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Outcomes of the 1st JRC ECML Crisis Technology Workshop

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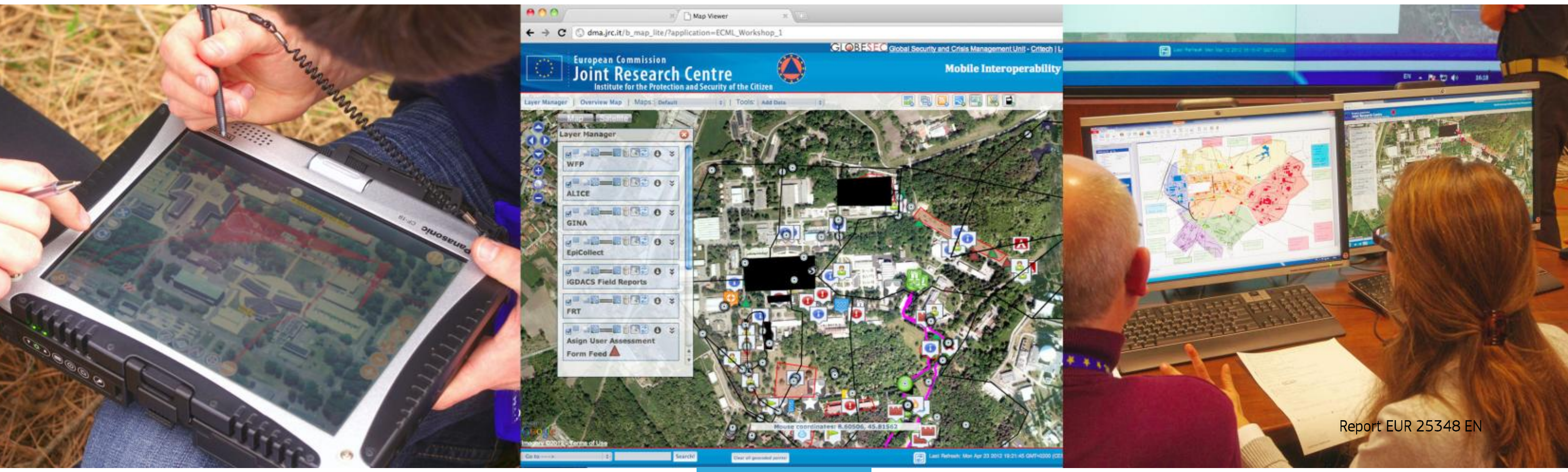
2012



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Institute for the Protection and Security of the Citizen

Contact information
Markus Rester
Address: Joint Research Centre, Via Enrico Fermi 2749, TP 680, 21027 Ispra (VA), Italy
E-mail: markus.rester@jrc.ec.europa.eu
Tel.: +(39) 0332 78-3805
Fax: +(39) 0332 78-5154

http://ipsc.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

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Outcomes of the 1st JRC ECML Crisis Technology Workshop on Mobile Interoperability for International Field Deployment, 12-13 March 2012

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1 Executive Summary

The 1st JRC ECML Crisis Technology Workshop on Mobile Interoperability for International Field Deployment (ACRIMAS Pilot Case) took place in the European Crisis Management Laboratory (ECML) of the Joint Research Centre in Ispra, Italy, from 12 to 13 March 2012. 37 participants attended the workshop. They were coming from: 11 EU countries and Norway, Brazil and US, 3 UN agencies, and 2 NGOs.

The workshop's purpose was to measure the added value of mobile assessment technology for rapid situation assessment in international emergency operations. Seven mobile assessment systems were deployed among the participants and needed to provide, in an interoperable way, real-time data to a single electronic On-Site Operations Coordination Centre (eOSOCC). The performance of the systems was benchmarked against a traditional paper-based assessment that was conducted simultaneously (pOSOCC).

The following systems participated in the experiment with active attendance of the respective technology providers, except Open Data Kit which was set up ad hoc by a participant:

- Alice by Astri Polska Sp. z o.o., Warszawa, Poland
- ASIGN/GEO-PICTURES by AnsuR, Fornebu, Norway
- EpiCollect by Imperial College, London, United Kingdom
- Field Reporting Tool (FRT) by JRC, Ispra, Italy
- GINA System by GINA Software s.r.o., Czech Republic
- iGDACS by JRC, Ispra, Italy
- Open Data Kit by University of Washington and Google, USA

The field experiment took place on the JRC site in Ispra. 42 Markers were placed over an area of approximately 550000 m2. The clearly visible markers only contained a numerical ID and a verbal description of the situation encountered on the placed location. The eOSOCC received real-time information from the field teams via the feed URLs provided by the technology providers. All participating systems were able to provide either GeoRSS or KML feeds. All information streams appeared in the eOSOCC on a single map utilizing OpenLayers.

The evaluation of the experiment was done collaboratively by practitioners, field experts, strategic level personnel working with national and international headquarters of civil protection and crisis management, and JRC staff.

1.1 Outcomes

In general, the experiment was a success: all data feeds reached the eOSOCC, all teams left on time, and there were no major problems during the field exercise. Devices were able to use either GPRS/3G or were able to utilize the available WiFi network hotspots on site to transfer their data.

The final map with all incoming feeds in the eOSOCC was very cluttered due the great number of devices, field teams, and different systems. The eOSOCC team leaders reported that there was considerable information overload. As much as 328 entities of information (placemarks, tracks, polygons, etc.) were simultaneously streamed to the eOSOCC. Therefore sophisticated editing, filtering, and visualization functionalities (e.g., multiple views) have to be available for OSOCC staff.

By the time the first teams arrived back from the field, most information had been processed and was available on a summarized situation map. The eOSOCC team then converted the available information in a priority list and action items. After each team leader was consulted to confirm and correct information, the eOSOCC was ready for presentation, including an electronic map and action documents.

The pOSOCC leaders used the A0 map they produced for presentation and they had an overview of the priorities which they marked also with post-it notes. They did not prepare any documents in writing to be shared or communicated.

Both paper and electronic OSOCC reached similar situation awareness. The final map based briefing material is almost identical with very few exceptions. Interestingly both OSOCC teams made mistakes with regard to the exact positions. The mistakes of the eOSOCC team made in transferring accurate data to the briefing material underline the need for an OSOCC software suite covering the whole workflow of procedures essential in OSOCC operations.

The outcomes showed that both paper and electronic OSOCCs reached a similar situation awareness in the same time, identifying similar needs and locations for prioritization, but only the eOSOCC had products available as sharable electronic maps and documents. The pOSOCC would need at least 30 minutes to come to the same result. The other advantage of the eOSOCC was the possibility to monitor a situation changing over time and the possibility to keep track of the situation (awareness) evolution.

1.2 Status-Quo and Further Development Needs

Mobile technology is mature and can be deployed in an interoperable way. However, as soon as it comes to interoperable sharing, the information of each and every system leaves the proprietary applications for processing and analyzing the data. Therefore, processing tools and training to these are needed.

The main impression from the eOSOCC team was that there is a lot of potential. Having access in real-time to field information was felt to be extremely useful. However, at the moment tools and procedures are missing for exploiting this benefit. Most important are tools to curate, filter, manipulate, edit, and delete assessment information of all teams (i.e. post processing tools). A dedicated OSOCC software suite is needed that gives full control over the data to OSOCC staff. The participants encouraged a follow-up workshop after such tools are developed.

1.3 Process for developing systems

The group of practitioners gave some concrete recommendations on how mobile technology can be improved and integrated in humanitarian operations. They considered workshops like this one an essential tool, but it is more important to have a dedicated community that has regular activities or meetings on the topic to keep the momentum of development ongoing. A forum for technology providers to exchange ideas and products would be also useful. The contribution of practitioners to this dedicated community is of great importance because only they can ensure the very vital input for a user and task driven development of proper ICT systems.

Besides physical workshops or exercises, tools like table top exercises and dedicated technical teleconferences are as important. Gradual integration in Standard Operating Procedures and adaptation of training curriculums is a way to integrate mature technology in the existing assessment practices of operational organizations. The more open the architectures and standards of these technologies are, the likelier is the integration and adaption process.

2 Workshop and Experiment Overview

The 1st JRC Crisis Technology Workshop on Mobile Interoperability for International Field Deployment (ACRIMAS Pilot Case) took place in the European Crisis Management Laboratory (ECML) of the Joint Research Centre in Ispra, Italy, from 12 to 13 March 2012.

The workshop was co-organised with ACRIMAS, the FP7 project aimed at discussing and testing coordinated response solutions from crisis managers and first responders across Europe in order to prepare a large Demonstration Project in crisis management for FP8. One of the tasks of this project was to run a demonstration of a crisis management situation. This ACRIMAS Pilot Case demonstrated that controlled experiments are a useful way to assess and advance crisis management technology.

37 participants attended the workshop. They were coming from: 11 EU countries and Norway, Brazil and US, 3 UN agencies (Office for Coordination of Humanitarian Affairs (OCHA), World Food Programme (WFP) and Development Programme (UNDP)) and 2 NGOs (MapAction, Technology Sans Frontières).

The workshop's purpose was to measure the added value of mobile assessment technology for rapid situation assessment in international emergency operations. Seven mobile assessment systems were deployed among the participants and needed to provide, in an interoperable way, real-time data to a single electronic On-Site Operations Coordination Centre (eOSOCC). The performance of the systems was benchmarked against a traditional paper-based assessment that was conducted simultaneously (pOSOCC).

2.1 Scenario and Storyline

A disaster assessment operation must be set up in an international environment. Teams from various countries arrive on scene, each with their own tools and approaches to assess a situation and communicate it to a coordination centre. In order to set up a coordinated and integrated operation plan, the On-Site Operations Coordination Centre (OSOCC) must be able to receive, process, and visualize information from all teams. The time to agree and set up an interoperable data transmission system must be reduced to a minimum in order to start the assessment as fast as possible. The focus is on collecting categorized information to get the "big picture" of the situation.

The simulated situation is comparable to a natural disaster outside the EU. Many teams arrive and one of the first international organizations being on site coordinates all activities. In this event this role was played by the UN OCHA team, which has a long experience in this task in real situations. The main objective is the assessment of a rather stable situation shortly after the event occurred. There are no tactical security issues like public unrest, riots, or plundering that have to be dealt with.

On 12.03.2012 at 0037 hours local time a major earthquake hit the Varese area. The small town of "JRC Ispra" was particularly affected. Several buildings probably collapsed and many are likely to be seriously damaged. There are rumors that some areas and districts are especially struck with massive damages to houses.

2.2 Workflow

The OSOCC leaders announced the categories of information needed for assessment and planning, e.g. need for water purification equipment, spotted spontaneous refugee camps. Technology providers then set up their systems as quickly as possible. Customization, configuration, and negotiation on the fly for interoperability were other key elements in in this exercise.

The assignments of participants to 6 field teams were communicated and the teams deployed to the field with mobile devices to assess the situation. Participants were teamed up also in interchangeable couples: one person collected data with the mobile devices and the second recorded the very same data traditionally. After returning from the field one person went to the eOSOCC and the other reported to the pOSOCC.

The technology providers had about 15 minutes to train the users of the field teams. This training not only covered the technological aspects of the system use but also the semantics of the information to be collected (categories to be used according to OSOCC needs).

Technology providers then joined the field teams thus one mobile device of each of the 7 participating systems was accompanied or operated by an expert user. Other devices of the same system were assigned to other field teams and operated by novice users.

The field teams were deployed in different sectors on the JRC site. There they found clearly visible "markers" on situations they should report (see Annex E: Marker template for providing information to be collected by field teams). An overview paper map of the locations of the markers was available to all participants (see Annex F: Overview Map of Placed Markers and NO GO Zones). The two OSOCC teams tried to make sense of all incoming information and had to draft first steps of action according to their situation assessment (see Annex G: OSSOC Instructions and Templates).

