*Driv*ing Innovation in Crisis Management for *E*uropean *R*esilience

D43.11 - Damage and Needs Assessment Experimentation Report

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List of Acronyms

Abbreviation / acronym	Description
CM	Crisis Management
COP	Common Operational Picture
DEWS	System for Tsunami Warning
DLR	German Aerospace Center
EmerT	Emergency Mobility of Rescue Forces and Regular Traffic
EMM	Europe Media Monitor
ESS	Emergency Support System
GCS	Ground Control Station
GDACS	Global Disaster Alert and Coordination System
ICT	Information and Communication Technology
KML	Keyhole Markup Language
MEGO	Floods Modelling solution
OGC	Open Geospatial Consortium
PROCeed	Situation analysis solution
REST	REpresentational State Transfer
RIB	Decision support database
RPV	Remotely Piloted Vehicle
RPAS	Remotely Piloted Aircraft System
SITRA	Solutions suite for situation reasoning
SUMO	Simulation of Urban Mobility
TRL	Technology Readiness Level
U-FLY	Ground control station (GCS) for Remotely Piloted Aircraft (RPV)
ZKI	Center for Satellite Based Crisis Information
CBRN	Chemical, Biological, Radiological and Nuclear (referred to threats)

Project Description

DRIVER evaluates solutions in three key areas: civil society resilience, responder coordination as well as training and learning.

These solutions are evaluated using the DRIVER test-bed. Besides cost-effectiveness, DRIVER also considers societal impact and related regulatory frameworks and procedures. Evaluation results will be summarised in a roadmap for innovation in crisis management and societal resilience.

Finally, looking forward beyond the lifetime of the project, the benefits of DRIVER will materialize in enhanced crisis management practices, efficiency and through the DRIVER-promoted connection of existing networks.

DRIVER Step #1: Evaluation Framework

- Developing test-bed infrastructure and methodology to test and evaluate novel solutions, during the project and beyond. It provides guidelines on how to plan and perform experiments, as well as a framework for evaluation.
- Analysing regulatory frameworks and procedures relevant for the implementation of DRIVER-tested solutions including standardisation.
- Developing methodology for fostering societal values and avoiding negative side effects to society as a whole from crisis management and societal resilience solutions.

DRIVER Step #2: Compiling and evaluating solutions

- Strengthening crisis communication and facilitating community engagement and self-organisation.
- Evaluating solutions for professional responders with a focus on improving the coordination of the response effort.
- Benefiting professionals across borders by sharing learning solutions, lessons learned and competencies.

DRIVER Step #3: Large-scale experiments and demonstration

- Execution of large-scale experiments to integrate and evaluate crisis management solutions.
- Demonstrating improvements in enhanced crisis management practices and resilience through the DRIVER experiments.

DRIVER is a 54-month duration project co-funded by the European Commission Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 607798.

Executive Summary

One of the first tasks in the management of a crisis is meant to provide a better understanding of the situation with an initial evaluation of the damages caused to the resources of the territory and the related impact on the population.

It requires the combination of observation and information extraction (from satellite and aerial images or from media and social platforms) with the knowledge of the territory in terms of population density, quality and quantity of infrastructures and the like.

The information technology required to integrate this knowledge is based on common traits that created a sort of paradigm in presentation, mainly based on georeferenced information.

In order to plan an experiment on the subject of damage and needs' assessment in 2016, during **November 2014 in Aix-en-Provence, the DRIVER consortium presented some tools, which could be valuable in the process of estimating the impact of a crisis. However, during the evaluation, more solutions than those initially foreseen were considered relevant by the evaluators.**

The results will be the basis to design the experiment of 2016, its working title being *"Assessment techniques integration: The 2015 Nepal Earthquake"***, also known as EXPE46.**

The deliverable presents the capabilities of the solutions presented in the scope of this task:

- **MSB RIB Dangerous Substances**
- **FOI SITRA**

As well as those, the evaluators considered relevant for the task:

- **ESS**
- **PROCeed**
- **MEGO**
- **CrisisWall**
- **EmerT**
- **ZKI**

The deliverable also analyses the feedback received from different evaluators and discusses the possible experiments for the second round of experiments and the synergies with other DRIVER solutions. The solutions presented, though various in nature, have common traits related to the features needed, like presenting geo-referenced information on a map. The overall quality level of the solutions is very high, since all of them are rated as mature and several solutions are already operative.

The evaluation was not fit to assess the solutions thoroughly, but to have the consortium build knowledge about them and the relations between them, in order to enable the design of the experiment linked to this Task 43.1 in the subsequent second round of experiments.

1 Introduction

1.1 Scope

The purpose of this document is to report on the experiment related activities lead by SP4 and more specifically by Task 43.1 "Damage and Needs Assessment" during the first experimentation round. During this first round, conducted in November 2014, a specific session took place to present all tools that are related to Task 43.1. Tool features were evaluated by different project partners or end-users. This was decided to enable the validation and presentation of solution related features on the one hand, and to develop ideas and concepts between different solutions on the other hand.

The outcome of the evaluation aims to disseminate knowledge about the available technologies from the project partners. A thorough and complete description and evaluation of the solutions will be covered by subsequent activities and experiments within DRIVER. The result provides an initial classification that created a much more integrated vision of the interaction between the different aspects of information and communication technology (ICT) applied to crisis management.

Based on the knowledge acquired, the project will have been able to draft a second round of experiments to be performed in 2016 and early 2017, which will have been designed in the forthcoming period.

The evaluation related to damage and needs assessment means to evaluate the effectiveness of the integration of the different means of assessment, exploiting data extraction from aerial images and from media and social networks, integrated with the field activities.

1.2 Document overview

This document contains the following chapters:

- A first chapter gives this introduction to the document,
- A second chapter discusses the concept of damage and needs assessment,
- A third chapter presents the results at task level, and
- A fourth chapter presents the conclusions that are derived from the experimentation round.

1.3 Reference Documents and Standards

This report refers to the following documents:

D41.1.1 Initial Inventory of Solutions - SP4 level report

Solution descriptions: see DRIVER Space

→ SP4: SP4 Solutions very short descriptions:
https://driver.atosresearch.eu/index.jsp?uuid=fb8f9121-45cd-47cc-927d-ce7f37be2881
→ SP4: SP4 1st Initial Inventory of Solutions (Aix) → Solution Descriptions
https://driver.atosresearch.eu/index.jsp?uuid=0f36372a-56d1-4c1c-82f4-e58d26e47da

2 Damage and needs assessment

This chapter discusses the content and relevance of Task 43.1 concerning the needs of first responders in a crisis situation.

2.1 Task description

Task 43.1 *Damage and Needs Assessment* addresses the need for enhanced situation and needs assessment, particularly:

- Solutions for gathering data from the field;
- Enhanced situation analysis including assessment of needs for reaction or evaluation of related vulnerability for preparedness;
- Preparation of information for supporting informed decision-making.

These needs are strictly related with each other and are meant to be combined in systems, usually of ICT, that improve the understanding of disaster risks and crisis evolutions.

Data flow from and to the field are nevertheless very different in their respective natures. Data flow from the field is required to create a better common operational picture (COP) of the situation, while the communication to the field, including team organization and dispatching, is an operational need of first responders. The latter is a task not strictly related to the scope of this document and it is therefore not covered in this study.

Field reporting can significantly improve the processes of assessments and evaluations by increasing the quantity of data; but it can also improve the processes themselves, when applied as control tools (e.g. verification of assessments previously performed through aerial imagery). The results of this kind of analysis can also be exploited to improve the field reporting, when used as references data (e.g. geographic layers), which leads to more focused operations on the field.

Gathering information from the field and from preliminary studies (vulnerability assessments) and prompt analysis (damage/needs assessments) would not be complete without the support of models to forecast the impact of the crisis. This does not only relate to Task 43.3, but requires also that the interoperability of tools will be taken into account.

The use of harmonized, which does not imply being common or shared, means to distribute information is needed to develop a system out of the single tools. Though the number of available standards is up to the needs, the technology exploiting them is limited and sometimes the tools are not even intended to perform as components of a bigger system. This was evident in some tools present in DRIVER that is considered resembling well the global presence of such tools.

To evaluate the effectiveness of the integration of the different means of assessment, based on different sets of tools, an experiment related to Task 43.1 is planned:

- Damage and Needs Assessment Techniques Using Nepal Earthquake 2015 (EXPE46).

