Driving Innovation in Crisis Management for European Resilience

# SUMMARY OF TRIAL 1, WARSAW, POLAND

22-25 MAY 2018

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# The DRIVER+ project

Current and future challenges, due to increasingly severe consequences of natural disasters and terrorist threats, require the development and uptake of innovative solutions that are addressing the operational needs of practitioners dealing with Crisis Management. DRIVER+ (Driving Innovation in Crisis Management for European Resilience) is a FP7 Crisis Management demonstration project aiming at improving the way capability development and innovation management is tackled. DRIVER+ has three main objectives:

1. Develop a pan-European Test-bed for Crisis Management capability development:
    a. Develop a common guidance methodology and tool, supporting Trials and the gathering of lessons learnt.
    b. Develop an infrastructure to create relevant environments, for enabling the trialling of new solutions and to explore and share Crisis Management capabilities.
    c. Run Trials in order to assess the value of solutions addressing specific needs using guidance and infrastructure.
    d. Ensure the sustainability of the pan-European Test-bed.
2. Develop a well-balanced comprehensive Portfolio of Crisis Management Solutions:
    e. Facilitate the usage of the Portfolio of Solutions.
    f. Ensure the sustainability of the Portfolio of Solutions.
3. Facilitate a shared understanding of Crisis Management across Europe:
    a. Establish a common background.
    b. Cooperate with external partners in joint Trials.
    c. Disseminate project results.

In order to achieve these objectives, five Subprojects (SPs) have been established. **SP91** ***Project Management*** is devoted to consortium level project management, and it is also in charge of the alignment of DRIVER+ with external initiatives on Crisis Management for the benefit of DRIVER+ and its stakeholders. In DRIVER+, all activities related to Societal Impact Assessment are part of **SP91** as well. **SP92** ***Test-bed*** will deliver a guidance methodology and guidance tool supporting the design, conduct and analysis of Trials and will develop a reference implementation of the Test-bed. It will also create the scenario simulation capability to support execution of the Trials. **SP93** ***Solutions*** will deliver the Portfolio of Solutions which is a database driven web site that documents all the available DRIVER+ solutions, as well as solutions from external organisations. Adapting solutions to fit the needs addressed in Trials will be done in **SP93**. **SP94** ***Trials*** will organize four series of Trials as well as the Final Demo (FD). **SP95** ***Impact, Engagement and Sustainability***, is in charge of communication and dissemination, and also addresses issues related to improving sustainability, market aspects of solutions, and standardisation.

The DRIVER+ Trials and the Final Demonstration will benefit from the DRIVER+ Test-bed, providing the technological infrastructure, the necessary supporting methodology and adequate support tools to prepare, conduct and evaluate the Trials. All results from the Trials will be stored and made available in the Portfolio of Solutions, being a central platform to present innovative solutions from consortium partners and third parties, and to share experiences and best practices with respect to their application. In order to enhance the current European cooperation framework within the Crisis Management domain and to facilitate a shared understanding of Crisis Management across Europe, DRIVER+ will carry out a wide range of activities. Most important will be to build and structure a dedicated Community of Practice in Crisis Management, thereby connecting and fostering the exchange of lessons learnt and best practices between Crisis Management practitioners as well as technological solution providers.

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# 1. Background

A Trial is an organised and systematic process of searching for innovation in Crisis Management. A Trial should be tailored to find innovations that show potential to limit or cover identified Crisis Management Gaps related to Crisis Management Functions. However, to achieve this ambitious goal in a manner which enables relevant and representative results, it is important to organise a Trial in conditions as realistic as possible to minimise research biases.

The Trial Guidance Methodology (TGM), as a systematic and research-based method, assists Trial Owners in this challenge. Further, the Test-bed Technical Infrastructure (TTI) facilitates creating a realistic set-up for that purpose. A Trial Owner is also actively supported by a Trial Committee, which consists of experts supporting the TGM and Test-bed infrastructure implementation, coordination of solution providers and practitioners. The Trial Committee is permanently working with the Trial Owner through the entire process of the Trial organisation.