After all field teams had arrived back and the two OSOCC teams had presented their conclusions, a hot wash-up discussion focused on the technology issues experienced in the exercise.

2.3 Technical Framework Requirements

2.3.1 Data Exchange Formats

The workshop focused on interoperability of mobile devices for crisis management, so the technological requirements for exchanging information were a key parameter. The experiment was meant to be as realistic as possible, i.e. the need for ad hoc collaboration of different teams arriving on the scene with different systems, and this includes also the team of the eOSOCC with their respective Information and Communication Technology (ICT) systems. Therefore common and recognized data interchange standards had to be chosen. All participating systems were able to provide either GeoRSS or KML feeds that were "consumed" by the eOSOCC (see Table 1).

Standard	Reference
GeoRSS simple	http://georss.org/simple
KML	http://www.opengeospatial.org/standards/kml/

Table 1: Supported data exchange formats.

2.3.2 Shared Map of eOSOCC in ECML

In the eOSOCC all information streams appeared on a single map utilizing OpenLayers. This setup can be described as a system of systems (see Figure 1).

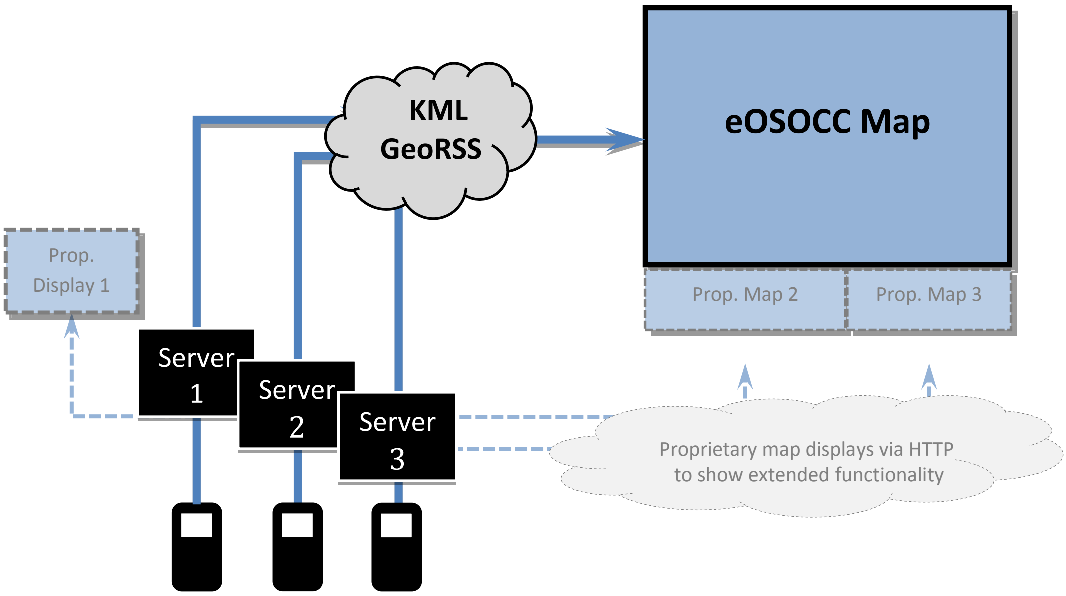


Figure 1: System of systems overview.

The eOSOCC received real-time information from the field teams via the feed URLs provided by the technology providers. The field area was well covered by GSM networks. In many areas on site it was possible to utilize hotspots (i.e. open WiFi networks). Communication channels were not the focus of the experiment so satellite communication was not encouraged.

Beside the shared map there was room for display of mapping systems of the different technology providers which have different functionality, like filtering etc. For systems displayed on the big wall screen of the eOSOCC for demonstration purposes a URL to a web based system was needed (see Figure 2). There was also an interactive whiteboard system available to run proprietary desktop applications, again for demonstration purposes.

Figure 2: Right side of display: map viewer (http://dma.jrc.it/map/) used by eOSOCC in ECML. Left side shows proprietary web based applications of three participating systems.

2.3.3 Feed Validation

Technology providers have been asked in advance to check whether their feeds are valid by checking it with a validator, e.g. http://googlemapsapi.blogspot.com/2007/06/validate-your-kml-online-or-offline.html or http://www.feedvalidator.org/. Also the map application at http://dma.jrc.it/map/, implementing the OpenLayers framework, was available to them to check if their feeds are visualized properly in general.

2.3.4 Categorization, Tagging, and Keywords

For the eOSOCC team not only technical but also semantic interoperability is an issue. The readability and utility of a single map with all incoming streams depends on shared vocabularies or at least negotiated "translations" of used categorizations. The experiment accounted for this by providing last minute information on the categories to use before the teams deployed to the field. In case of a KML feed the technology providers are in control of the symbols. Being able to adapt to the requested information help the OSOCC team in sense-making considerably. In case of GeoRSS either the system is adaptable to provide the required tagging or the meaning of the used tags has to be negotiated with the eOSOCC. Requested information categories by the OSOCC leaders were:

- Needs (e.g., water, shelter)
- Infrastructure (e.g., status of buildings)
- Danger / Hazards (e.g., contamination, HazMat)

The following systems participated in the experiment with active attendance of the respective technology providers (see Annex A: Participating Systems for short system descriptions, product URLs, and screenshots of server side / desktop applications):

- Alice by Astri Polska Sp. z o.o., Warszawa, Poland
- ASIGN/GEO-PICTURES by AnsuR, Fornebu, Norway
- EpiCollect by Imperial College, London, United Kingdom
- Field Reporting Tool (FRT) by JRC, Ispra, Italy
- GINA System by GINA Software s.r.o., Czech Republic
- iGDACS by JRC, Ispra, Italy

In addition, there was an ad hoc participation of a seventh system. United Nations World Food Programme utilizes Open Data Kit (ODK) and this system was set up by a participant of UN WFP on the fly and joined the experiment as well:

- Open Data Kit by University of Washington and Google, USA

3 Evaluation Scope

The evaluation of the experiment was done collaboratively by practitioners, field experts, strategic level personnel working with national and international headquarters of civil protection and crisis management, and JRC staff. This ensured real, down-to-earth criticism on the usefulness of mobile systems and their interoperability and fosters the validity of the results. The planned scope of evaluation of the interoperability experiment conducted during the workshop was threefold:

1. Technical aspects of interoperability: What is the status quo of participating systems, what are the shortcomings, and what future development needs have to be tackled?

2. Utility of mobile devices in the assessment and planning phases of crisis management: Added value or just more complexity?
3. Towards adaption of mobile devices for crisis management by authorities: What are the needs and requirements of authorities, how are they met by current systems, and what actions are needed to drive an adaption process?

4 Outcomes of the Experiment

4.1 Technical Interoperability: Theory

For the field systems to communicate with the On-Site Operations Coordination Centre (OSOCC) well established standards need to be supported. Table 2 and Table 3 give an overview of the supported data exchange formats, available communication channels, and additional functionalities of the proprietary control and administration interfaces of the systems.

System	Supported Data Formats for Information Sharing						Communication Channels		
	KML	GeoRSS	GPX	XML (SOAP)	shapefile	WMS/ WFS	GPRS/3G	WiFi	Satellite
Alice	X				X	X	X	X	X
ASIGN/GEO-PICTURES	X	X		*API under develop ment*		X	X	X	*Designed for SatCom. Now adapted to handheld systems.*
EpiCollect	X						X	X	
GINA	X	X	X	X	*Planned*	X	X	X	
FRT	X	X			X	X	X	X	
iGDACS	X	X			X	X	X	X	
ODK	X						X	X	

Table 2: Systems overview -- Supported formats and communication channels.

System	Additional Functionality of Server-Side / Desktop Application
Alice	Moderate Layers (Content) depending on user login authentication; Turning on/off predefined symbols; Events history managment; Import new layers (static or dynamic ones)
ASIGN/GEO-PICTURES	Filter, Sort, Edit, Send, Download, Mission Administration, etc.[1]
EpiCollect	Filter, Edit, Chart Views, Project Administration
GINA	Mission Control; Content, Tasks and Needs Management; Reporting; History Browsing
FRT	Voice Annotations in the Field, Automatically Print Report, Read Out Loud Support
iGDACS	Add Data (Digitizing)
ODK	Visualize, Export, Publish

Table 3: Systems overview - Additional functionality on server-side application.

4.2 Technical Interoperability: Practice

Technology providers tested their feeds with the map application available in the ECML (see section Feed Validation). The time needed for modification of systems to provide compatible feeds - OpenLayers is very strict in what is accepted in streams - was reported by the system providers:

[1] Available for PC (Mac, Windows, Linux) and Mobile (Android, iPhone).
Extensive list of features includes: rapid mapping, interface to satellite EO data ordering, project management, tracking, dynamic survey templates, receiver functions, send to many, send via email, sms, ftp or dedicated receivers, pre-written captions, server can adjust / correct positions, category and priority settings for all photos, supports video clips, zoom in on regions of interest in full resolution, can integrate to various map/GIS servers, minimizes bandwidth requirements, robust design and protocols for poor links, operational for years and used in missions. Ready to apply.

- Epicollect, FRT, iGDACS, ODK: No time needed. KML is supported natively by default.
- ASIGN/GEO-PICTURES: Feeds needed minor changes to be processed by DMA map application.
- Alice: Adjustments were already made for previous JRC workshop. One more day was needed for additional changes.
- Gina: Small KML modifications were necessary. The definition of proper layers and the installation of Ispra map data took only minutes.

After the OSOCC introduced the scenario to field teams, all systems had to be set up to share the collected information with the eOSOCC. In addition, the system had to be customized to support the information needs of the eOSOCC. This often included the definition of appropriate assessment forms to collect the required data or the introduction of agreed tags to categorize the collected information.

Field team members were provided with a form to record relevant observations for these two initial stages of the experiment (see Annex B: System Set Up / System Customization Form). Unfortunately workshop participants were very reserved in filling out these forms (return rate 10%, duly filled forms 2,5%). So, forms proved to be an improper scientific method to gather data for technology assessment in this setting of senior experts. The few filled forms stated very fast set up times for 3 systems (between 5 to 15 minutes) and very little expertise needed to get the systems up and running. No further details are given due to the low return rate.

In general, the experiment was a success: all data feeds reached the eOSOCC, all teams left on time, and there were no major problems during the field exercise. Devices with no GSM connectivity due to missing Italian SIM cards were able to utilize the available WiFi networks on site.

4.3 Experiment: Field Team Observations

The field experiment took place on the JRC site in Ispra. 42 Markers were placed over an area of approximately 550000 m^2. The clearly visible markers only contained a numerical ID and a verbal description of the situation encountered on the placed location (see Annex E: Marker template for providing information to be collected by field teams). For areas (e.g., possible camp site) a small detail map gave an indication of the outline. No categories, titles or the like were given. It was part of the experiment to see how the field teams encoded the given information semantically according to the needs stated by the OSOCC.

The results of the experiment should not be influenced by the need to search very hard for the markers. In reality information that has to be reported is clearly visible. So the field teams received a very coarse overview map of the places of markers. This map only showed the location of markers giving no other details (see Annex F: Overview Map of Placed Markers and NO GO Zones).
Field teams, consisting of members utilizing mobile devices as well as members applying traditional paper based data collection methods, were provided with 2 forms accordingly:

- For the mobile device usage a diary was kept recording relevant meta-information on set actions (e.g., reporting on markers giving timestamp and marker ID to be able to cross-check their reception) or usability problems, troubles in semantic encoding of encountered information, etc. (see Annex C: Field Experience Form – Mobile Device Usage).
- For the paper based collection of information there was a simple form just asking for team identification, timestamp, marker ID, and recorded information. Any meta-comments on the paper based process were also mentioned on this form which main purpose is to provide uniform artifacts for the OSOCC as well as for later analysis (see Annex D: Field Experience Form – Paper Based Information Collection).