2.2 Damage and needs assessment concepts

The relevance of this topic is very high in the first phase of a crisis, when the information are needed to establish a map of important areas and to provide the optimal allocation of resources. The combination of different means to extract the information improves the speed of the process, providing all the relevant information as soon as available. This integration requires an effort of harmonization and an appropriate rating of the quality of information.

An interesting field of application of the same techniques (for example; aerial imageries analysis for buildings, socioeconomic analysis for population etc.) used in damage and needs assessment is the vulnerability study of an area, an activity which can benefit from the same tools and procedures.

The recent developments of communication means available to the population, together with high level services connected with them (geolocation, data transmission of pictures and videos), created the paradigm of citizens as sensors, where the population provides additional information on large scale events.

By either providing aggregated voluntarily provided information (e.g. crowd mapping) or monitoring the flows of public information generated by the population (e.g. crowdsourcing), the crisis managers can receive first-hand information on areas, the first responders still did not assess or even reach, therefore adapting the response strategies to the needs of the population.

In EXPE46, to be performed in late 2016, there will have been a comparison of the value added to more traditional assessment methods by exploiting social media.

2.3 Related operational needs

This section discusses the way different projects have described the needs addressed by Task 43.1.

In the list of gaps identified by ACRIMAS (cf. [3]), three topics with identified improvement needs are closely related to the concept of damage and needs assessment:

- Damage and needs assessment;
- Acquisition of information from external sources;
- Efficient ways to gather data from first responders.

Within DRIVER, WP43 therefore assesses solutions that operationalise damage and needs assessment and for that purpose rely on the acquisition of information from a variety of external sources and organise efficient ways to gather data from first responders in the field.

The CRISYS project (cf. [4]) has identified eight main capabilities out of which four are particularly relevant to the Task 43.1. This also is an axis of improvement and technological evolution identified in DRIVER's D41.21 "*Vision on Response 2025*" **(cf. [5]) and D41.22** "*First stage State of the Art Response Systems*" **(cf. [6]):**

- **Communication: Exchange information between citizens, rescue workers and authorities;**
- **Situational awareness: Collect and present relevant static and dynamic information about the incident;**
- **Adaptable Command & Decision Support: Coordinate action between various rescue organizations;**
- **Restore of basic services: Restore basic needs of people (water, food) and infrastructure (electricity, transportation).**

Bringing these overall considerations closer to the aspect of damage and needs assessment, it is recommended to look at the EU-FP7-security project DESTRIERO that explains "operational needs" and "collaboration requirements" and "information management challenges". Even though it is **written for recovery and reconstruction, the fundamental aspects also apply to response activities and can therefore be adapted as follows (cf. [7]):**

1. **Support different NGOs working together on their separate, yet compatible, missions. Thus, do not influence the information systems and procedures of the organizations. Instead, provide loose coupling and deal with heterogeneous information systems.**
2. **The information owner must be capable to decide what information to share or not. Hence, it is important in a concept for damage and needs assessment to differentiate between the information an organization has and the information it is willing to share.**
3. **Key challenge is the inter-organizational collaboration, among others specifically between NGOs and partners from outside the effected region.**
4. **For the establishment of baseline information it is relevant to be capable of handling the Common Operational Datasets (COD), which are usually provided by UNOCHA.**
5. **Try to manage and track information needs expressed by organizations in order to satisfy their information needs in the future if possible.**
6. **Coordinated assessments should be supported, for instance by compiling comparable data into a single database for a shared analysis (harmonized assessments).**
7. **Calculate and present indicators for damage and needs in order to assess and monitor the disaster impact.**
8. **Optional: support decision making by administering potential measures. For this purpose, it should help to keep track of priorities and monitor activities in the field.**
9. **Support the day to day relief routines in extended operations with reporting functionalities like enriched maps, quick data analysis or data aggregation.**

Summarizing, we can identify the following needs:

- **Interoperability in terms of adoption of common standards in terms of formats and protocols (1, 3, 4, 6)**
- **User friendliness, easing an immediate use of the solution with little or quite no training (1, 3, 9)**
- **T**echnical maturity, which includes the adherence to the users' workflows and procedures (2, **5, 7, 8, 9)**
- **Produce information for other systems and audiences (1, 2, 6, 9)**
- **Support all the activities related to the crisis until and after it ends (5, 6, 8, 9)**

Therefore, the evaluations should assess not only the maturity of the tools, but also their capabilities to interact in the frame of a bigger system. In order to ease the integration, interoperability is a key aspect, achieved usually by adopting common protocols or formats. Another key issue is a multi-language user interface.

Geographic based data aggregators are extremely useful to integrate information from various sources into a common picture: this is achievable thanks to specific data formats that are now available to almost all solutions (Shapefiles[1], KML/KMZ[2], GPX[3] etc.), including free tools like GoogleEarth[4] or QGIS[5]. These allow even non-literate users to start consuming and producing georeferenced information.

It is in fact necessary to spread the use of georeferenced information to the level of office tools, like spreadsheets and word processors, since maps and related information are now very important to share and publish timely and effectively crisis related details.

1 Information available at https://doc.arcgis.com/en/arcgis-online/reference/shapefiles.htm
2 Information available at https://developers.google.com/kml/
3 Information available at http://www.topografix.com/gpx.asp
4 Available at https://www.google.it/intl/it/earth/
5 Available at https://www.qgis.org/it/site/

3 Task experiment report

All the solutions available in SP4 *Strengthened Responders* **were presented and evaluated during the** *Initial Inventory of Solutions* **in Aix-en-Provence, hosted by POLE from November 24th to 28th, 2014.**

A summary of this week and general conclusions are summarized in a joint document [1].

3.1 Evaluation sheet structure

The operational needs described in section 2.3 led to a set of features, which do not map one-to-one, because of the scope of this initial inventory activity. The rest of the evaluation is covered by subsequent evaluation activities in DRIVER, for instance the interoperability level achieved by the solutions in work packages 42 and 45.

In order to widen the pool of evaluators, the evaluation sheets are based on a more generic description of the needs. Therefore, the basic capability of interoperability, for instance, is addressed by the sub-feature *machine-readable info* **and the user friendliness is accounted for by** *human-readable info* **and by** *Information preparation***.**

Task	Feature	Sub-Feature
T43.1 Damage and Needs Assessment	Gathering data from the field	Human-readable info
		Machine-readable info
	Situation analysis	Alerting
		Statistics and trend analysis
	Assessment of risks	Risk catalogue
		Simulation solutions
	Information preparation	Map view
		List view
		Report generation
	Decision support	Information processing for decision making purposes
		Automatic decision modelling

Table 1: Solutions' evaluated features

The solution features related to Task 43.1 are described and evaluated in 3.3 with the help of the table above. Features and sub-features of each solution are rated by the evaluators. Additional free text fields allowed the evaluators to give remarks and an overall impression.

For a complete reading of the evaluators' work, please refer to the **Annex: Evaluation sheets. it contains the evaluation sheets and the free text impressions by the evaluators.**

3.2 Solutions involved

The following solutions are presented specifically as relevant for T43.1:

Solution	Provider	Session	Evaluators
RIB and Dangerous Substances	MSB	T43.1	TNO, THW, IAO, DLR, TCS
SITRA	FOI	T43.1	TNO, THW, IAO, DLR, TCS

Table 2: Selected solutions

According to the provider description, the following solutions also provide some of the mentioned features. Therefore, they are considered relevant for T43.1 and the evaluators rated them as well.

Solution	Provider	Session	Evaluators
ESS	GMV Sistemas	T43.4	TNO, AIT, MSB
PROCeed	ITTI	T43.3	TNO, THW, IAO, DLR, TCS
MEGO	HKV	T43.3	TNO, THW, IAO, DLR, TCS
CrisisWall	JRC	T43.3	TNO, THW, IAO, DLR, TCS
EmerT	DLR	T43.1, T43.2, T43.3, T44.2, T44.4	MSB, THW, WWU, Pole Risque
ZKI	DLR	T43.1, T43.2, T43.3	MSB, THW, WWU, Pole Risque
U-FLY	DLR	T43.2	MSB, THW, WWU, Pole Risque
SUMO	DLR	T44.2	MSB, THW, WWU, Pole Risque

Table 3: Additional solutions

3.3 Inventory results

3.3.1 Solutions feature coverage overview

The table below shows the feature coverage by solutions as result of the evaluation, ordered by the tasks.