Therefore, a Trial aims to actively involve Crisis Management practitioners in the search for innovation which meets their expectations. Gaps are revealed and defined by them on the basis of their experiences and problems they face in the realisation of their missions. These expectations and gaps are to be met and covered (partially or completely) by solution providers who address them with their solutions.

By the inclusive approach of the DRIVER+ Trial organisation, it is possible to reach out to external organisations (solution providers and CM practitioners) to enhance external cooperation and shared understanding. Broad involvement of these two groups at a relatively early stage of a Trial organisation facilitates building a common platform. Furthermore, it enhances the understanding between those groups, which provides positive prospects for fulfilling their expectations, as well as achieving the main aim of finding and adopting innovation in Crisis Management.

It is important to underline that the briefly described process of the Trial implementation during the project period is being done in order to test, verify and improve the project outputs, i.e. the Trial Guidance Methodology (TGM), the Test-bed Technical Infrastructure (TTI) and the Trial Guidance Tool (TGT). This will help to make these outcomes ready for an effective and sustainable utilisation after the project's end.

From **23 to 25 May 2018**, the first Trial organised as part of the DRIVER+ project (Trial 1) took place in Warsaw, Poland, at the Main School of Fire Service (SGSP) and at the SGSP training ground located 30 km away from Warsaw. This event involved more than 150 firefighters from 12 European countries, and 24 other practitioners from 13 countries. The **general purpose** of Trial 1 was to improve cross-border communication, coordination and resource management between different organisations and agencies from different countries, in large scale and complex (multi-event) crises resulting of cascading effects.

**Figure 1.1: the Main School of Fire Service (SGSP), Warsaw, Poland**

# 2. Context

This section presents the practitioners' needs (gaps) which the selected solutions aimed to address, the research questions guiding the Trial overall process, as well as the scenario on which the Trial realisation is based.

## 2.1 Crisis Management capability gaps

In DRIVER+, a capability gap is understood to be "the difference between a current capability and the capability considered necessary for the adequate performance of one or more disaster management tasks."[1] The list of Crisis Management capability gaps proposed by Trial 1 practitioners is presented below.

- Limitations in the ability to model real-time (response phase) or pre-event (preparedness phase) dynamics of the chemical and radiological threat and visualisation of obtained results in a form that can be used directly by the Head of the Rescue Operations.
- Lack of a Common Operational Picture (COP) environment to integrate data sources and calculation results from different models crucial for decision making process from the perspective of Head of Rescue Operation.
- Limitations in the cross vulnerabilities (people, property, environment) assessment to optimize task prioritisation and decision making.
- Insufficiencies in terms of resource management (human resources, hardware, etc.) during multi-stakeholder long-term rescue operations.
- Lack of effective public warning system with the ability to verify whether the information reached the recipient.

All these gaps have been discussed and validated during the DRIVER+ gaps assessment workshop[2] in January 2018 and subsequently prioritized by the Trial 1 Committee.

## 2.2 Main Research Questions

The main research questions driving the Trial 1 process are the following.

I. How can visualisation of a chemical threat dynamics support communication and information exchange?
II. How can an integrated COP support decision-making processes at tactical and operational level?
III. How can models of chemical threat dynamics support taking decisions sooner, faster and better?
IV. How can models of cascading effects support taking decisions that minimise the impact on people, infrastructure and environment?
V. How can cross-border resource management be supported through socio-technical solutions during multi-stakeholder long-term rescue operations?
VI. How can information on needed and available resources of multiple stakeholders be shared to increase the operational performance?

[1] ECORYS and TNO for European Commission DG HOME. First Responders - Identifying capability gaps and corresponding technology requirements in the EU. January 2016.

[2] DRIVER+ Project. D922.11 List of CM gaps. March 2018 (https://www.driver-project.eu/wp-content/uploads/2018/08/DRIVERPLUS_D922.11_List-of-CM-gaps.pdf)

## 2.3 Scenario outline

The scenario of the Trial 1 includes a massive release of liquid toxic substances as a result of maintenance failure in a reservoir collecting chemical wastes. A valve failure causes that pumps pumping chemical waste liquid to the reservoir cannot be switched off. Due to this, there is a rapid inflow of a significant amount of a liquid, mud like toxic chemical to the retention reservoir. Dikes of the reservoir are weakened after prolonged rainfall during past few days and under the influence of pressure the reservoir, the dikes break. The affected land includes a river that crosses the border between the two neighbouring countries Landpol and Manyger.