Whereas the forms for plain data collection were usually used, the feedback forms for problems with the mobile devices showed a similar return rate as the system setup forms (2,5%). Since it is not valid to derive any conclusions from this data, it is given here without details of the affected system(s):

- Missing ability to cancel a report or delete a photo if taken in error
- Missing ability to scroll through the message to add or amend + view before sending
- Missing ability to add more than one photo to a report
- When viewing the report's location on the map the respective marker should change colour so you know which one it is
- When selecting a report from the map it should show written coordinates in order to be able to pass on by voice / radio
- Too small buttons for people with large hands/fingers
- In bad weather conditions device too fragile

4.4 Experiment: OSOCC Situation Assessment Results

Two OSOCC assessments were presented at the end of the experiment: one prepared by a team which was provided with real-time data streams form the different mobile systems (eOSOCC) and the other one prepared by a team which received the paper based collected data from the field teams after their return to the respective headquarter (pOSOCC).

4.4.1 Situation Assessment Outcome by eOSOCC

The eOSOCC started receiving data as soon as the teams left the base. Information from all teams was shown on a single map using real-time feeds, each with the symbols chosen by the system providers who decided on KML as format for sharing information (7 in total). The icon mapping for one GeoRSS feed – which per design does not include icon data - was chosen in the dma map viewer application.

The first 30 minutes were spent discussing how to use and process the data. The eOSOCC team could not fall back on well-trained procedures and had to come up with a way to analyse the information. After few attempts (including using on-line digitizing), the eOSOCC decided to work in pairs: one person read the integrated map with all real-time feeds and a second person recorded analyzed information on a PowerPoint-based map.

The final map of the viewer application with all incoming feeds was very cluttered due the great number of devices, field teams, and different systems (see Figure 3). Even zooming in to a very detailed level could only partially ease this because of multiple reports on the very same information by different field teams or by devices of different systems. The eOSOCC team leaders reported in the hot wash-up after the experiment and also in the discussion on the next day that there was considerable information overload. Of course, in reality the likelihood that two teams visit the same spot is much lower than in the exercise. On the other hand participants discussed that in reality different stakeholders collect and report information according to their interest. So again for instance the very same building could be reported as searched by one organization and as providing temporary storage space by another one.

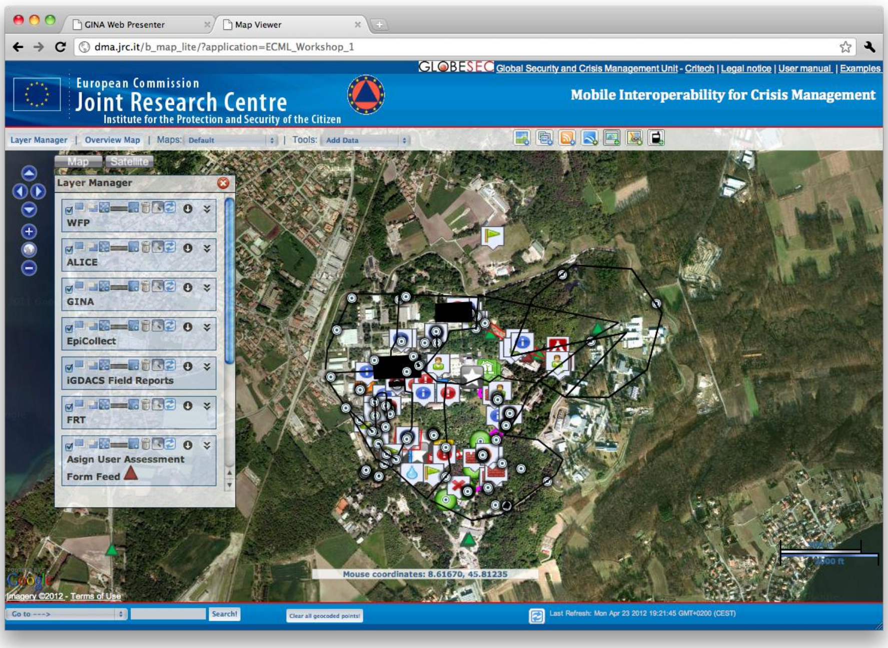


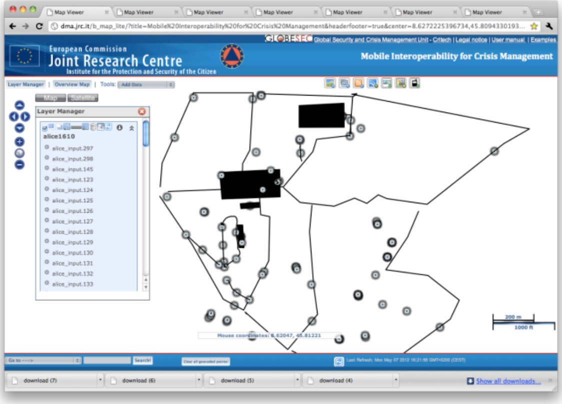
Figure 3: Map viewer application used by eOSOCC showing all 7 final feeds.

The integrated map was read by visualizing one feed at the time and hiding the others (see Table 4), to avoid confusion with symbols. The analysts cycled through the information continuously, trying to keep up with the new information (not easily distinguished from old information) using a variety of symbols. The FRT system produced also automatic paper printouts of recorded information while the field team was still out (see Figure 4). This was useful for understanding and taking notes.

By the time the first teams arrived (at 15:45), most information had been processed and was available on a summarized situation map in PowerPoint. The eOSOCC team then converted the available information in a priority list and action items (in PowerPoint tables). Around 16:15, each team leader was consulted to confirm and correct information. By 16:30, the eOSOCC was ready for presentation, including an electronic map and action documents.

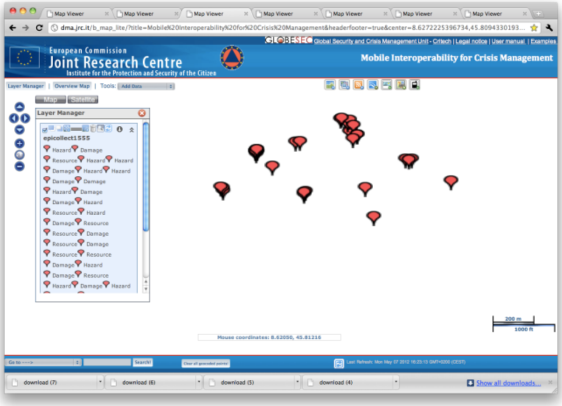
Figure 4: Process of information collection and briefing material production by three eOSOCC leaders. On the desk next to the keyboard lies an automatic paper printout of the FRT system used in addition to electronically visualized incoming information.

Alice



ASIGN/GEO-PICTURES

EpiCollect



FRT

Gina

iGDACS

ODK

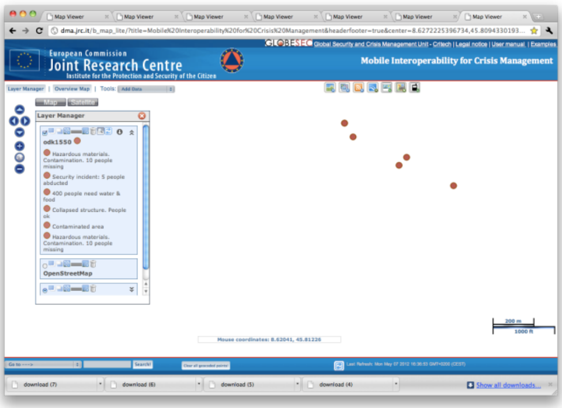


Table 4: Overview of final feeds by system. Base layer satellite map removed to boost data visibility.

The process in recording incoming information and generating the final briefing map of the assessed situation (see Figure 5) can be summarized as follows:

1. All participating mobile systems provided either GeoRSS or KML feeds that were "consumed" by the eOSOCC.
2. In the eOSOCC all incoming information streams appeared on a single map utilizing OpenLayers.
3. The single map was visualized on a big wall display but could be interacted with also on a desktop computer.
4. Briefing material was produced according to tasks utilizing the template document (see Annex G: OSSOC Instructions and Templates).

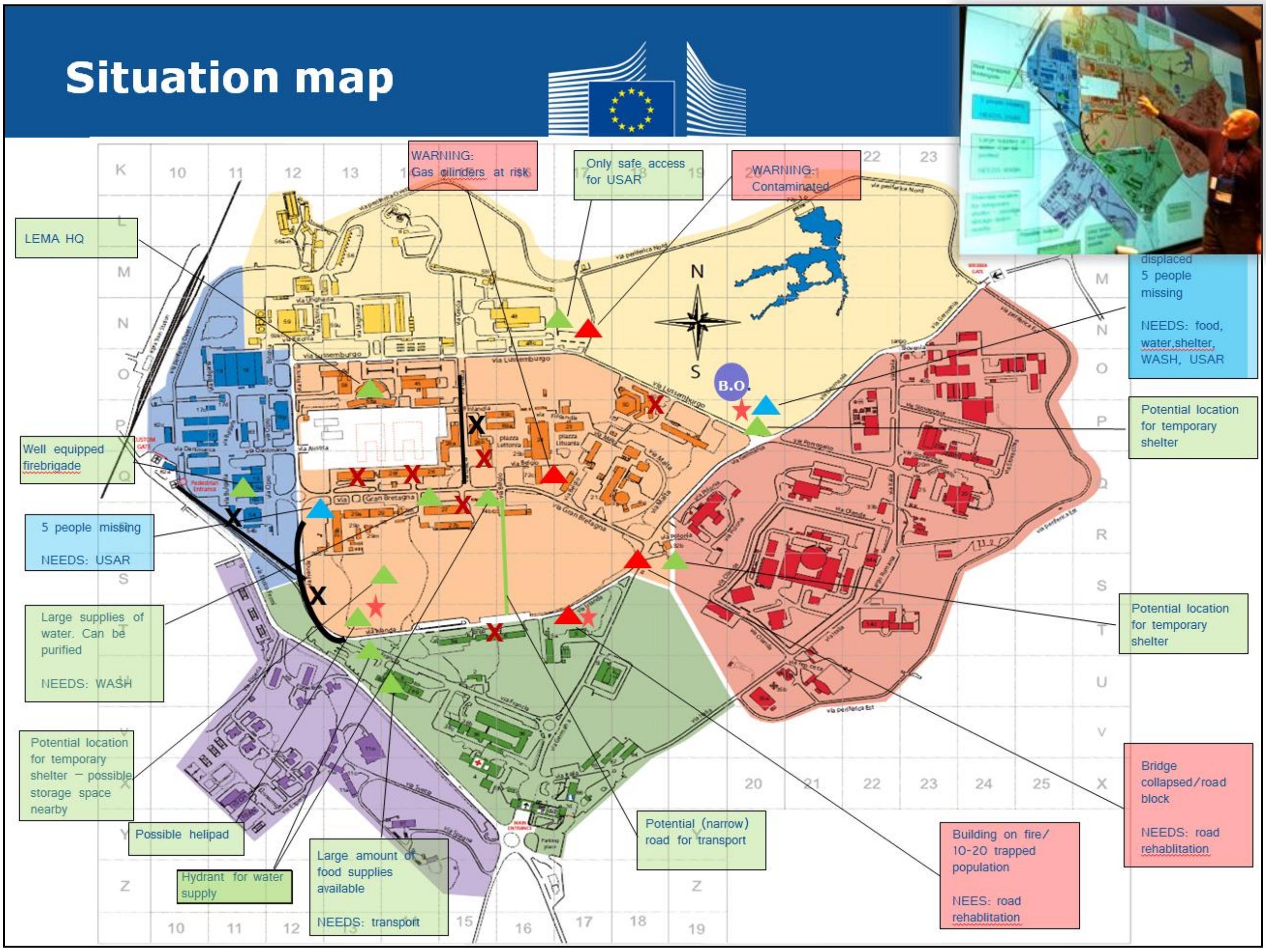


Figure 5: Situation map prepared for briefing by eOSOCC

The eOSOCC team compiled also a list of top and medium priority needs for the briefing on their situation assessment (see Figure 6). The prioritized list of the necessary steps resulting from their assessment was:

1. Top: Search and rescue of 30 missing and trapped people.
2. Top: WASH, shelter, and food for 600 displaced people.
3. Medium: Health support for 600 displaced people.
4. Medium: Bring in more experts (assessment teams, camp managers, engineer, etc.)
5. Medium: Bring in transportation and equipment.