(dark green=FULLY COVERED & DEMONSTRATED, light green=COVERED (according to solution provider but no demonstrated), yellow=PARTLY COVERED, white=NOT COVERED)

Fully Covered / Covered / Partly Covered / Not Covered	Task session	T43.1: Damage and Needs Assessment		T43.4: Interaction with citizens	T43.3: Crisis dynamics & early warning			T44.2 Tasking and capacity monitoring	T43.2: Airborne Sensor Processing		
	Solution supplier	MSB	FOI	GMV Sistemas	ITTI	HKV	JRC	DLR	DLR	DLR	DLR
	Solution name	RIB	SITRA ZKI	ESS	PROCeed	MEGO	Crisis Wall ZKI	EmerT	U-Fly	ZKI	SUMO
Feature	Sub-feature										
Gathering data from the field	Human readable info										
	Machine readable info										
Situation analysis	Alerting										
	Statistics and trend analysis										
Assessment of risks	Risk catalogue										
	Simulation solutions										
Information preparation	Map view										
	List view										
	Report generation										
Decision support	Information processing for decision making purposes										
	Automatic decision modelling										

Table 4 Solutions' feature coverage

The tables shows that the presented set of tools has a good coverage across tasks and features alike. Each tool is capable of at least one feature and T43.1 *Damage and Needs Assessment* is already covered at least partly across all features. The subsequent development of the inventory of tools will discuss in how far the coverage is sufficient or if open gaps remain to be closed.

The next sections give a short description of each tool listed above along with an evaluation and, if available, a statement of the tool provider regarding the application and development status of the tool. The evaluation given here is a summary of the comments by the evaluators and discusses aspects beyond the feature fulfilment. For a more detailed description of the fulfilment table above, please see the evaluation tables in the Annex: Evaluation sheets.

3.3.2 MSB RIB and Dangerous Substances

RIB is a decision support solution by MSB tailored for first responders but used in many professions in containing a knowledge base of 18,000 documents, data of 5,000 items of hazardous substances and resources (equipment and experts). The RIB acronym stands for "Resources and integrated decision support". RIB is presently only available in Swedish language. The desktop version (Windows based) has the advantage of being usable offline, while as a web application it is partially usable using an online translation system.

3.3.2.1 Evaluation

The high quantity of cross-references is identified as useful. Particularly the link between substance and relief resources is new and interesting. The integration with other tools, for instance sharing the information by email, is posing some interoperability limitations. Where available, geographic information is not displayed on a map, which increases the effort to extract such information. Databases of this kind are extremely valuable, when constantly maintained. The language limitation in the current state hinders the adoption by other member states.

3.3.3 SITRA

SITRA is a suite of research prototypes solutions by FOI, which combines techniques such as adaptive situation based reporting, semantic technologies and risk modelling in order to improve situation awareness.

SITRA has three main components at current date:

- A mobile application for gathering data from the field
- A situational awareness operational picture (COP)
- A framework for risk models that can be used to predict events, get early warnings, identify information gaps, and assess risks

The content of the risk models is dependent on the users' needs and are therefore not explicitly predefined. However, a solution for creating risk models is available (Impactorium[6]). SITRA can be configured to be used in various crisis settings. The idea is that the risk models are developed by, or with the help of, domain

[6] R Forsgren, L Kaati, C Mårtenson, P Svenson, E Tjörnhammar, in Skövde Workshop on Information Fusion Topics (SWIFT 2008). An overview of the Impactorium tools, 2008

experts and validated before use. The risk models define how to calculate the probability, impact and risk for an event given a set of available data on the situation. An ontology is used as a basis for information exchange between the components. Data collected by the mobile application is fed into the operational picture. Individual data items, such as incident reports as well as overlays representing risk types per geographic area, are accessible from the COP. The risk values used in the overlays are calculated based on risk models. The risk model can potentially also be used to identify information gaps and prioritize information acquisition activities. The mobile app interface will reflect the current information need in terms of highlighting prioritized form fields and asking the user to report on certain matters.

3.3.3.1 Evaluation

Even if at an advanced development stage, the solution was not developed in tight collaboration with the end-users. This is perceived as a lack of vision. Many features are interesting and well developed, but their design is not fully aligned with end-user needs. The interoperability of the solution is very limited. It only accepts information from the field, which was created with its own mobile application. It is also not clear, in how far the solution is dependent on a working infrastructure, for instance mobile connection and use of background maps.

3.3.3.2 Statement of the solution provider

SITRA is a research prototype and its purpose is to try out and experiment with technologies for enhanced situation awareness spanning the whole chain from information collection, processing and analysis, and presentation based on semantic technologies. The technologies used have to some extent been studied and applied in other domains, such as military intelligence and port security. From a pure technological perspective, SITRA is relatively mature. However, as the evaluators have pointed out, several concept aspects are still relatively immature. For instance, the use of risk models in a crisis situation needs to be studied in greater detail and validated before any conclusions can be made. Other areas that need more work are information quality aspects and information weighting.

SITRA is at current date generic and not tailored to for any specific scenario. In order to test and explore if the concept is useful, it is planned to configure the system to be used for a specific crisis scenario. In addition, the involvement of domain experts and end-users will be increased in order to get the feedback to improve the concept.

3.3.4 ESS

The Emergency Support System (ESS) by GMV Sistemas is a suite of real-time data-centric technologies, which will provide actionable information to crisis managers during abnormal events. This information will enable improved control and management, resulting in real-time synchronization between forces on the ground (police, rescue, firefighters) and out-of-theatre command and control centres (C&C).

3.3.4.1 Evaluation

Even if listed in the category *Interactions with citizens*, the tool is well designed to operate in the context of crisis management. In order to create a valuable COP, it allows incorporating different information including

outputs from models. Assuming a fine-grained control and a technical solution for high numbers, the feature to send alert SMS messages is very important, considering that is independent from the network availability. It has to be inserted in the daily activities, though, in order to provide the users with a familiar environment during the crisis management activities. Its maturity is high and it is ready to get operational.

3.3.4.2 Statement of the solution provider

The main goal of ESS is to present crisis managers with the COP of a crisis to improve their situational awareness. As one of the evaluators mentions, ESS is well suited to act as a middleware to show information from several sources. Regarding crisis dynamics and early warning, ESS contribution is limited to the distribution of warnings, broadcasting SMS messages through phone network (requires involvement of ALCATEL Lucent) or network hijacking (requires the use of an IMSI catcher, which is legally troublesome). Given the high number of solutions available for this task, it is proposed to consider ESS as a backup option and to focusing more on crisis dynamics and early warning.

3.3.5 PROCeed

PROCeed is a platform for authoring and playing interactive situation models by ITTI. It allows training crisis managers by playing an interactive game in a dynamic environment. It provides common situation awareness and communication between crisis managers. The interactive situation model processed by the platform consists of sequences of events. The events depend on the answers of users. Usually several users playing different roles must cooperate to realize the intended goals. The off-the-shelf models of flood, epidemic, train accident, etc. are available to play as a simulation decision-based games. The PROCeed server is available over the internet. It is used for several years at Polish higher education schools.

3.3.5.1 Evaluation

The tool applies gaming paradigms to the simulation and training activities, in order to let crisis managers face realistic simulated situations. This helps them improving their crisis management skills. However, it does not reflect a real environment, because the operators have to work within PROCeed environment. It would be better, if the tool would feed scenario data into a system the crisis managers work with on a daily basis and train them in their normal environment. Their confidence with the tool would then improve. Furthermore, it is not clear how the decisions and actions of the trainees are rated in order to provide an evaluation of their performance.

3.3.6 MEGO

MEGO by HKV creates flood hazard maps based on sensor or satellite data, or user estimates for dike breaches. Hazard scenarios are calculated in terms of maximum depths, consequences to roads, transport lines and buildings, to be used in the threat assessment and development of disaster plans (for example: evacuation plans, location of shelters etc.). MEGO is currently in operational use for flooding in Netherlands and is connected to other front-end tools, like the mobile application "**Overstroom ik?**".

