the provision of thematic products, to be added in the portfolio of services. The main criterion is the added-value of products with risk-specific information.

### 2.2 Expected results and impact

The main expected impact of SAFER is the integration on the service side. This action is mandatory in order to reach the critical mass and meet the targeted quality and performance of the ERCS service.

Closer to the operational stage, SAFER, in particular with the “full size – real conditions” validation activities, is a key instrument to foster the dialogue between the actors currently involved in rapid services and define enhanced operational processes and the related service level agreements.

As for the other GMES services, SAFER will demonstrate that efficient and shared solutions can be set up at European level, with a good balance between the mutualisation of resources and the subsidiarity principle.

#### A user-driven pre-operational service:

- Service delivered as early as 2009, with an incremental Service Level Agreement defining the levels of performance.
- Validation by users with the support of an independent entity (The Joint Research Centre of the European Commission).

#### A rapid mapping capacity:

- Gradual increase of activations: 30-45-60 events per year.
- Reference maps available in less than 6 hours (targeted performance)

#### A more complete information content:

- Anticipation of new acquisitions, based on events monitoring, to speed-up mapping.
- Reference mapping prepared in advance. More than 7 M km<sup>2</sup> covered.
- Progressive enrichment of the service with thematic maps (assets and population maps, risk maps, historical damage maps) for the different types of hazards.

#### An end-to-end support service:

- Focal point, as single point of contact available 24/7 to manage service delivery.
- Service gateway for efficient access.
- Geo-information delivered up to the intervention field (“in-field” GIS solutions).

#### Preparing a fully operational service:

- Service development and validation according to standard processes.
- Set-up of service infrastructure to allow seamless integration between service partners and with end-users.
- Written procedures and methods. Quality organisation. Training courses for users.

Table 1 - SAFER expected results

### 2.3 Products and service examples

Figures 3 and 4 are samples of products which have been delivered for validation purposes. The satellite image on figure 3 is a Spot 5 high resolution image which has been used for the assessment of the damages caused by the severe fires near Athens in August 2009. The map on figure 4 is a reference map to be delivered between 6 and 24 hours after the alert. On this particular

map, based on Express maps, Infoterra added some specific layers describing the impact on the earthquake in Afghanistan in April



2009. Figure 5 is a map produced by SERTIT for SAFER in rush mode during the activation after the Corsica fires near Aullènes.



*Figure 3 – High resolution Spot 5 image acquired after the greek fires near Athens – Overview and details (August 2009). This image is the input data for the rapid mapping activity*

#### **2.4 The challenge of the timeliness performance: the operational organization of the service**

The experience of the previous projects shows that, for a reactive and time-critical service as targeted in SAFER, an “operational coordinator” of the service is necessary.

This operational coordinator must ensure the end-to-end management of an operation (a crisis response support), coordinating all the actors that will contribute to the service (data acquisition, value-added provision of different types), and the interface to the users.

This need is recognized in the ERCS Implementation Group report which states: “The ERCS focal point represents an expert layer able to harmonize and coordinate the activity of the providers consortia and of European agencies and centers, to receive through the national or European focal points user information requests and to decide and finalize effective operational steps (e.g. to perform the negotiation with a mission plan to acquire new data, to verify the suitability of the actual available input dataset, etc.)

One of the operational innovations brought by the SAFER service organization is the ability to anticipate reference maps production and data acquisitions when early signs of an upcoming crisis occur (in example hydro-meteorological forecasts for flood, etc.), or when the first information regarding the effective start of a crisis arrives.

This anticipated activity allows to work in “hidden time”, and thus to improve the delivery delay with respect to the effective user request.

The role of the SAFER focal point also appears in the functional architecture as depicted in the ERCS Implementation Group report, shown below in figure 5.

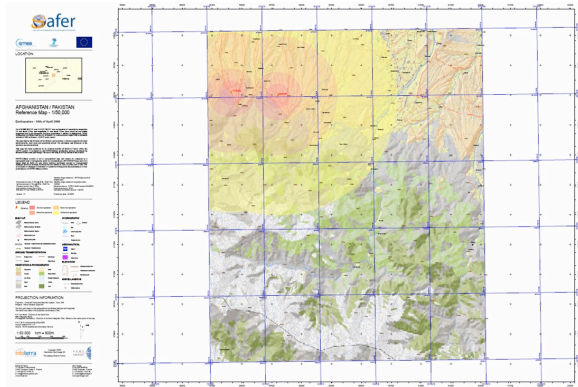


Figure 4 – Reference map of Afghanistan produced by Infoterra for SAFER. Based on Expressmaps with additional layers describing the impact of the earthquake

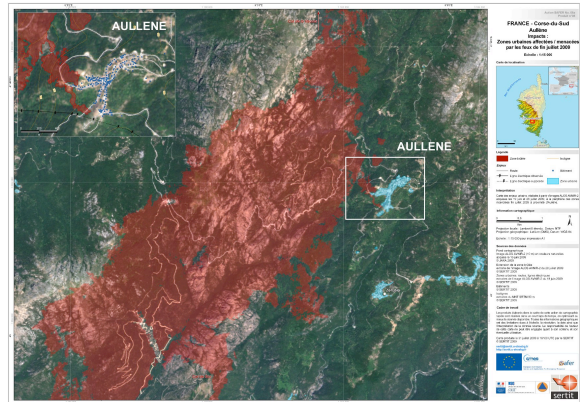


Figure 6 – Assessment map produced by SERTIT after the fires in Corsica (Aullènes, July 2009)



Figure 5 - SAFER organization and operational model

## 2.5 SAFER implementation: a European consortium with a wide expertise

The SAFER consortium, coordinated by Infoterra France, includes 54 partners from 16 countries (29 private organisations and 25 public institutions). With users such as European civil protection authorities or international UN agencies, SAFER is built around a core team of European industry and research institutes that have gained experience in this area within the framework of both the EC's Sixth Framework Programme for Research and

Technological Development and ESA programmes (including PREVIEW, RISK-EOS, RESPOND, TERRAFIRMA, LIMES and BOSS4GMES).