Priority Needs

European Commission

	Needs	Priority	Comments
USAR	30 people (10 missing, 20 trapped)	TOP priority	USAR teams to move in ASAP via accessible road
WASH	600 displaced people (camp); water supplies to be purified	TOP priority	Water supplies to be purified
Shelter	600 displaced people (camp) + potential new camps	TOP priority	
Food	600 displaced people (camp) + potential new camps	TOP priority	Need to assess food needs (most vulnerable)
Health	600 displaced people (camp) + potential new camps	MEDIUM priority	
Expertise	Assessment teams (in depth ass.); camp managers; building engineers; medical personnel; SAR; Logistics		
Logistics	Transportation and equipment for food, water, clearing debris, road rehabilitation	MEDIUM priority	

Figure 6: Priority needs prepared for briefing by eOSOCC.

Figure 7: Plan of action prepared for briefing by eOSOCC.

Following the top and medium priorities, a detailed list of assignments to deal with the identified priority needs was presented (see Figure 7). The assignments not only made use of the given resources from the provided list of available equipment (see Annex G: OSSOC Instructions and Templates), but also included available resources and equipment reported by field teams (i.e. intact and well equipped local fire brigade, food supplies). For Equipment that was neither listed in the available resources nor discovered in the field, the plan of action requested the bringing in of these resources.

1. *Available* USAR teams: rescue trapped people
2. *Available* water purification unit: purify reported water resources
3. *Reported* fire brigade: assist USAR team at burning building, neutralize gas cylinder risk.
4. *Reported* food supplies: to be transported to reported camp site.
5. *Needed* shelter + WASH equipment: to be sent in and set up at camp sites.
6. *Needed* experts: assessment teams, emergency coordinator, camp managers, engineers for road assessment.
7. *Reported* hazards: to be sealed off (contaminated area, blocked roads, collapsed bridge).

Observations of the processes, procedures, and activities in the eOSOCC by note takers of JRC staff included also the following:

- The information represented by the icons on the map (but not shown explicitly) is so important that it has to be accessible in a much easier way than by clicking through hundreds of small icons.

- Standardized icons are missing and would help very much in reading and understanding the map.
- For processing the incoming information, icons of viewed reports should be faded out or become transparent to reflect the status of the information.
- Drawing functionality in map viewer is missing.
- Filter by time functionality in map viewer is missing.
- Moderate, delete, flag as important, hide if not important functionalities are missing.
- Communication / chat with field teams is missing.

4.4.2 Incoming Feeds of Mobile Systems

The core experiment started around 14:30 when the first field teams left the OSOCC building after the systems have been set up and the basic user training has been held. Few minutes later the first reports arrived in the eOSOCC (see Figure 8). The absolute number of information entities by system was of course influenced by the number of devices in the field for each system (Alice: 3, ASIGN/GEO-PICTURES: 3, EpiCollect: 3, FRT: 1, Gina: 6, iGDACS: 2, ODK: 1). For a normalized picture see Figure 9. Also the way some systems encode the recorded information differed significantly. Some used e.g., three <Placemark> encodings to describe one discovered information by adding shape areas and color shadings as additional <Placemark> entities.

The Alice system seemingly starts much earlier in providing information. This was due to the fact that the system providers used it already in the introductory briefing by the OSOCC teams to record e.g., the directions the 6 field teams should head first to avoid that all field teams report on the very same markers in the field while other information is never reported. The Alice system can easily record information for "remote" locations (other than device's actual one) and that was utilized here. This turned out to be a "wanted" feature as some of the other systems do not support this properly.

Another very noteworthy aspect is the massive spike in the Alice feed between 15:30 and 15:55. These were 61 placemarks within the area of collapsed high rise buildings. It could either be due to usability problems, system failure, or user misuse. They were edited (i.e. deleted) as the timestamps suggest immediately after return from the field. Also the ASIGN/GEO-PICTURES feed was corrected at 16:15 even though only for 1 entry. Whereas the causes for the irrelevant data points remain unclear it shows one important fact: direct access to data for modification, updating, or deletion is necessary by all means. From an interoperability aspect these data control functionalities must not stop at the particular system level but have also to be available to the OSOCC team that has to deal with many different data input streams.

ODK was set up on the fly during the experiment and installed on one device without connectivity in the field. Therefore all information became available just after return to the eOSOCC when they were uploaded to the system server.

Two data series had to be reconstructed using the creation timestamps of the reports in the final feed. This is considered acceptable because there was good 3G coverage and lots of WiFi hotspots available during the experiment. In case of Gina there was obviously a problem with the caching script that saved all the incoming feeds every five minutes. With EpiCollect the reason was quite different. A faulty device on which the time was not set and therefore was returning data that didn't have associated timestamps. This invalid data broke the feed. Of course, this problem was fixed immediately after the workshop by the system providers.

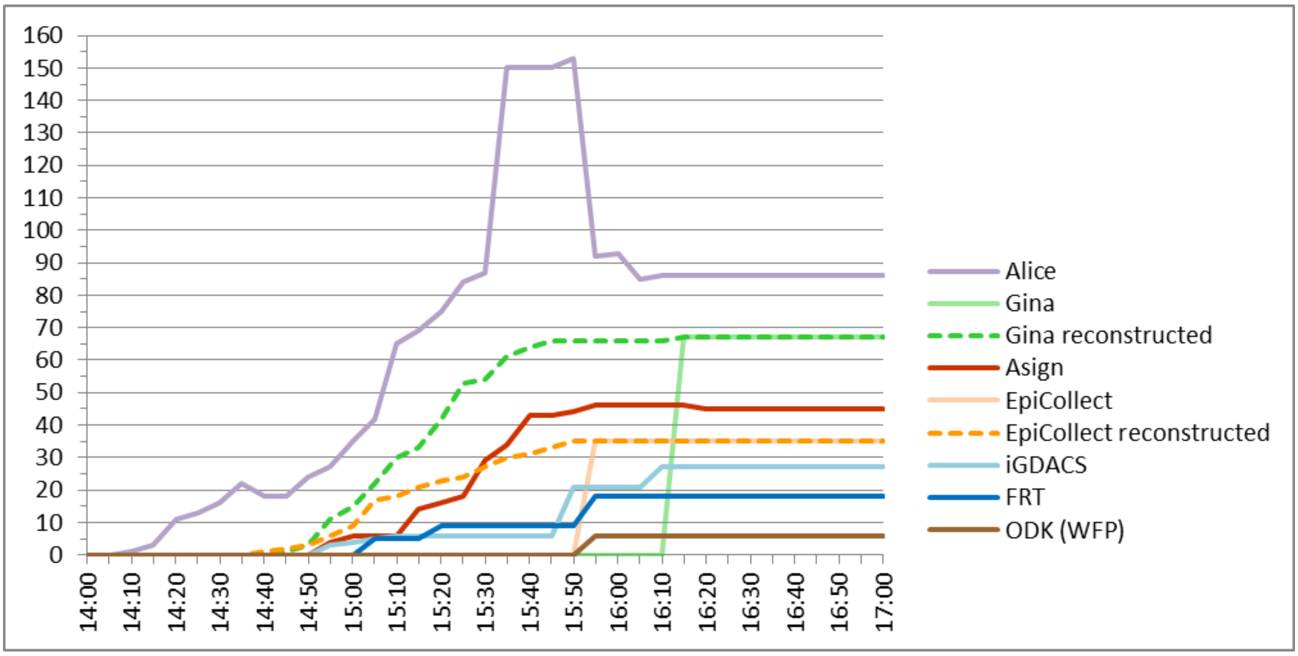


Figure 8: Number of incoming information (placemarks, tracks, polygons, etc.) in the feeds by system. Remark: number of used devices varying between 1 and 6.

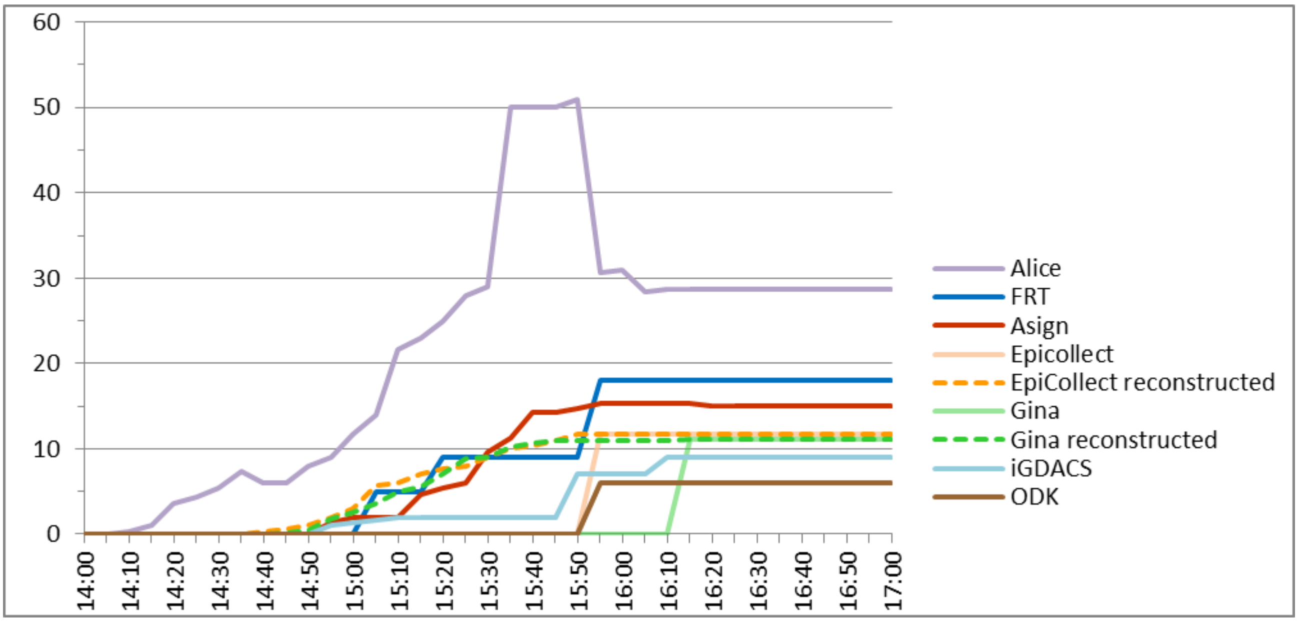


Figure 9: Number of incoming information (placemarks, tracks, polygons, etc.) in the feeds by system. Normalized by number of used devices.

There was significant information overload the eOSOCC team had to deal with. As much as 328 entities of information (placemarks, tracks, polygons, etc.) at 15:50 were simultaneously streamed to the eOSOCC (see Figure 10). Therefore sophisticated editing, filtering, and visualization functionalities (e.g., multiple views) have to be available for OSOCC staff.