3.3.6.1 Evaluation

This solution is very mature and used in operational contexts. It would also be beneficial to use it for training. The content is presented in a clear and effective way, allowing to aggregate actual information with forecasts. It should be stated that MEGO relies heavily on the network, which is less problematic for early warning situations. Due to the pre-computed scenarios, the use outside of the Netherlands is to be evaluated.

3.3.7 CrisisWall

The CrisisWall software by JRC is targeted to the principal emergency management tasks in a national or international crisis room, such like the European Emergency Response Centre. Driven by the outcomes of previous research and ECML (European Network of Crisis Management Laboratories, see requirements in D27.1 *"Requirements for Establishment of the ENCML"* **[2]) experiments, the following tasks were identified as having the most potential to benefit from the CrisisWall:**

- **Surveillance**
- **Activation: analytical tasks for an emergency**
- **Presentation**

Features provided by CrisisWall include:

- **Real-time data gathering**
- **Sense-making: filter, search a COP**
- **Event management**
- **Consult COP (multi-platform)**
- **Collaborative analysis -> social graph**
- **Varied visualizations**

The main scope for the CrisisWall software is to exploit the large display and interaction surface of a large video wall. However, a principal design element of the software is collaboration, be it with several analysts in front of the video wall, or distributed analysts using different devices. Therefore, the CrisisWall software - or elements of it - should work on normal PCs, tablets, and smart phones, but also on surface tables and alternative devices.

3.3.7.1 Evaluation

The software innovates the visualization of an aggregation of many sources and clearly is a valuable COP tool. Designed after the daily needs of crisis managers, it should be made available to the National Crisis Centres as well as to European bodies. Additional specific user interfaces should be made available when drilling down to a single event and its related information. In order to enter the decision making process, procedures and trainings should be updated.

3.3.7.2 Statement of the solution provider

After the good reception of the solution during the presentation in Aix-en-Provence, its development continued achieving the following results:

- The development of clients exploiting its API was continued: web client, Android app, and Windows Universal app are supported.
- In order to improve the interoperability, new data formats and sources have been added. The procedure to add a new source was greatly simplified also thanks to a set of ready-to-use components.
- The use of standard icons from UN-OCHA has been enriched by colour coding them accordingly to the relevance of the displayed information.
- Part of the additional sources required then a refinement of the access control. The users are now classified based on their clearance to access specific information. This allows using the same system in different contexts and providing sensitive information aside publicly available information, while not requiring the duplication of the system. Information can easily transit from one context to the other. Users with insufficient rights are not aware of the access restrictions.
- A special class of users has also been created specifically for unmanned systems: This feature is intended to auto login a client operating, for instance, in a situation room and displaying the information on a big visualization surface.

These features are tested and used in daily business. In future developments, CAP and EDXL formats will be handled as well as the integration of other services. There will be additional client applications for mobile devices developed during the year.

3.3.8 EmerT

EmerT is a web-portal developed within the Delphi and VABENE projects of the German Aerospace Center (DLR). With EmerT, it is possible to visualize the current traffic situation using different traffic sources (aerial images, inductive loops, Floating-Car-Data etc.). The traffic data can be used as basis to simulate and predict traffic and for supporting the decision processes in traffic management actions in case of an incident or planning a big event.

3.3.8.1 Evaluation

EmerT is a mature solution, which fits well in the task of aggregating information in a COP, allowing planning activities related to logistics and transportation, including evacuations.

3.3.8.2 Statement of the solution provider

The evaluators rated EmerT as a mature and useful solution for DRIVER. The output is of high interest for all traffic and logistic related tasks. A limitation within an ad hoc crisis is of course the set up time for gathering all relevant traffic data and the problem that people might behave in an unpredictable way. These issues will be considered in the DRIVER project and research will be done to overcome these problems.

3.3.9 U-Fly

U-Fly by DLR is a ground control station (GCS) for Remotely Piloted Aircraft Systems (RPAS). The capabilities include mission planning and evaluation for single RPAS or swarm formations. U-Fly receives aerial sensor data, processes and evaluates sensor data, and dynamically adapts RPAS missions to newly received information. The research aircraft D-CODE, a modified Dornier 228 with digital autopilot and control/payload data link, can be controlled via the GCS and be used as remotely piloted vehicle (RPV) demonstrator in DRIVER experiments. Equipped with a 3K camera system, the RPV will gather aerial images of a disaster area.

3.3.9.1 Evaluation

The overall impression of U-Fly by evaluators was "very valuable", "highly relevant and mature", and "interesting in order to get an overview". The monitoring aspect of the tool was seen as less interesting for **immobile units (such as pumps), but the assessment of traffic density was seen as more interesting. The ratio of cost versus benefit for deployment of an RPV was seen as an issue.** The tool's usability was rated 3/3, with **the remark that the usability for the end-user of the images might be more relevant than the usability for flight planning purposes. By the time of the evaluation, it was not defined in which experiments the RPV will have been active as part of the DRIVER system of systems.**

3.3.9.2 Statement of the solution provider

The estimated Technical Readiness Level (TRL) varies from 5 to 8, while DLR would set the TRL between 4 and 5, as by the time of the evaluation this technology is only deployed in DLR's experimental environment. All **evaluators express their good overall impression of the solution with emphasis on the usability of collected imagery data within the DRIVER system of systems. Beside the two main advantages of using unmanned systems, the ability to operate up to 30 hours and the ability to operate in inhospitable environments, the solution provider has outlined the benefit of using gathered imagery data as a map overlay for decision support. In this context, a more refined deduction of information is suggested. One evaluator did not see decision support based on displayed sensor data, which may result from the varying expectations from such functionality. From the solution** provider's perspective, t**he advantages of using unmanned systems in crisis management should be demonstrated in further experiments. This will outline and strengthen the role of RPAS within the crisis management community.**

It was mentioned that monitoring of selected units might not be important (e.g., in flooding scenarios). This might apply to certain scenarios, but in the past, constant airborne monitoring of fire-fighting operations during large forest fires in the US, or the monitoring of cooling efforts in the nuclear plant of Fukushima, has been of great support to the disaster management mission.[7,8]

[7] http://www.australiansecuritymagazine.com.au/2014/04/unmanned-vehicles-enhancing-security-rescue-and-natural-disaster-management-capability-part-ii/

[8] http://www.ga-asi.com/news_events/index.php?read=1&id=424

3.3.10 ZKI

The Centre for Satellite Based Crisis Information (ZKI) provides a 24/7 service at DLR for the rapid provision, processing and analysis of satellite and airborne imagery during natural and environmental disasters, for humanitarian relief activities and civil security issues worldwide. The resulting satellite and airborne-based information products are provided to relief organisations and public authorities and are mainly freely available on the ZKI website. According to the requirements of the user, the information products are delivered in the form of maps, GIS-ready geodata or dossiers. The ZKI is ISO 9001 certified. Within DRIVER, the focus of ZKI is on providing innovative 3D-maps and 3D-visualisations (e.g. virtual fly over the disaster region) as an improved emergency mapping service according to the user needs.

3.3.10.1 Evaluation

As proved by the Copernicus service, the use of rapid mapping is crucial in crisis management. The service provided by DLR is now mature and provides high quality outputs, ready to be used in other systems. Its integration would be welcome, also because of the innovative products soon to be available.

3.3.10.2 Statement of the solution provider

The evaluation of ZKI reflects the usability and maturity of the service. Most features have been assessed with TLR 8 or 9, which corresponds to the TLR given by DLR, as this service is already operational. Furthermore, most features have been marked as fully usable by the evaluators. The possibility to create different map formats has been positively perceived with an emphasis on the importance of vector formats, which ensure reusability by other solution providers. The use of satellite imagery is very much appreciated, but it is also outlined that the acquisition of such images may take a long time. The evaluators point out the importance of the data and maps provided by ZKI, and it was highlighted that the information should be integrated in the common operational picture.

When working with satellite data, time is indeed the limiting factor. The analysis and preparation of maps play minor roles. The time consuming part is the satellite acquisition and satellite delivery to the ZKI. For this reason, vector data derived by satellite imagery is not much faster than delivering the map product. In contrast to this, the advantage of airborne imagery like demonstrated in DRIVER is the faster availability of the images.

One of the user requirements regarding emergency maps was to have a virtual landscape, to understand the disaster event better and to imagine the disaster region. By developing innovative mapping products like 3D-maps or flyovers, ZKI fulfilled this user demand, which can be tested in DRIVER.