A wide network of scientific partners and service providers extend the European dimension of the project, in particular to the EU New Member States. The total budget of this three year project is € 40 M with a € 27 M grant funded by the 7th Framework Programme for Research and Technological Development of the European Commission.

The main European service providers (Infoterra, Sertit, Telespazio), space agencies (CNES, ROSA, DLR), small and medium enterprises (Keyobs, Magellium, etc.) and research teams (UNIFI, CNRS, INGV, LATUV)) are involved:

SAFER is therefore one of the largest projects launched at European level in the frame of the GMES initiative.

### 3. FIRST OPERATIONAL RESULTS ON REAL EVENTS

First operational use of SAFER started in early 2009 with the decision to activate the service after the two earthquakes in l'Aquila and in Afghanistan. A large operational exercise was also organised in France (Richter 6.5 in Lourdes) with the French Civil Protection.

Because of the intensity and frequency of the wild and forest fires, SAFER service activity increased during the summer 2009, with four major activations between mid-July and end of August : fire in Marseille (France), fire in Corsica (France) and Sardinia (Italy) and the large fires near Athens in Greece.

Reference and assessment maps, have been produced and delivered by SAFER in rush mode to the end users (French, Italian and Greek civil protections).

During these emergency situations, the SAFER operational model has been successfully implemented and validated: Infoterra, as focal point operator, is in charge of operational management and a network of European service providers (mainly SERTIT and DLR for the work performed during the summer) produces the geo-information. This model includes the interface with the GMES data access component (earth observation data provision coordinated by the European Space Agency). One of the activation has been performed in close partnership with the International Charter Space and Major Disasters, using a cooperation agreement defined between SAFER and the Charter board.

Among the main lessons learnt, it is worthwhile mentioning:

- The importance of early warning and anticipation of the activation by the users. This is a key success factor in order to save time in the mobilisation of earth observation capacities and to meet users' expectations for fast delivery of information. SAFER implements an "auto-activation" or "pre-activation" mechanism, based on daily monitoring of alert and early warning signals. This is an efficient solution for the anticipation of the official request of the users.
- The benefits brought by a well-specified operational model, with clear responsibilities, interfaces and procedures. Even with a networked organisation, if the decision-making process is defined and applied, the distribution of the work among a set of service providers has no impact on the end-to-end performance. Even in rush mode, this model can provide an efficient solution in order to implement "online" quality control in the operational loop, before dissemination of the information products.
- The means for the dissemination of the information products not only to the headquarters but also up to the final users (in-field). Even if this issue is mainly depending on internal organisational and operational rules at civil protection level, some tools can be helpful for a more efficient distribution of the SAFER products.

During the summer, the French civil protection in Corsica has exploited a set of mobile terminals and a risk management equipment developed by Astrium Services and Infoterra (ELISEO system). It includes communication, navigation and real-time mapping functions, this tool improved the efficiency of the geo-information products for field operations.



Figure 7 – ELISEO system used for distribution of information products to in-field operatives. Operational validation in Corsica (August 2009)

- In order to be fully exploited by the various users not only in rush mode during the crisis itself but also after the event for the detailed assessment of damages (e. g. for the ministry of agriculture or ministry of environment), the information products shall be interoperable and designed to allow:
  - 1) Easy integration by the users in their GIS tools and working environment.
  - 2) Flexible combination of information layers in order to fulfil various needs (e. g. burnt area boundary overlaid on a reference map or on a detailed land use map).
  - 3) Fast transfer to in-field operatives and integration in the field equipment, i. e. with multilayered vector representation and efficient use of the bandwidth of the communication channels.
- Setting up an appropriate organisation and management structure at European level with four requirements:
  - 1) Political engagement,
  - 2) Link with users at European, national and regional level,
  - 3) Clear mandates to service operators and selection of a main operator entity for the operational service management,
  - 4) Pan-European organisation and activation rules for non European users.
- Defining the right balance between mutualisation of resources at European level and subsidiarity at regional / member state level. For SAFER, it includes also the long term plans for the cooperation with the International Charter Space and Major Disasters.
- Securing long term public funding for the operation of the GMES core services.
- Guaranteeing continuity of Earth Observation sources, at European level but also and perhaps mainly at national (institutional and commercial) level: emergency response services require mainly high resolution optical and SAR images and this capacity is firstly provided by national missions.

#### **4. CONCLUSIONS**

During the next three years, SAFER project will be one of the main instruments of the European Commission in order to implement operational GMES services for the emergency response.

The first operational results highlight the validity of the service concept and of the organisational model. The next step will be the confirmation of these lessons with a wider set of users and crisis situations.

In order to achieve the successful transition from a research and project-driven logic to sustainable operations, the main identified challenges are:

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