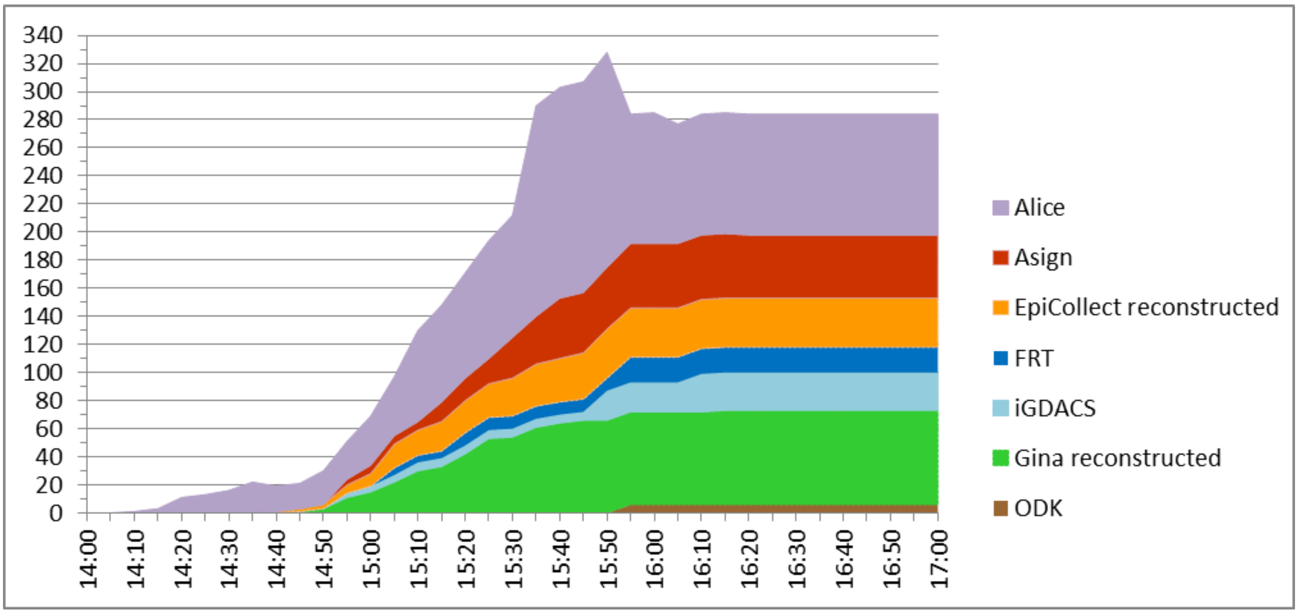


Figure 10: Total cumulative number of incoming information (placemarks, tracks, polygons, etc.) to be handled in the eOSOCC.

4.4.3 Situation Assessment Outcome by pOSOCC

While the teams were collecting data, the pOSOCC prepared procedures and paper map support for receiving information. These were procedures were well known by the experienced OSOCC staff and took little time to prepare. By the time the first teams arrived (at 15:40), information could be processed in a very organized way. Information was collected in three categories: humanitarian needs, infrastructure and hazards. It was drawn directly on a transparent layer on the large paper map.

The process in recording incoming information and generating the final map of the assessed situation (see Figure 11) can be summarized as follows:

1. The pOSOCC leader used a big empty map (A0) of the site.
2. A layer of transparent film fixed to the map was used for recording the collected information from the field.
3. The pOSOCC received the field groups one by one with one or two representatives only.
4. Permanent markers of different colors were used to represent different categories of information.
5. Finally, pOSOCC leaders utilized post-it markers to summarize the most relevant information they wanted to highlight in the briefing.

Figure 11: Process of information collection and mapping in pOSOCC. Two pOSOCC leaders receiving reports by field team representative.

By 16:30, the map was ready for presentation. The OSOCC leaders had an overview of the priorities which they marked also with post-it notes for the presentation, but did not prepare any documents in writing to be shared or communicated (see Figure 12).

Figure 12: Situation map prepared by pOSOCC also used for briefing.
For the presentation most important information was marked with post-its by the pOSOCC leaders.

Observations of the processes, procedures, and activities in the pOSOCC by note takers of JRC staff included also the following:

- Some groups gave a very brief and condensed report on only essential information
- Other groups were too verbose trying to report too many details.
- Some groups could refer the information to given unique identifier numbers of markers in the field, as was requested by the pOSOCC team leaders.
- Other groups were not able to provide this information because they only took notes on street numbers and/or building numbers which hindered efficient mapping of the incoming information.
- Basic - though incomplete - information was recorded on the map and successfully supplemented by more detailed reports coming in later.

4.4.4 Comparison of Situation Assessments: eOSOCC vs. pOSOCC

Both paper and electronic OSOCC reached similar situation awareness. The final map based briefing material (see Figure 5 on page 18 and Figure 12 on page 25) is almost identical with very few exceptions to be described in detail below (see Table 5). Interestingly both OSOCC teams made mistakes with regard to the exact positions. Two very important facts are missing in the eOSOCC briefing map and one factitious information (no marker placed in the field) shows up but on a wrong position (unclear whether incorrectly mapped or incorrectly reported).

Correct information	eOSOCC	pOSOCC
Marker 36: 400 displaced people	Correct position **But 600 displaced people stated.**	Correct position. No number of people stated.
No marker placed in the field, but information on gas cylinders reported by field teams to both OSOCCs	Correct position.	**Wrong position (ca. 140 meters)** Labeled with "Y40??" showing **confusion with marker 40**. Marker 40 mapped correctly but also labeled "G40??" showing mentioned confusion.
Markers 28+29: 2 sides of blocked road	Correct position in feeds **But transferred incorrectly into briefing map (250 meters off, identifying wrong road).**	Both markers mapped correctly.
Marker 5: Partially collapsed building. Unknown number of people missing. Marker 6: Road Blocked from here towards N Marker 7: Completely collapsed building.	Correct positions.	Correct relative position of 3 markers. **But wrong position on map (140 meters off).** Confusion because on the paper map there are no buildings. Labeled as "USAR", "**Road Block North??**", "**USAR??**"
Marker 13: Probably many people stuck in collapsed building of reinforced concrete building.	**MISSING**	Correct position. Labeled "G13 USAR".
Marker 18: Large area of collapsed high rise buildings. All through roads blocked	**MISSING**	Correct position. Labeled "G18 USAR High Rise". Building of marker 5 included in area boundaries.
No marker placed.	"Potential (narrow) road for transport". Source unclear. Not part of any feed. **Probably 155 meters off.**	--

Table 5: Major differences between eOSOCC and pOSOCC maps

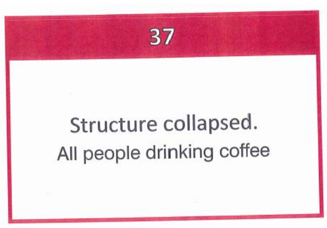
The mistakes of the eOSOCC team made in transferring accurate data to the briefing material underline the need for an OSOCC software suite covering the whole workflow of procedures essential in OSOCC operations. This was also an outcome of the evaluation discussion sessions (see below).

The following minor details (see Table 6) are listed for sake of completeness of the comparison of eOSOCC and pOSOCC outcomes and do not indicate strengths or weaknesses of neither of the two modes of operation.

Correct information	**eOSOCC**	**pOSOCC**
Marker 33: Structure collapsed. No people trapped.	*Not mentioned as not essential.*	Correct position. Labeled "USAR (no trapped)"
Marker 37: Structure collapsed. No people trapped.	Correct position. Mapped as collapsed building.	Correct position. *Mapped as "WASH Food Shelter" with wrong ID "Y36". Confusion most likely due to the fact that marker was vandalized by unknown suspects who changed content[2].* Marker 36 across street labeled "Y37"
Marker 35: Rumors of 5 missing persons in this area.	Correct position. Labeled "5 people missing" + "USAR"	Correct position. Labeled "USAR?"
2 intact fuel stations	*Not shown on briefing map as not essential.*	Shown on map due to being complete information collection.

Table 6: Minor differences between eOSOCC and pOSOCC maps

[2] "Vandalized" marker: "Structure collapsed. All people drinking coffee"



4.4.5 Discussion of Experiment Outcomes (Hot Wash-Up)

After the presentations of the outcomes of the two OSOCC teams all workshop participants shared their experiences in a hot wash-up and discussed the perceived processes and procedures, and the results of the experiment. The main points in this discussion were as follows:

> ***"Assessment has to be very concise and very clear! Some teams came back and even did not know exactly where they have been."***

This relates very likely to the wrong position of markers 5, 6, and 7 of the pOSOCC since it was stated by one of the pOSOCC leaders. The unreliability in case of this information was recognized by the pOSOCC as there were no buildings on the paper map were they mapped this information. Here mobile devices add a lot of trust to incoming information by giving precise location coordinates.

> ***"Assessment is a professional activity of trained experts. How can untrained people contribute?"***

Part of the nature of the experiment design was to provide novice users with devices they never have seen before and to see how easily they can be used. Nevertheless even if the devices were unfamiliar the users themselves all have experience in disaster management on different levels. The context here focuses more on the sometimes very promising idea of crowd sourcing. There the users use their own devices but are very likely to be totally inexperienced when it comes to disaster management or field assessment. So information provided by such users has to be dealt with caution.

> ***"In the eOSOCC interactive communication with the field teams was missing. The speed gain of the eOSOCC does not outweigh this missing communication."***
>
> ***"Voice communication (VHF) [with field teams] was missing."***

It was mentioned on more than one occasion that although ICT offers so much possibilities of new and improved procedures for OSOCC operations a reduction to only computer mediated information flow is not desirable. Communication back channels are needed to verify and validate incoming information or assure correct interpretation. Field team members gain so much insight in the field that can be of great value also for cross checking the final "big picture" of the situation assessment.

> ***"Incoming real time data is like a dream come true for any OSOCC team. Filtering mechanisms for handling the incoming streams are necessary."***

The information overload was an issue for the eOSOCC team leaders. The incoming streams were simply "consumed" and interaction with was very limited. Manipulation of the data was not possible at all. This starts with features that simplify the process of reading the continuous streams by marking analyzed information and ends with complex editing capabilities to fuse different reports and compiling authoritative interpretation. It has to be possible to delete, edit, and create data.

"It is necessary to deal with changes in time. A situation usually is not static. Snapshots should be supported in a proper way."

A disaster assessment may change with every piece of additional information that becomes available. In a traditional way of working this might not be of great importance as there are clear stages defined by briefings of returning field teams. Discussions probably take place in groups so a given amount of information is reported, taken into account, validated, etc. which then leads to a new state of assessment. If this more discrete process turns more and more into a continuous one there has to be a change in procedures as well. A new piece of information may lead to a re-interpretation of other already known facts. If this later turns out to be faulty data a rollback in the assessment has to be performed. Such operations might be supported by snapshots but maybe more complex interdependence graphs are needed on which changes can be performed on.

"What is the added value of pictures to a report? How to interpret and integrate the information a picture provides in the information processing?"

The question arose on what the added value of pictures in field reports actually is. Whereas some might argue that one picture is worth more than a thousand words it is obvious that a picture has to be read and interpreted to support sense making. If there are e.g., structural engineers in the field assessing the stability of partially collapsed buildings their expert opinion on the building is valued in the OSOCC and not colorful pictures that probably show few, if any, aspects that led to the expert's conclusive assessment whether this building is safe for USAR operations or not.

Pictures on the other hand become much more important in the case of crowd sourcing where untrained people submit information to be evaluated by OSOCC staff or expert teams. Here pictures might also add to the credibility and trustworthiness of crowd sourcing information discussed above.

"Usability is an issue. It was possible to send [electronic] reports with no data in them."

While in general most of the participating systems can be described as mature and ready for deployment even the most advanced ones will show the one or the other weakness when undergoing stress tests. Even if it is on purpose that it is possible to send empty reports (maybe for quickly reporting one owns location) it is still questionable especially for users new to a system. As with any ICT minimal or even no training should be necessary to utilize it. Giving the own system into the hands of novice users and even people that are not domain experts in crisis management or field assessment is always a very fruitful experience for iterative technology enhancement.