3.3.11 SUMO

SUMO is a microscopic and open-source road traffic simulation by DLR. In SUMO, it is possible to simulate vehicles, pedestrians, traffic lights and multimodal mobility. In principle, SUMO requires a road network that includes roadside infrastructure, such as traffic lights, and a traffic demand for performing a simulation. Given both, the simulation SUMO moves the vehicles from the start position of their journey to their end position.

SUMO is a development of the Institute of Transportation Systems at the German Aerospace Center (DLR). The first concepts were developed in the year 2000 and the first public release was done in the year 2002.

3.3.11.1 Evaluation

SUMO is interesting, because it is a quite mature model of an anthropic effect. It can be used as a natural effect model both for preparedness and for assessment. It can be useful to design evacuation routes or to develop scenarios, thus allowing crisis managers to improve the operating procedures. It could also be used to model the behavior of the population combined with the present conditions/events and refine the operative planning. Thanks to the openness of the service, it can easily interact with other systems.

3.3.11.2 Statement of the solution provider

The evaluation stated that SUMO seems like a very useful solution for DRIVER when traffic simulation is needed. It was mentioned that its setup time for gathering required data is a limitation. This is a well-known problem in general for traffic simulations. This problem will have been addressed in subsequent activities within DRIVER.

Another issue is that SUMO should be seen as a service for other solutions. Therefore, effort is put on concepts for coupling SUMO with other solutions (e.g. the simulation environment AnyLogic).

3.3.12 Mapping of DRIVER Tools

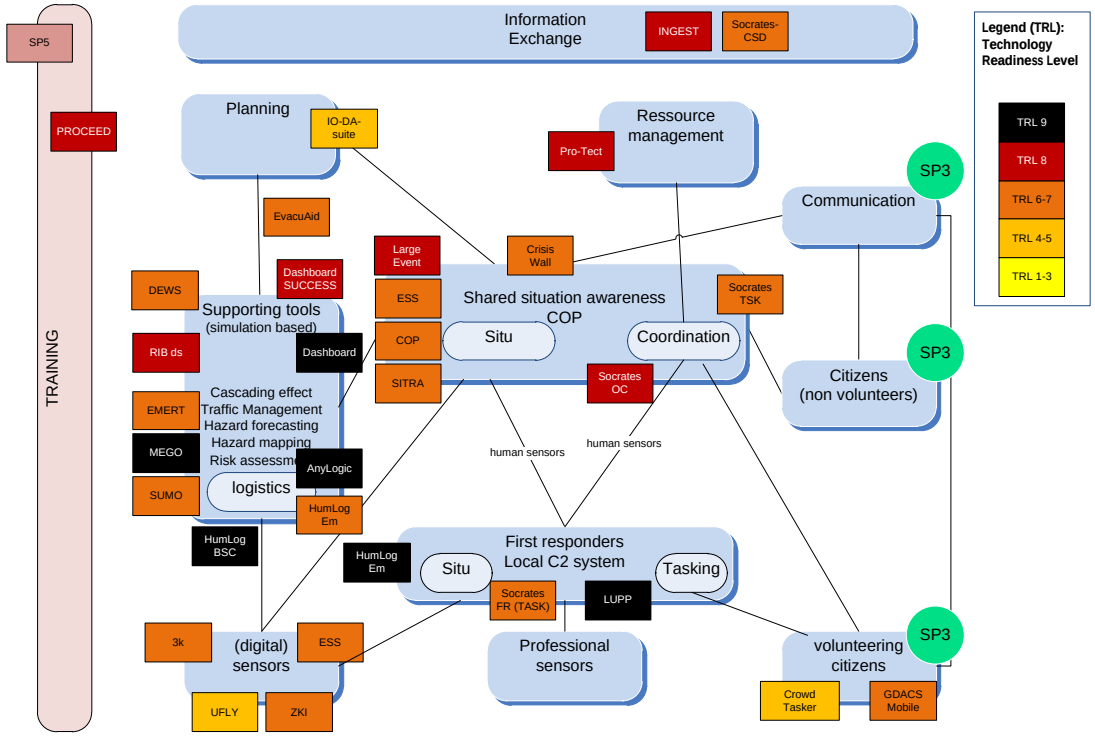

Figure 1: Mapping of DRIVER Tools (and Maturity level)

This diagram above proposes a set of IT tool categories, which relate to the scope of DRIVER SP4, and shows the way the tools proposed by SP4 DRIVER partners as candidates for the SE2 experiments relate to these categories. These categories are presented from field to higher levels of decisions. Tools relating to the field are at the bottom of the picture and categories relating to higher levels of command are in the higher part of the figure. Each tool is represented by a rectangle, which colour reveals the maturity level on the TRL scale[9].

Command and Control systems are decision support systems for the commanders and contain two subcategories which are relating to lower levels of command ("First responders local C2 systems") or higher **levels of command (**"Shared situation awareness"). C2 systems support the main commanding activities of situation assessment and planning and tasking ("Planning"). The planning and tasking, which relate to the **resource management, are performed at field level and other higher levels in the chain of command. The situation assessment task is performed by fusing inputs from inputs from either other C2 from lower levels or similar levels from other organisations, or from sensors which can be either human (**"Citizens" and "Professional sensors") or technical ("digital sensors") such as radars or satellite, aerial imagery or social **media monitoring. The situation of a certain level is usually sent to a higher level (commanding level or administrative level) where the various situation**s are merge to produce the situation at this level "Shared situation awareness"). In order to interoperate these C2 systems have to be connected through **communications means (e.g. radio, telephone) and exchange information in either voice or data format** ("Telecommunications"). Data content can be standard**-based messages, which can be understood by all** parties ("Information exchange"), and are usually corresponding to domain standards (e.g. Emergency **Management Shared Information (EMSI)). Specialized supporting functionalities such as logistics or prediction** are supported by supporting tools ("support").

The "Damage and Needs Assessment" activity is a part of the situation assessment in the domain of crisis **management. As any situation assessment, it relates to both sensors (human or technical) and to the C2** functionality. Some C2 tools contain training functionalities ("Training"). This category is a potential link between SP4 and SP5 "Evolved Learning".

[9] **HORIZON 2020 General Annexes G. Technology readiness levels (TRL)**
https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

4 Conclusions

This initial inventory was successful in evaluating the readiness of the solution and the capacity to produce new contents. A first overview about the user-friendliness, the interoperability and the capacity to follow the evolution of the crisis is given. The solutions presented, though various in nature, have common traits related to the features needed, like presenting geo-referenced information on a map. This document covered all solutions, which declared to have relevance for the task *"Damage and Needs Assessment"*, and not only the two presented specifically for it. A detailed assessment of the tools will be covered in subsequent activities within DRIVER. The presented results are used to build a common understanding and overview about the tools within the consortium, enabling the planning of their application and further evaluation.

The overall quality level of the solutions is very high. All of them are rated as mature and some solutions are already operative. The relationship with T43.3 is obvious, being that the topics are strictly related. This affinity might indicate that a combination of the solutions would provide a solution covering better the needs of a crisis management activity. However, this overlapping should be studied in detail. It is in fact debatable, if incorporating the features of solutions into one single solution would be better than a synergy. Some solutions are quite specific in their design (e.g. MSB RIB or CrisisWall), and perform better in collaboration with other systems. A lack of localization of the solutions, including an adaptation of the user interface to the culture of the user as well as language and data presentation, limits most of them to an English speaking audience, but in one case restricted the audience to a less diffused language.

Two main aspects were not covered to full extend by this inventory process:

- The evaluation of interoperability will be addressed by activities foreseen in work packages 42 and 45, while the results shown here provide some first insights into the tools capability.
- A more detailed coverage of decision-making support is foreseen in EXPE41, 42 and 43, which are capable of performing the required simulations and activities. The experiments will make use of the results shown here to design the subsequent activities.

Several tools are very extensive and designated to a specific task, which requires significant time in order to fully present and comprehend the functionality. Due to the format of the first presentations of tools, the quality of presentations are assumed to have taken effect on the solution evaluation. As stated previously, subsequent activities will make use of the results shown here, in order to further develop the inventory of tools taking all gaps into account.