The scenario is based on the disasters which took place in Romania in 2000 (Baia Mare cyanide spill) and in Hungary in 2010 (Ajka alumina sludge spill).

Trial 1 was realized as a table-top and field Trial. The table-top part was conducted at SGSP, while the field part was conducted at the SGSP training ground outside Warsaw.

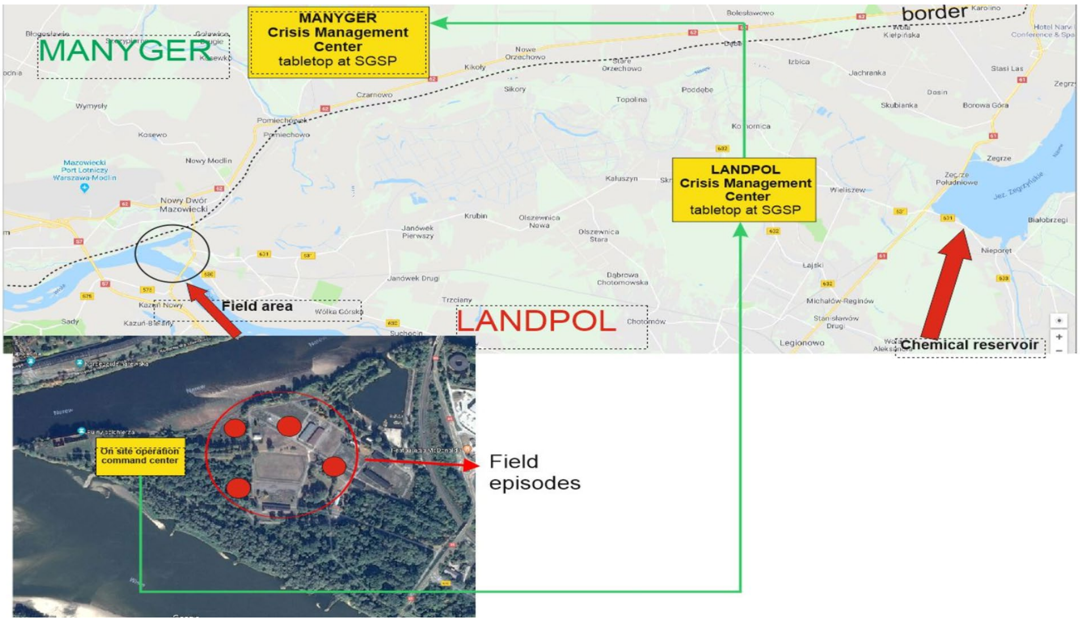


**Figure 2.1: The conceptual set up of Trial 1**

Trial 1 was divided in five sessions. **Sessions 1 and 2** focussed on shortening decision-making time, and improvement of situational reports' quality; **session 3** on improving the decision-making process during the response; **session 4** was dedicated to trial a Common Operational Picture software solution, in particular to improve the quality of Requests for Assistance; and **session 5** focussed on improving the decision-making time and decision quality related to conducting damage and needs.

# 3. Solutions

After passing the Call for Application and the selection process, the Dry Run 1 and Dry Run 2, the following three solutions were implemented in Trial 1. Two of them (3Di and Drone Rapid Mapping), were provided by non-DRIVER+ partner companies while the third one (Socrates OC) was from a DRIVER+ partner.

**3Di** (provided by Nelen and Schuurmans, the Netherlands) enables flood forecasting on the basis of a detailed model. The model is able to predict flooding locations, water depths, and water arrival times, among others. The results can easily be analysed and processed via a ready-to-use plugin in open GIS software tool QGIS. 3Di is a fast, accurate and interactive modelling suite, in which users can easily adapt the model during runs. For example, users can open breaches, or add portable levees to investigate the effects of implementing possible mitigation measures for flood scenarios. The Crisis Management functions addressed for Trial 1 were: mitigation of effects through identification of vulnerabilities, raise awareness and anticipate to support decision makers with protection and response measures, Communication between stakeholders for shared situational awareness, and support C3 decision-making.