4.5 Panel / Group Discussion: Assessment of Technological Interoperability

The second day of the workshop was dedicated to discussions on usability, interoperability, and utility of mobile devices for crisis management driven by the experiences from the experiment. Methodologically these sessions have been designed as "extended" focus group discussions with 6 people on a panel giving key statements to foster a fruitful discussion, one moderator, and active participation of the audience. At any time at least 2 note takers documented the statements of the participants.

On the plus side, there was massive involvement of the audience and a lively discussion took place. The downside of course directly related to this was that the group was way too big for a traditional focus group discussion procedure adhering to a question guideline. The different topics that were discussed were very diverse and the designed question guideline visible on a projector screen was merely giving an impression of central questions for the session:

- Q: System setup and system use is easy (learnability, usability)?
- Q: System customization (e.g., categories, labels, tags, forms, …) is possible to meet different needs?
- Q: Systems are able to interoperate with each other (compatibility, information granularity, symbology, etc.)?
- Q: What enhancements and developments are necessary to improve technical interoperability?

Session 1 focused on interoperability from a more technological viewpoint. So, the panel was composed of 7 technology providers (Alice, ASIGN/GEO-PICTURES, EpiCollect, FRT, GINA, iGDACS, ODK) and moderation was done by a senior JRC scientist.

4.5.1 Panel / Group Discussion Outcome

> ***The outcome of putting all the different streams together was a mess! […] Is it feasible to establish a universal symbology?***

A standard library of icons, tags, etc. to be used by all information and data providers definitely would help in reading a map of combined feeds. Participants mentioned also that even if such standardization would take place there will always be situations that are not covered by any given set. Furthermore, the question arose in the discussion on who would be the authority to develop or at least approve this library.

> ***Data collection tools are useful but the context matters so much. Different users have different views on the very same information or situation to assess.***

In a real crisis situation many different stakeholders are present who all collect data on very different levels according to their interests (e.g., building X is collapsed vs. 10000 people need food & water). It would be a pity not to use this information but powerful data handling functionalities have to be available to deal with the different scopes of this data and integrate them to contribute to a situation assessment.

Semantic interoperability has two sides. On the one hand the technology providers have to provide feeds that allow desired data handling. On the other hand the OSOCC staff should have every possibility to handle the data to their needs. For instance assign icons on a one by one basis.

This important statement raises the justified question on how to define interoperability. It posits the necessity not to stop at a technological level but to include users' needs when talking about interoperable information. When the task at hand is the interpretation and sense-making of data and information the user needs every support to categorize, merge, or subdivide these information chunks according to the bigger picture that is developed in this process. The latter was discussed also in the session on the utility of mobile devices for OSOCC operations (see section 4.6 Panel / Focus Group Discussion: Assessment of Utility of Mobile Systems for OSOCCs).

"Analysis in eOSOCC was done on 'paper' as well because the needed functionalities e.g., to edit the incoming data, are missing." "[It] is possible to edit the data. But for that you have to open up the server side applications of the various systems." "An API could be a solution for e.g., turning on/off reports, etc."

A first step to give OSOCC staff access to the data could be the provision of an application programming interface (API). So the analysts could for instance easily exclude data entries from the input stream that they do not need (any more). Again standardization would be necessary for all the systems of different providers supporting these API standards. Using such an approach OSOCC staff would 'operate' on the original data of the different systems. Whether this is wanted and/or sufficient is a question that was addressed again later in the next discussion session.

4.6 Panel / Focus Group Discussion: Assessment of Utility of Mobile Systems for OSOCCs

Again, as described above the designed question guideline visible on a projector screen was merely giving an impression of central questions for the session:

- Q: Does the use of multiple mobile devices/systems lead to the creation of more accurate and timelier maps?
- Q: Does the use of multiple mobile devices/systems enable more accurate and timelier response plans?
- Q: Can a single map showing feeds from different devices be understood by practitioners?
- Q: What enhancements and developments are necessary to improve the experienced shortcomings?

Session 2 focused on interoperability and utility of different systems working together for OSOOC operations. Accordingly the panel was composed of 3 experienced OSOCC leaders (Austrian Ministry of Defence and Sports, Danish Emergency Management Agency, UN WFP) and moderation was done by a senior crisis manager of UN OCHA.

4.6.1 Panel / Group Discussion Outcome

> ***"In the chaos of real disaster situations technology often is not that helpful. At later stages of crisis management it definitely is useful. But in general, technology use for technology's sake is a bad idea."***

At the beginning of the evaluation session on the utility of mobile devices for crisis management very fundamental questions were raised: What is the real benefit of technology usage? Is there an unquestioned process of introduction of (new) technology driven by unjustified hopes or false promises? Any ICT development or introduction should be user driven. If and only if it contributes to the tasks at hand it is worth looking into that technology. There was suspicion among the participants that sometimes software takes the center of stage in technology adoption processes disregarding the (maybe missing) users' needs.

> ***"Mobile devices are useful but don't trust the technology or rely solely on it. You always need a fallback solution if technology fails."***

The well-known vulnerability that goes hand in hand with the introduction of any ICT system has to be addressed properly. Computers, servers, devices, or software will fail. Back-up systems add security but one has also prepare for the worst case. What happens if all collected data from the field is lost or just becomes inaccessible for some time? Proper procedures have to be established that ensure continuing OSOCC operability in case of total ICT failure. Automatic paper based dumps of collected data, analyzed information, and situational assessment could be worth looking into. Relying solely on technology not only introduces vulnerability but also could limit one's scope of action. Interoperability of incoming paper based information with used ICT systems has to be equally ensured as interoperability of different technological systems.

> ***"One should combine paper and electronic procedures. An interactive whiteboard and separate logging system could make sense."***

Drawing on a map, sketching plans of action, or manually marking points of priority are not actions performed after a situational assessment took place to communicate the outcome but are integrated parts of coming to an understanding of a situation. The value of - in the context of omnipresent ICT - such "antiqued" working practices should be accounted for in providing ICT solutions allowing for this. Interactive whiteboard systems displaying high precision real-time data but in the same time allowing to collaboratively draw and scribble with digital ink while analyzing and interpreting are one example of a fruitful combination of this two worlds.

> ***"Both field teams and OSOCCs should have technology support staff."***

The more complex utilized and deployed ICT becomes, the more support is needed for the smooth operation of these systems. Crisis managers, field assessment experts, etc. should be able to concentrate completely on their challenging tasks and not have to deal with system setup, bug fixing, or troubleshooting ICT. Against the background of the already mentioned certainty of failure of technological systems at some time this becomes the more important.

It was mentioned by participants that different organizations provide already such support packages: International Humanitarian Partnership (IHP) offers different modules e.g., information and communications technology support, a tented office and equipment for the setup and management of an OSOCC, basic staff functions within an OSOCC, etc. Also the WFP or ECHO have similar offerings.

> ***"[You] cannot push devices or technology on the humanitarian community. The different organizations have to show up with their own devices. And as coordinator you just want to tell them to download this or that application and use it."***

It was mentioned on several occasions in the discussion that ICT systems should be as open as possible. They should be able to interoperate and share information. Different information needs may be addressed by different data collection applications that should be able to install without any problems on any devices present in the field. Open system architectures, open protocol standards, and open interface specifications should be developed and/or adopted for a maximum of flexibility and interoperability.

> ***"The validity of information is key. It is about the trustworthiness of the source. One problem with electronic systems is that information comes in so fast that there is no time for validation."***
>
> ***"Crowd sourcing is a huge resource. The open question is how to use the information and how to validate it."***

In traditional reporting situations validation is an integral part of the field team members reporting to OSOCC staff who is able to ask for clarification or even request help in the interpretation of the reported information. Participants stated that in an eOSOCC it is not possible to question every incoming piece of information and ensure its validity. This could either be addressed by having enough trust in the source or by establishing procedures that provide validation capacity like de-briefing sessions.

When it comes to crowd sourcing, of course, de-briefing sessions are not possible but by the size of the crowd the reported information may become trustworthy to some extent. Trust in and validation of crowd sourcing information remained an open question in the discussion.

"[Tools] are needed to create and provide a moderated new feed available to field teams."

Already in the hot wash-up discussion immediately after the experiment the need for a back channel was stated. Whereas at that time information verification and validation was the crucial factor for this request, here a new quality of communication is addressed: feeding the "big picture" back to the field teams providing them also with an up to date situational awareness. Parts of this communication include command and control aspects but from a self-organization viewpoint: for instance all teams see in real time where the other field teams currently are thus being able to direct their own next movements to areas still to assess. Or a live picture of current needs allows e.g., teams in close range to react autonomously.

"Making sense of the information is critical. Huge amount of information is collected easily. But processing and sense-making is the problem."

"[The] flood of incoming information was not understandable for the OSOCC team."

"The categorization and interpretation should take place in the OSOCC and therefore tools are needed to support this."

"We have seen automated data collection but there is no automated data analysis so far."

Probably one of the most prominent outcomes of the discussion on the utility of mobile devices was the need for proper software tools to deal with the collected data. As indicated in the four citations above several levels of information processing have to be addressed. It starts with rather simple functionalities like selecting different data sources and filtering specific report categories. More complex operations on the data include e.g., encoding of categorizations / interpretations and establishing relationships between data have to be available to OSOCC staff. And finally, to some extent even automatic data analysis should be possible.

"Future research should investigate on how to produce a common operational picture of a situation. Currently maps are sent around and updated constantly. For this technology support is also needed."

"End users want systems that are capable also to produce overviews e.g., what is needed for how many people."

An OSOCC software suite should also be able to generate reports that are needed to communicate a current situation. Periodic situation reports (SitReps) usually have to be produced on an evolving crisis. Summarizations of different aspects (water & food needs, hazards, security threats, etc.) on very detailed or rather abstract levels are often needed. These reports - at least partially - could be generated fully automatic by the ICT system(s) in the OSOCC used to assess the situation.

5 Recommendations

The outcomes showed that both paper and electronic OSOCCs reached a similar situation awareness in the same time, identifying similar needs and locations for prioritization, but only the eOSOCC had products available as sharable electronic maps and documents. The pOSOCC would need at least 30 minutes to come to the same result. The other advantage of the eOSOCC was the possibility to monitor a situation changing over time (to be precise in this case a changing situation awareness as all placed markers were static) and the possibility to keep track of the situation (awareness) evolution.

5.1 Status-Quo and Further Development Needs

Mobile technology is mature and can be deployed in an interoperable way. However, as soon as it comes to interoperable sharing, the information of each and every system leaves the proprietary applications for processing and analyzing the data. Therefore, processing tools and training to these are needed.

The main impression from the eOSOCC team was that there is a lot of potential. Having access in real-time to field information was felt to be extremely useful. However, at the moment tools and procedures are missing for exploiting this benefit. Most important are tools to curate, filter, manipulate, edit, and delete assessment information of all teams (i.e. post processing tools). While part of this can be achieved by APIs to the different systems, a non-destructive way to edit or delete data is also needed because the original feeds might be required for other purposes as well. This implies the import of feeds into a dedicated OSOCC software suite that gives full control over the data to OSOCC staff. For the development of such a software suite available design guidelines originating from the research areas of Information Visualization and Visual Analytics should be considered as the information processing needs in an OSOCC are closely related to the exploration and sense-making cycles inherent in the mentioned research fields. The participants encouraged a follow-up workshop after such tools are developed.

5.2 Process for developing systems

The group of practitioners gave some concrete recommendations on how mobile technology can be improved and integrated in humanitarian operations. They considered workshops like this one an essential tool, but it is more important to have a dedicated community that has regular activities or meetings on the topic to keep the momentum of development ongoing. A forum for technology providers to exchange ideas and products would be useful. The contribution of practitioners to this dedicated community is of great importance because only they can ensure the very vital input for a user and task driven development of proper ICT systems.