As outlook to further assessments, it is worth noting that usually solutions and procedures for *Damage and Needs Assessment* can be easily exploited in the field of vulnerability assessment as well. It would be interesting to evaluate the versatility of the solutions in this sense.

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[7] Vandieken, T., Engelbach, W. et al.: D2.1 – Requirement specification and collaboration needs, Deliverable of DESTRIERO (A DEcision Support Tool for Reconstruction and recovery and for the IntEroperability of international Relief units in case Of complex crises situations, including CBRN contamination risks), 2014. (p56 to 110).

Annex: Evaluation sheets

MSB RIB and Dangerous Substances[10]

Feature	Sub-Feature	MSB RIB	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info	Na				
	Machine readable info	Na				
Situation analysis	Alerting	Na				
	Statistics and trend analysis	Na				
Assessment of risks	Risk catalogue	Na				
	Simulation solutions	Na				
Information preparation	Map view	Na	Yes	3	8.5	FHG-IAO Support English language/translation
	List view	Search results coordinated for documents, information regarding toxic substances and national				

10 Evaluators' names are not mentioned in this public deliverable due to privacy reasons, but are known to the consortium partners.

Feature	Sub-Feature	MSB RIB	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		resources.				DLR1 Seems like a more or less Swedish national solution. To build up the functionalities as a pan-Europe data base could be adding additional assets.
	Report generation	Printed				
Decision support	Information processing for decision making purposes	Toxic substances: Identity, Physical properties, rescue instructions, emergency health care instructions, environment, transportation and handling rules. Resources: Experts and materials, searchable based on emergency situation. Contracts governing the usage of the resources etc are displayed. Physical location (approximate location for sensitive resources) Documents: Summary text plus full pdf document or streaming media if available, otherwise link	yes	3	8.5	TCS An axis of development might be to create an ontology specialised in toxic substances. Automatic Language Processing could be used to index the documents and link them to the resources database. THW Already existing in manifold sources. The link between substance and relief resources is new and interesting. Where is the benefit of additional resources for first responders? TNO DSS aspect could be improved; e.g. map aspect is missing, responders need visualization on a map.

Feature	Sub-Feature	MSB RIB	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		to server or reference to physical library. The document library database contains approximately 18.000 records. All content is quality assured by MSB.				
	Automatic decision modelling	Na				

Table 5: RIB evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
IAO	It seems to be a useful tool as it provides detailed information. However, I am not sure about how to cope with the language barrier as all the data/documents are in Swedish language. Is a trustworthy translation possible? Also the information in some documents is valid for Sweden only - here some kind of localization is necessary so i.e. firefighters in another country are shown the appropriate information for their country.	3	
DLR1	Professional knowledge database. Language Swedish, translation by Google Chrome online done, for the usage in DRIVER an English version could be helpful.	3	Could be used as a knowledge database for end users in case of an accident with toxic substances.

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR2	Usable tool for decision support in certain cases. Merely applicable in Sweden. Usage seems to be easy and clear. The tool has been extensively used and tested in Sweden.	3	End-users can get access easily
TCS	Specialized database filled with relevant information from the field. Capitalization and maintenance of the knowledge is ensured by MSB for Swedish national resources. For the resources part, this knowledge base is difficult to translate and maintain to other contexts than the Swedish one. Information exchange with other systems is a condition for usability of the tool in national contexts out of Sweden.	2	This is a specialized database to be consulted if technical questions on substances and associated risks. The benefit of integration with other tools is not evident.
THW	A database of Hazmat is nothing new. Plus, Internet based sources have some disadvantages compared to printed sources (fail-safe?) The new interesting thing is the linking of substance with potential relief resources.	3	
TNO	Robust/Validated Very static/traditional A dynamic aspect is missing e.g. dealing with date from the field, that is needed for emergency response	2	Potential from static point of view First impression/approach at incident At later stages of less interest.

Table 6: RIB remarks

Feature	Sub-Feature	FOI SITRA	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info Machine readable info	Information (text, forms, images etc.) on damages and needs are collected by reporters on the field using a hand held Android device. The information is per default machine-readable.	Yes	3	4.17	DLR1 Can help to analyse the risks of different areas. Is able to improve the online information gathering in the field. TCS To broaden the scope, one idea could be to accept reports from any type of source, not necessarily from devices with the SITRA android application. DLR2 Think about fall-backs to have a backup for information in case of power failures. Also, areas of interest may be declared as "free" so that reporters can schedule their own work (and maybe mark an area "under investigation").
Situation analysis	Alerting	Incoming information trigger alerts in the form of new symbols on the dynamic map and alert info-boxes.	Yes	2.33	4.33	FHG-IAO I am not sure how these alerts are then further processed by the operator. TNO Determine with end-user which triggers they want to have
	Statistics and trend analysis	Na				

Feature	Sub-Feature	FOI SITRA	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Assessment of risks	Risk catalogue	SITRA can assess the risk by the use of risk-models. The models can be constructed using a model construction tool. This demo will demonstrate some examples of risk-models.	Yes	2.67	3.5	IAO Support formulation of observations as free text. DLR1 No direct risk catalogue available, SITRA it is a tool to model a risk. TCS Basing the risk assessment on an ontology is a powerful feature if the ontology is itself well designed and powerful. TNO Risk modelling requires proof of scientific research
	Simulation solutions	Na				
Information preparation	Map view	The map displays information (events, risks, facilities, roads etc.) using intuitive symbols and overlays.	Yes	2.83	3.5	DLR1 Can help to analyze the risks of different areas. Is able to improve the online information gathering in the field. TNO Ask end-users what they want to see/what they need DLR2 Involve databases to include pre-disastrous information on infrastructure demography, etc. TCS I am not sure of what has been demonstrated.
	List view	The list view displays information (events, risks, facilities, roads etc.) in table form.	Yes			
	Report generation	SITRA supports report generation by listing all relevant information for each area and/or risk.	Yes	2.83	4.17	

Feature	Sub-Feature	FOI SITRA	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Decision support	Information processing for decision making purposes	SITRA support decision making by information processing. It suggests what information that needs to be acquired in order to get a better understanding of the situation	Yes	3	4.17	DLR1 It is able to improve the online information gathering in the field. THW The suggested check list is good (what obstacle keeps you from saving a person) -> (possibility to add free text?) TNO The principle is proven, but content-wise much work to be done DLR2 A weighting of information relevance could be a feature to structure the required information.
	Automatic decision modelling	Na				

Table 7: SITRA evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
IAO	Nice tool, however the model might need a validation in order to be of reliable use.	2	
DLR1	Professional research prototype.	2	Could be used to gathers online information from the field during a crisis to provide input to the common operational picture.
DLR2	Very useful tool to support disaster management missions. Several features have a great potential. To cover certain cases (like power failure,	3	Position within the DRIVER System of Systems (potential integration with..., complementary to...)

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
	multiple reports of the same incidents, etc.) further development is indicated. The map view is structured in a good way and clearly arranged.		Including pre-disastrous information, as well as information collected by other partners could be a helpful feature.
TCS	The tool is very promising. The usage of an ontology is a very good potential for the tool. Models have to be developed; capitalized and improved by the experiences on the field - which is not the easiest part to be organized.	3	
THW	Generally an interesting tool that can help to assess a crisis quicker. However: - What happens, when the infrastructure fails (Internet) - Privacy laws (pictures) - Assessment and quality of reports - Where is the info (maps) coming from?	(1-2) Still relatively immature	Could be used as an information-gathering tool during a scenario based interactive experiment.
TNO	- End-user involvement lacks - Risk models lack any proof/validation - How to use this in an operational environment is not clear	1 ½ (see third bullet above)	There is potential, e.g. damage assessment based on info from the field.

Table 8: SITRA remarks

ESS

Feature	Sub-Feature	GMV Sistemas ESS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info	Text and pictures entered by responders via Android application	Yes	5	6	AIT1 In my opinion, having a middleware service, which is capable of integrating different sources of observations and sharing the raw data and fused results with other tools, would help us to avoid duplication of efforts in DRIVER. Maybe this application could be used as one. AIT2 Useful for COP MSB3 I see catcher and integrity issues
	Machine readable info	Integration of sensors via Data Fusion and Mediation System (DFMS)				
Situation analysis	Alerting		No	5		AIT1 The tool allows mass sending the SMS and voice messages - even in the situation where network is not available. AIT2 The tool allows operators to send mass SMS and voice messages. Unclear if they can be distributed to specific groups only. MSB3 3 Towards human in the loop
	Statistics and trend analysis					
Assessment	Risk catalogue		Yes	5	6	AIT1 The simulation part of the tool (GUI)

Feature	Sub-Feature	GMV Sistemas ESS	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
of risks	Simulation solutions	Gas spread, flood and fire simulation.				appears quite interesting to me. The question is; how much work (if any) is required to make these simulations work in a new area? AIT2 How are the events modelled? TNO Not demonstrated
Information preparation	Map view	Selectable overlays on base map; Dynamic import of geo-referenced data layers	Yes	5	6	AIT1 My impression of the GMV map view is that it's a good tool for technical users which need to figure out which sensors are out there before trying to use them in own tools. That is OK if the tool is used as a middleware, but I have doubts concerning its usability for end users. MSB3 3 Increasing need for info management
	List view	Filtered lists of items (visible in the map pane or all)	Yes		6	
	Report generation		No			
Decision support	Information processing for decision making purposes		No	5		
	Automatic decision modelling					

Table 9: ESS evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
AIT1	This tool appears to be well done and my impression is that it is either already at the "operative" level or pretty near to being operative. Main functionalities it offers are in my opinion: - Middleware for gathering and sharing of information from various sources. - Mass-informing functionality through several channels. Most interesting appears to be a feature, which allows sending of SMSs to everyone in an area even if the network is down. - modelling sub-system which can be used to assess and predict the risk development for certain types of events (e.g. fire)	3	See "overall impression". In my opinion, the tool could be used as a part of the complete crisis management support infrastructure and provide one or more of the three main functions listed above. From AIT1 point of view (CrowdTasker), incorporating a map of danger areas resulting from model runs in local situation shown to volunteers would be nice. Also, the possibility to send some tasks to "everyone" - even in situation when the network is down sounds interesting.
AIT2	Appears to be a very mature tool with many possible use cases in CDM and in the environmental domain.	3	Is it only for COP during the crises or also in all other phases? Could be used as a general crisis management supporting tool in DRIVER or as middleware to combine input from other tools. Depending on the use cases, this could be e.g. social media monitoring or crowdtasking.
TNO	Technically promising	2 ½	Non-technical part should be improved, e.g. in relation with SP3 (wrt communication with citizens) how to deal with N (N > 100) messages in a short period.

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB3	Under "interactions with citizens" but seem to hold many other features, not enough time to understand the tool.	3	

Table 10: ESS remarks

Feature	Sub-Feature	ITTI PROCeed	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info					
	Machine readable info					
Situation analysis	Alerting	Alerts triggered by made decisions, changes in the objects features or occurring of an event.	Yes	2	9	
	Statistics and trend analysis					
Assessment of risks	Risk catalogue		Yes	2	9	
	Simulation solutions					
Information preparation	Map view	Selectable overlays on base map; Dynamic import of geo-referenced data layers.	Yes	2	9	
	List view	Filtered lists of items (visible on the map or in the object panel)				
	Report generation	Feasible after				

Feature	Sub-Feature	ITTI PROCeed	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		adjustments				
Decision support	Information processing for decision making purposes	Processing of information regarding available means and resources; situation awareness provided by map visualization.	Yes	2	9	
	Automatic decision modelling					

Table 11: PROCeed evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR2	Interesting tool that can also be used for training.	3	SP5 - trainings! Scenario design, proof of logic of scenarios
DLR3	Both scenario creator and player seemed professional, but functionality was presented very shortly. I did not get the info if there will be a "score" or something. Is there any logic in the tool that calculates a performance based on decisions and actions?	3	
TNO	Not that innovative! Gaming industries uses this kind of simulation for decades.	1 wrt SP4 2½ wrt SP5	SP5 solution, not SP4!
MSB1	Simulation tool for training flood, epidemics, chain of supply. This tool seems to be unique in the SP4 and fills a gap. It is also possible to expand with more models. Not to be used in an operational situation.	2	Any types of scenarios that have to be done in the pre planning phase.
IAO		3	

Table 12: PROCeed remarks

MEGO

Feature	Sub-Feature	HKV MEGO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info	None	Yes	3	8.5	
	Machine readable info	Geocoded maps in different formats.				
Situation analysis	Alerting	None		2		
	Statistics and trend analysis	None				
Assessment of risks	Risk catalogue	Access to maps with risk information i.e. hazardous objects, plants or sites. These maps may be combined with actual of forecast disaster areas (i.e. flooded areas).	Yes	3	8	DLR2 Display is clearly structured
	Simulation solutions	Solutions for combining scenarios (i.e. scenarios of single levee breaches combining into scenario with multiple levee				DLR2 Important tool to the scenario in DRIVER

Feature	Sub-Feature	HKV MEGO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		breaches).				
Information preparation	Map view	Almost exclusively.	Yes	3	8.33	
	List view	Marginally, some info on scenario's (i.e. number of casualties and damages).				
	Report generation	Includes export function of the maps.				
Decision support	Information processing for decision making purposes	Provides overview needed as a basis for situational awareness, prior to decision-making.	Yes	2.6	8	
	Automatic decision modelling	None				

Table 13: MEGO evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR2	- Very advanced level of maturity - Display is clearly structured and easy to understand - What kind of up-to-date data is involved?		Possible contribution to training? Scenario design?
DLR3	Very mature level from what was shown. Possible online/live use is not clear to me.	3	Combination with traffic analysis systems seems to be useful or even other data (airborne gathered etc). Otherwise useful component for scenario analysis.
TNO	Disadvantage: only expected flooding are pre-calculated. So; is it useful outside NL? Approach: OK	2 Is it validated for non-Dutch situations? Flooding in mountainous areas.	Useful for back office purposes during flooding. Aspect of warning could be improved; I miss an outcome related to warning.
MSB1	It is in operation and focuses on early warning. Not redundant if there is a lack of Internet connection?	3	Have been developing integration with open data. They are somewhere in between the systems Dews and PROCeed if you try to group the systems in clusters.

Table 14: MEGO remarks

Feature	Sub-Feature	JRC CrisisWall	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info					
	Machine readable info					
Situation analysis	Alerting					
	Statistics and trend analysis					
Assessment of risks	Risk catalogue	Access to maps with risk information i.e. hazardous objects, plants or sites. These maps may be combined with actual of forecast disaster areas (i.e. flooded areas).				
	Simulation solutions	Supported as backend by our simulation engine	Yes	3	7	DLR2 Not visible DLR3 Not visible
Information preparation	Map view	GoogleEarth is enriched by many sets of geographical information	Yes	3	7	DLR2 Sorting by e.g. severity, or type of event was not really possible, but would be a nice feature

Feature	Sub-Feature	JRC CrisisWall	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
	List view	Filtered List of Events (Visible in the Map)	Yes			Emiz Linked with other EOC in EU
	Report generation	Templated reports are generated for each event	Yes			
Decision support	Information processing for decision making purposes		Partly	1	8	TNO Decision support: not clear how it can be used by decision makers and to what purposes
	Automatic decision modelling		Partly	1	8	Emiz Same schema. Same forms.

Table 15: CrisisWall evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
DLR2	The tool can contribute to the COP production in various ways. It is usable, but needs some time to be used by untrained user. A tutorial or readme would be useful to understand "Crisis Wall" and to use it in an efficient way. The information view is sometimes slightly unstructured and overwhelming. To view information more dedicated to specific events could be useful. Also, to incorporate in the view information on what is important to a specific user could be could. A more structured display of information, filtered by severity or for example, relevance to the user could help to see and understand	3	Towards more shared understanding of CM Potential to integrate many information coming from other tools (COP, SUMO, etc.)