Besides physical workshops or exercises, tools like table top exercises and dedicated technical teleconferences are as important. Gradual integration in Standard Operating Procedures and adaptation of training curriculums is a way to integrate mature technology in the existing assessment practices of operational organizations. The more open the architectures and standards of these technologies are, the likelier is the integration and adaption process.

6 Acknowledgements

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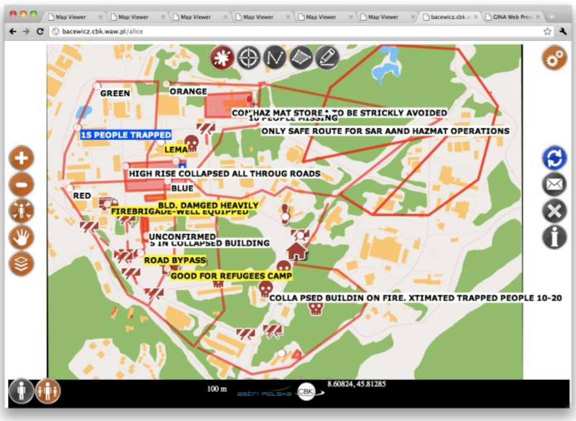
7 Annex A: Participating Systems

The following 7 systems participated in the experiment, of which 6 with active attendance of the respective technology providers. All of them offer sophisticated functionalities in their server side or desktop applications (cf. screenshots of desktop or web-based applications).

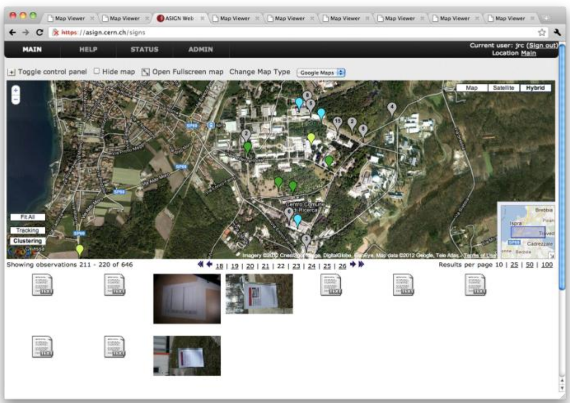
7.1.1 Alice by Astri Polska Sp. z o.o., Warszawa, Poland

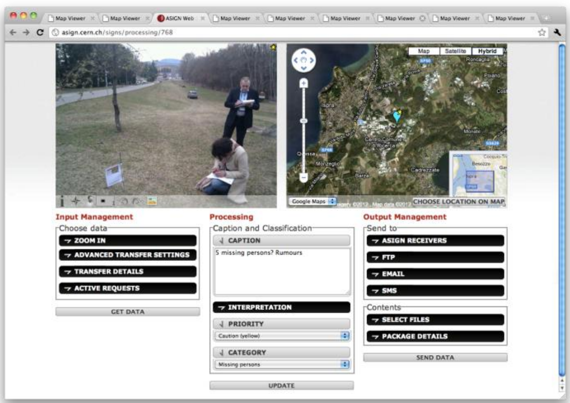
ALICE (Adaptive Layers for Information and Collaboration in Emergency) allows for rapid exchange of information between the various rescue units in the field and between field units and headquarter. ALICE provides a variety of information (GIS data, aerial and satellite images, units' localization, meteorological data, etc.) directly to the user in the field. ALICE was created with the strong support of Polish firemen and was designed according to the philosophy that to share an operational picture and to support decision making a shared geographic environment is crucial. [cf. http://www.astripolska.pl/0,1,93.html]



7.1.2 ASIGN/GEO-PICTURES by AnsuR, Fornebu, Norway

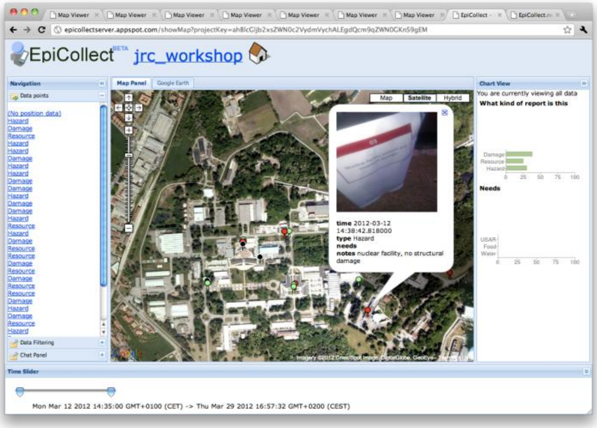
ASIGN (Adaptive System Image-communications in Global Networks) is an innovative Image Communications Solution, providing the most efficient transfer of high quality photos, videos and other sensory data. The fundamental challenges in digital communications form the basis for ASIGN: The need for rapid access to high quality visual data from remote field sites anywhere in the world. […] ASIGN allows all images the observer wants, in any resolution required, to be sent to an operations centre. [cf. http://www.ansur.no/index.php?option=com_content&view=article&id=100&Itemid=99]

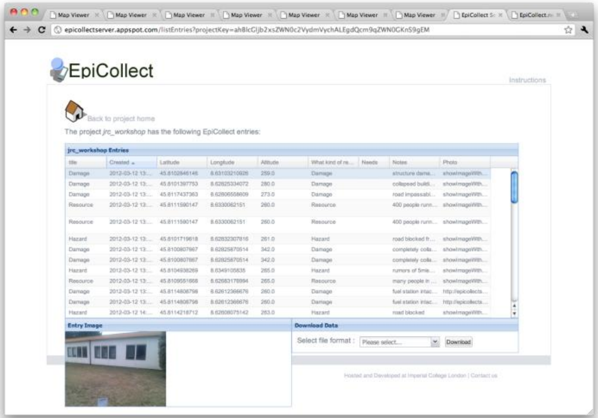




7.1.3 EpiCollect by Imperial College, London, United Kingdom

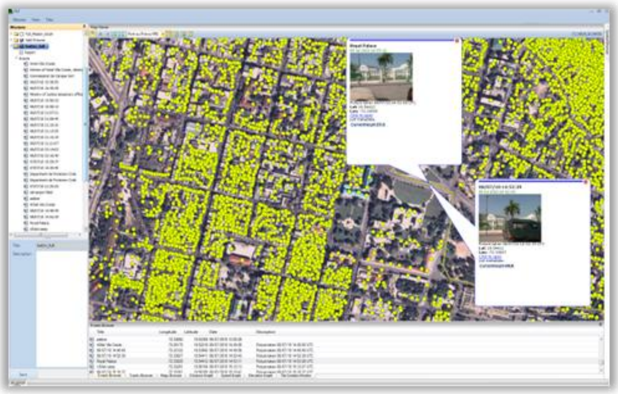
EpiCollect.net provides a web application for the generation of forms and freely hosted project websites […] for many kinds of mobile data collection projects. Data can be collected using multiple mobile phones running either the Android Operating system or the iPhone (using the EpiCollect mobile app) and all data can be synchronised from the phones and viewed centrally (using Google Maps) via the Project website or directly on the phones. [cf. http://www.epicollect.net/]





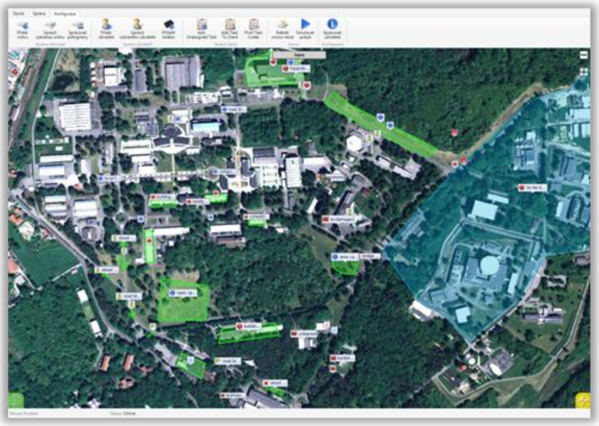
7.1.4 Field Reporting Tool (FRT) by JRC, Ispra, Italy

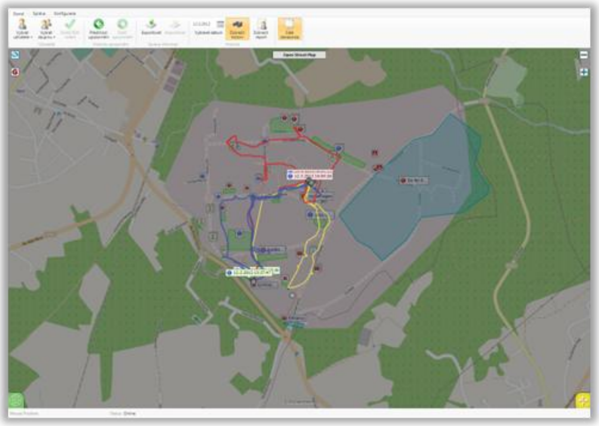
The Field Reporting Tool supports crisis situation awareness and post crisis needs assessments. During all phases of crisis management, it facilitates exchange data between headquarters and field teams in the most efficient and secure way to ensure timely shared situation awareness, and to better serve the field teams with shared situation assessments. All the information is stored in a common repository and shared among all the crisis players through a web portal and other geographic aware systems.



7.1.5 GINA System by GINA Software s.r.o., Czech Republic

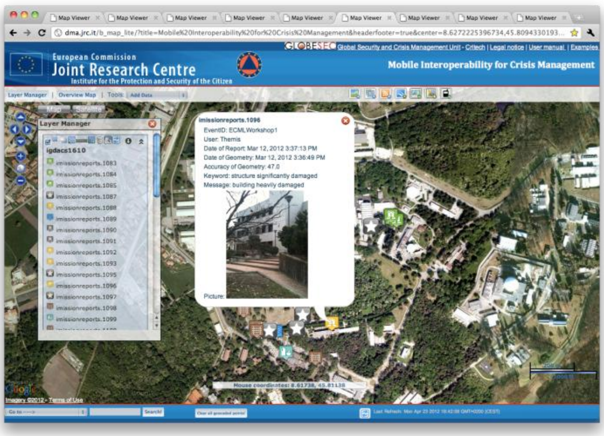
GINA is an interactive map software for mobile devices permitting navigation in difficult terrain, teams' coordination, and effective exchange of geographic information. Due to its features, GINA is destined for crisis management centres, rescue teams and other groups operating in difficult conditions. […]GINA is easy to control, because the use of the application has been inspired by an ordinary paper map. Just like you can draw on a map with a pen and stick a pin of various colours in it, GINA enables you to insert your own drawings […]. [cf. http://www.ginasystem.com/gina-system.htm]