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
	information and information changes at a glance. Who is the dedicated user? End-user could probably rather be informed by a national mission manager, as the information are not always officially authorized.		
DLR3	Nice use of Google Earth as display tool of newsfeeds. At first sight, it looks more like an informational tool for home uses. More features like forecasting and more diverse mapping/sorting should be useful for use in real crisis management. Highlighting/downgrading of single "news" could be used to build a system that displays the personal likes/needs.	2	
TNO	Monitoring at national level	2-3 Analysis/transcoding for own situation	Should be extend from ERCC to National Crisis Centres
MSB1	Very impressive visualisation capabilities of the information in the common operational picture. Good potential, the JRC backing can be important for the success of the tool. We look forward to a demo on site with full internet capacity and large screens.	3	This is the most obvious choice for a common operational picture tool on the highest level of aggregation in the project.
Pole Risque		2	

Table 16: CrisisWall remarks

Feature	Sub-Feature	DLR EmerT	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info	- Up-to-date aerial image maps are a valuable information source for situation assessment (3K Sensor) - Up-to-date mobile traffic data information (floating *emergency* car data, indirect traffic detection of mobile devices (DYNAMIC), portable traffic-cams) - traffic data information (floating car data, induction loop, stationary Bluetooth detection, traffic cams, Munich, Cologne, Brunswick) - Traffic-data fusion and prediction	Yes	3	7	
	Machine readable info	Data as image files, KML,	Yes	3	7	

Feature	Sub-Feature	DLR EmerT	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		OGC web services and REST Services				
Situation analysis	Alerting	Aerial images and traffic data to support the analysis of situation	Yes	3	7	
	Statistics and trend analysis					
Assessment of risks	Risk catalogue	Access to maps with risk information i.e. hazardous objects, plants or sites. These maps may be combined with actual of forecast disaster areas (i.e. flooded areas).	Yes	3	7	
	Simulation solutions	Simulated view of current traffic situation showing possible traffic bottlenecks is generated from DLR SUMO solution.	Yes	3	7	
Information	Map view	Road network from NAVTEQ is used,	Yes	3	7	MSB2 Very relevant with a dynamic isochrone map.

Feature	Sub-Feature	DLR EmerT	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
preparation		rendered maps as map backdrop, different thematic layers are used as map overlay.				
	List view					
	Report generation					
Decision support	Information processing for decision making purposes	Isochrone-map can be used, further more we have a risk routing which includes likelihoods of risks for possible routes.	Yes	3	7	
	Automatic decision modelling					

Table 17: EmerT evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB2	This tool seems very mature and rich in functionality.	3	I think it will be very central in Driver especially if its information content can be shared with other tools. All "other common operational picture" / "situation assessment" type of tools would benefit from integrating data from EmerT.
WWU	Very promising, useful and mature tool that could be used for various transportation planning tasks in the logistics domain, the set up time has to be considered	3	The output is of high interest for all logistics related tasks, many other tools can benefit from EmerT results.
THW	- Interesting tool primarily for planning events. Difficult to use in a ad hoc crisis, as people will behave in a unpredictable/less predictable manner. - Also good for evacuation.		

Table 18: EmerT remarks

Feature	Sub-Feature	DLR U-Fly	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info					
	Machine readable info	Airborne sensor data collection and data-downlink.	Yes	2.66	6.5	
Situation analysis	Alerting					
	Statistics and trend analysis					
Assessment of risks	Risk catalogue					
	Simulation solutions					
Information preparation	Map view	Map overlays for areas, in which sensor data have successfully been collected.	Yes	2.66	6.5	THW Allows even more refined information that can be deducted from the images.
	List view					
	Report generation					
Decision support	Information processing for decision making	The displayed sensor data will help the operator to plan/re-plan	Yes	3	8	MSB2 Not really decision support for the responders.

Feature	Sub-Feature	DLR U-Fly	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
	purposes	the mission.				
	Automatic decision modelling					

Table 19: U-Fly evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB2	Very valuable to have a "tool" that can be rapidly deployed to provide aerial images and very good that the images can be provided fast.	3 The tool for flight planning seemed user friendly but to us, the usability for the end user of the images is more relevant perhaps.	The plane may not be able to fly during the actual experiment.
WWU	Highly relevant and mature tool for DRIVER purposes. No concrete TRL is mentioned in the tool details, but only "prototype", however the impression is that some features seem to have even a TRL of 9. Coming from a different field an average of 8 was estimated to the overall tool.	3 Although coming from another domain the usability seems to be very high thanks to the well-structured presentation.	The integration seems to be very high, although it should be done partly automated and partly manually.
THW	- Interesting in order to get an overview. - Monitoring of units by a plane is less interesting (pumps do not move frequently) - Could be interesting in order to see which streets are affected, which route a unit should take. - Big issue: cost vs. benefit		

Table 20: U-Fly remarks

ZKI

Feature	Sub-Feature	DLR ZKI	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info	ZKI solution is tailored to the integration of georeferenced data from satellites and aerial imagery, vector data and is principally open for field data, which need to be delivered by end users or by other portals.	Yes	2	9	
	Machine readable info	Map products as image files, GeoPDF or OGC web services and ESRI REST Services.	Yes	3	9	
Situation analysis	Alerting		Yes	3	9	
	Statistics and trend analysis	- Quantification of exposed and affected population/infrastructure assets in case of emergency situations, - Trend analysis in a				

Feature	Sub-Feature	DLR ZKI	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		sense of monitoring and quantifying changes in the spatial extent of different features (e.g. water extent).				
Assessment of risks	Risk catalogue	Risk can be addressed via the mapping of exposed or/and affected critical infrastructure, exposed assets & people	Partly	3		WWU Not sure about how risks are identified, but this might be only a matter further explanations (time frame of presentations).
	Simulation solutions					
Information preparation	Map view	Usually, a current or archived satellite or aerial image is used as map backdrop. Different thematic layers in vector format are used as map overlay e.g., infrastructure, damage information, hazard information. Tables, map labels and	Yes	3	9	

Feature	Sub-Feature	DLR ZKI	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
		map frame information (legend, interpretation texts...) complement the map view. Focus is on innovative 3D mapping products				
	List view	Lists or tables can be part of map products or information dossiers.	Yes			
	Report generation	Technical and information dossiers, which are delivered as PDF.	Yes	2	9	
Decision support	Information processing for decision making purposes					
	Automatic decision modelling					

Table 21: ZKI evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB2	My limited experience is that maps with processed satellite data are from Copernicus activations. It takes a very long time from satellite image requested and taken until the product is finally delivered. As a user, I may want a less "prepared" format such as a vector file instead of a map product if that data may be available quicker than the final product.	3 Maps and presented product seem very usable	The tool can provide imagery and geodata for emergency management and disaster assessment for the Driver experiments. Information should be integrated into the common operational picture tools.
WWU	ZKI is a very useful and established tool to fulfill the mentioned features.	3	Relevant to the most other tools as the provided information have a very high bandwidth and quality.
THW		2 Satellite imagery is a useful tool, if: - satellite is available - costs are reasonable - time between request and fulfillment is not too large	

Table 22: ZKI remarks

SUMO

Feature	Sub-Feature	DLR SUMO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
Gathering data from the field	Human readable info					
	Machine readable info					
Situation analysis	Alerting					
	Statistics and trend analysis					
Assessment of risks	Risk catalogue					
	Simulation solutions	Generating simulated view of current traffic situation showing possible traffic bottlenecks.	Yes	3	7	
Information preparation	Map view					
	List view					
	Report generation					
Decision support	Information processing for decision making purposes					

Feature	Sub-Feature	DLR SUMO	Feature available	Feature relevance (1-5)	Feature maturity (1-9)	Notes
	Automatic decision modelling					

Table 23: SUMO evaluation

Evaluator	Overall impression	Usability (1-3)	Position within the DRIVER System of Systems
MSB2	Seems very useful to most cases where traffic simulation is needed.	3	Useful as a service to other tools that need to complement with traffic simulation.
WWU	As mentioned also by the audience SUMO seems to have a high maturity level (the estimation of the evaluators is based on the information of the tool provider in the evaluation sheet, i.e. 7, although some features seem higher than this) but especially a very high relevance for many other tools. Both network planning and operational tools can benefit from SUMO outputs.	2-3 The only limitation to be considered is the required setup time in terms of new data (esp. transportation network).	As mentioned above SUMO can be understood as a tool that can both process data/results from (e.g. EvacuAid) and to other DRIVER tools (e.g. AnyLogic).
THW	Very useful tool. - If you can obtain info on the change in, for instance, the stability/load capacity of bridges, it could be very beneficial. Ex: Normally a bridge can handle 8t. After 5 hours of flood exposure, it can handle 3t. - If you can get info on the status of gas stations (do they still have gas, do the pumps function, are they flooded, etc.) that could help.		

Table 24: SUMO remarks