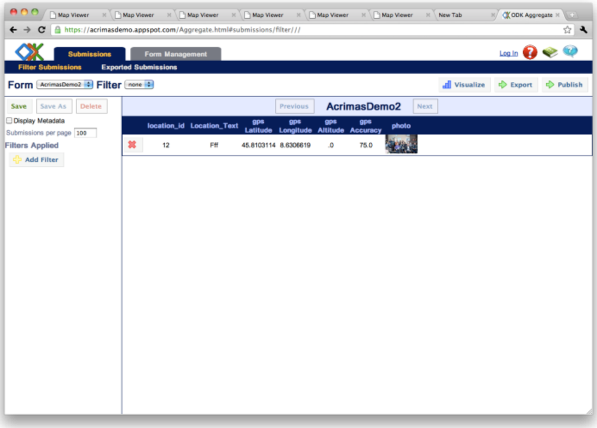
7.1.6 iGDACS by JRC, Ispra, Italy

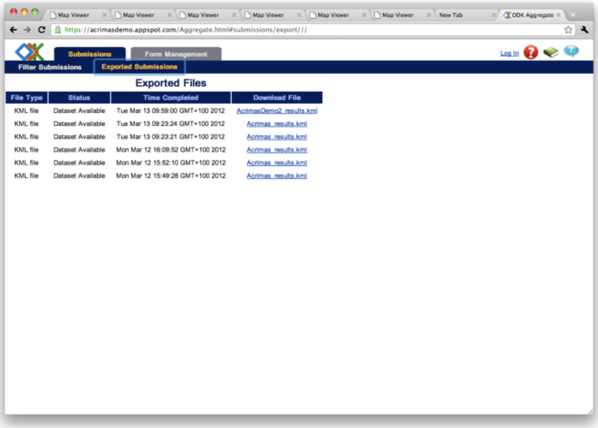
iGDACS provides near real-time information about natural disasters and gives the possibility to send back information in the form of a geo-located image and/or text. The Global Disaster Alert and Coordination System (GDACS) is a cooperation framework between the United Nations, the European Commission and disaster managers worldwide to improve alerts and information exchange. iGDACS is intended to tap the abundant information about disasters available from people who actually experience them. Reports of the iGDACS users are used to improve the overall situational picture. [cf. http://i.gdacs.org/]



7.1.7 Open Data Kit by University of Washington and Google (presented by UN WFP, HQ office in Rome)

Open Data Kit (ODK) is an open source data collection tool for Android phones, developed by the University of Washington with the collaboration of Google. It has developed a large user community and is currently in use in many developing and developed countries. It consists of 3 components: "build" for building the data collection forms in the XForms format, "collect" which is the app for the data collection that runs on android phones and transmits the data using mobile internet connection, and "aggregate" which is a server application to receive, publish and export the data. Aggregate can be installed on the cloud-based Google Application Engine, or on a local server. The World Food Programme is currently developing customised versions of Open Data Kit and of FrontlineSMS to enable ODK to work with SMS-based text messaging and to enhance some of the mobile and server's data collection capabilities. [cf. http://www.opendatakit.org]





8 Annex B: System Set Up / System Customization Form

Please record relevant aspects of the system set up (project/mission creation, user administration, …) and the system customization process (definition of forms, labels, tags, …) in your team.

System	ASIGN ☐ Alice ☐	FRT ☐ iGDACS ☐	EpiCollect ☐ GINA ☐

	Procedure to Set Up Information Sharing
Time Needed	
Expertise Needed	
Remarks	
	Procedure to Customize System (Forms, Tags, Labels, Icons, …)
Time Needed	
Expertise Needed	
Remarks	

9 Annex C: Field Experience Form – Mobile Device Usage

Please record all relevant aspects of your field mission: e.g., report submission (to be able to cross-check their reception), usability problems, semantic encoding of encountered information, …

Team		**System**	ASIGN ☐ Alice ☐ EpiCollect ☐ GINA ☐	FRT ☐ iGDACS ☐ ☐ ☐

Time Marker	**Mobile Device Usage -- Action / Observation / Problem**

10 Annex D: Field Experience Form – Paper Based Information Collection

Please record all collected information on this paper. You might also include comments on e.g., troubles of semantic encoding of encountered information, …

Team	

Time Marker	Recorded Information / Meta-Comments

11 Annex E: Marker template for providing information to be collected by field teams

Marker ID Number

Description of actual situation encountered at placed location. No title or categorization is used as it is part of the experiment how field teams encode discovered information semantically to fulfill the information needs stated by the OSOCC.

Field teams can decide to leave marks on visited locations to communicate to other teams which may arrive later on the same spot. It is not actively encouraged by a dedicated form area but possible on space intentionally left blank on this marker sheet. Whether to leave marks or not is left to the field teams and/or instructions given by the OSOCC.

This marker was placed for the ***1st JRC Crisis Technology Workshop on Mobile Interoperability for Crisis Management, 12-13 March 2012*** *by the Crisis Monitoring and Response Technologies (CRITECH) Action, Global Security and Crisis Management (Globesec) Unit, Institute for the Protection and Security of the Citizen (IPSC).*

Please do not remove! *For inquiries contact: Markus Rester, -3805, markus.rester@jrc.ec.europa.eu*

12 Annex F: Overview Map of Placed Markers and NO GO Zones

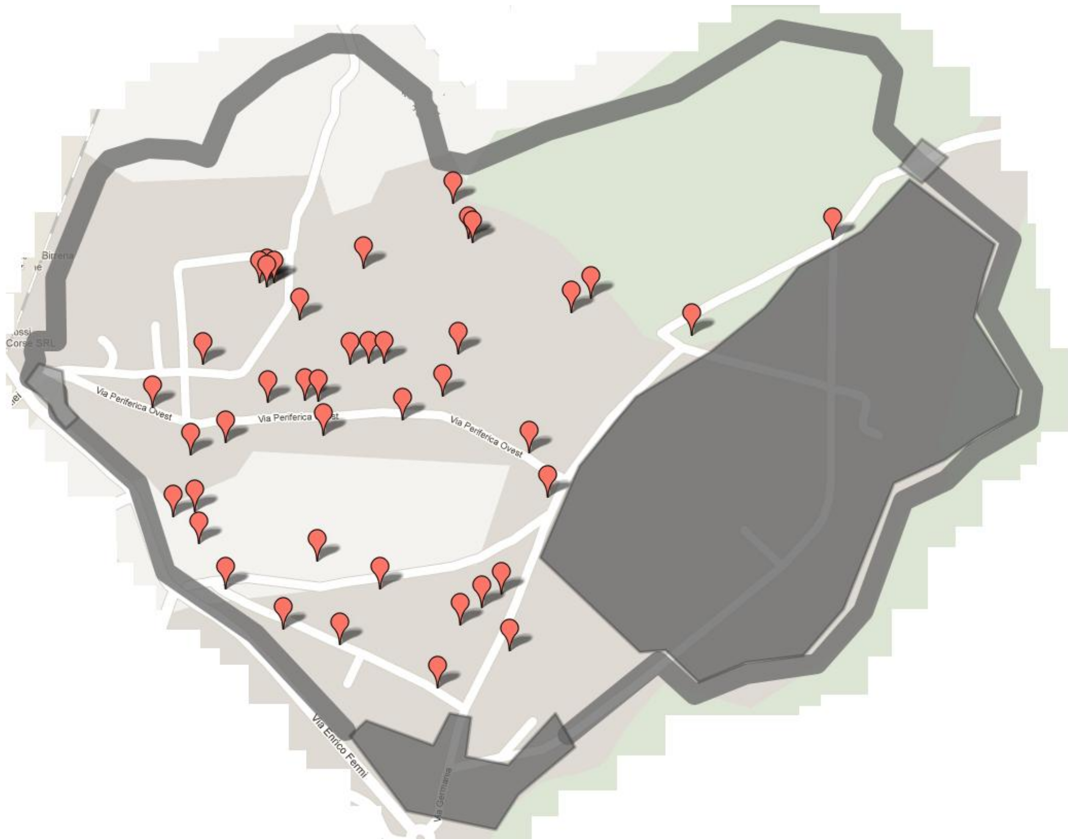
All field teams received the following overview map to lead them to the placed markers.

Please, ***do not enter any zones marked grey****!*

Please, ***do not photograph any sensitive areas****, including nuclear installations, any entrances to the JRC site, the site perimeter fence, Security staff, vehicles or details of related installations!*

Prefer close-ups to wide angle shots that would eventually allow the straightforward identification of the location and any inherent details!

Security Service may ask to review the collection of photographs and take any necessary measures to avoid the disclosure of JRC Ispra site images containing details deemed sensitive. In case Security Service addresses you please refer them to our contact person from Security Service being aware of our workshop:
Teijo Lehtinen   +39 0332 78 [removed]



13 Annex G: OSSOC Instructions and Templates

OSOCC
Instructions and Templates

1st JRC Benchmarking Workshop
ACRIMAS Pilot Case

Task: prepare a 10 min situation briefing

- **Situation overview (map format)**
- **Priority needs and need for additional resources (table format)**
- **Plan of Action**
- Logistics arrangements (optional)
- Communications (optional)

Task: prepare a 10 min situation briefing

Situation overview (map format)
- **affected areas/population, impact, national and international activities**

Priority needs and need for additional resources (table format)
- **USAR, WASH, shelter, health, expertise, etc.**

Plan of Action
- **Allocation/assignment of available resources (Base of Operation, operational areas for USAR teams and WASH)**
- **Safety and security constraints (crowd gatherings, blocked roads, HAZMAT, etc.)**

Task: prepare a 10 min situation briefing

Other standard items in OSOCC, but less relevant to this workshop

Logistics arrangements
- **procedures to obtain petrol, lubricants water, transport, translators**

Communications
- **VHF call signs and frequencies**
- **Other communication devices (e.g. GDACS Virtual OSOCC)**
- **National and international coordination setup (place and role of LEMA, OSOCC, RDC, etc.)**
- **Next coordination meeting**

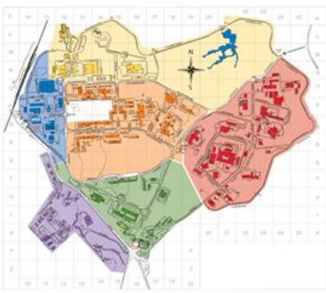
OSOCC resources

Available resources
- ***USAR teams***
  - *4 heavy*
  - *3 medium*
  - *5 unclassified*
- ***Water***
  - *1 water purification unit*
  - *3 inflatable water tanks 5000 l*

Safety and security
- **crowd gatherings**
- **blocked roads**
- **HAZMAT**

Situation map

Situation map



Priority Needs

	Needs	Priority	Comments
USAR			
WASH			
Shelter			
Health			
Expertise			

European Commission
EUR 25348 – Joint Research Centre – Institute for the Protection and Security of the Citizen

Title: **Interoperability of Mobile Devices for Crisis Management - Outcomes of the 1st JRC ECML Crisis Technology Workshop**

Author(s): Markus Rester, Tom De Groeve, Alessandro Annunziato, Daniele Galliano, Andreas Hirner, Luca Vernaccini, Stefano Paris

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Abstract

The 1st JRC ECML Crisis Technology Workshop on Mobile Interoperability for International Field Deployment took place in the European Crisis Management Laboratory (ECML) of the Joint Research Centre in Ispra, Italy, from 12 to 13 March 2012. 37 participants attended the workshop. They were coming from: 11 EU countries and Norway, Brazil and US, 3 UN agencies, and 2 NGOs.

The workshop's purpose was to measure the added value of mobile assessment technology for rapid situation assessment in international emergency operations. Seven mobile assessment systems were deployed among the participants and needed to provide, in an interoperable way, real-time data to a single electronic On-Site Operations Coordination Centre (eOSOCC). The performance of the systems was benchmarked against a traditional paper-based assessment that was conducted simultaneously (pOSOCC).

In the workshop experiment both paper and electronic On-Site Operations Coordination Centres (OSOCCs) reached a similar situation awareness in the same time, but only the eOSOCC had products available as sharable electronic maps and documents. The final map with all incoming feeds in the eOSOCC was very cluttered and there was considerable information overload. Therefore sophisticated editing, filtering, and visualization functionalities have to be available for eOSOCC staff.

Mobile technology is mature and can be deployed in an interoperable way. However, then the information of each system leaves the proprietary applications for processing and analyzing the data. The main impression from the eOSOCC team was that there is a lot of potential. Having access in real-time to field information was felt to be extremely useful. Still missing are tools and procedures for exploiting this benefit. Most important are tools to curate, filter, manipulate, edit, and delete assessment information of all teams. A dedicated eOSOCC software suite is needed that gives full control over the data to the eOSOCC staff.

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As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

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