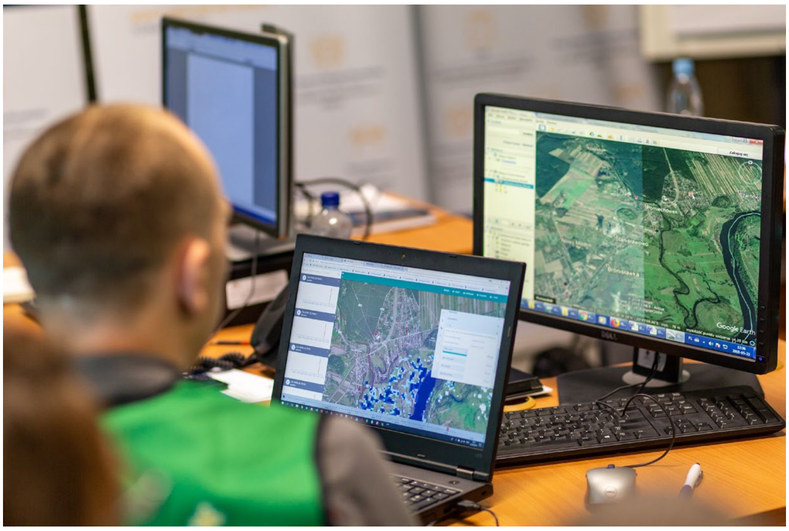

Figure 3.1. 3Di

**SOCRATES OC** (provided by GMV, Spain) enables the exchange and sharing of the information (expandable and customizable) among SOCRATES nodes and with other external systems enabling the reporting and tracking of events and inter-organisational tasking (mission assignment) and resource management (request, offer and transfer of resources). The information is displayed on a Common Operational Picture (COP). The Crisis Management functions addressed for Trial 1 were: conduct coordinated tasking and resource management, maintain shared situational awareness, and support C3 decision-making.


Figure 3.2. SOCRATES OC

**Drone Rapid Mapping** (provided by Hexagon Safety & Infrastructure, Poland) enables rapid mapping of incident/crisis area. The solution enables very fast generation of orthophoto maps based on imagery acquired by any drone (RPAS) available to rescue or crisis management actors. The additional product is a 3D terrain model, enabling better and more intuitive understanding of the area of interest. Rapid generation of maps is enabled by cloud computing. A drone operator is expected to conduct a flight over the area of interest and acquire imagery (using standard on-board camera) in line with the standard operational procedures. Data is uploaded into cloud and automatically processed. The resulting orthophoto map is available within the dedicated geoportal that can also provide access to other maps (satellite, topographic, etc.). The 3D model can be viewed in any standard program (3D viewer). The Crisis Management functions addressed for Trial 1 were: assess damage and needs, provide and maintain shared situational awareness, and provide information to media, decision makers and the general public.

**Figure 3.3. Drone Rapid Mapping**

# 4. Results

The results are structured along three dimensions: the Trial dimension, the solution dimension and the Crisis Management dimension. The **Trial dimension** relates to the Trial organisation: everything that has to do with the Trial run in a very "hands-on" manner is part of this dimension. The **solution dimension** tackles all functionalities as well as the usability of each solution that is trialled. The most important dimension is the **Crisis Management dimension**, because this is looking at the potential impact a solution has on the selected CM gaps.

## 4.1 Trial Dimension

There were no critical weaknesses regarding the Trial execution. However, there are some elements which could have been done better like the organization of the various sessions and the number of practitioners for these sessions. The respondents confirmed that data collection on the solution was carried out in a sufficient way to evaluate the specific functionalities of the solution. Furthermore, observation indicates that a high impact on the quality of the reports prepared by the teams is highly influenced by the team's configuration including the team's knowledge, experience, spirit, etc. It is therefore suggested to use the same teams twice in order to generate and collect data both for the baseline and the innovation line. The proposed approach has the risk of another bias, which is the lesson learned effect from the first to the second run (e.g. from the baseline to the innovation line run), which will naturally lead to better results in the second run. However, it seems that biases connected with the broadly understood human differences in a team (in knowledge, skills and competences) create more severe disturbances than these resulting from the lesson learned effect.

## 4.2 Solutions Dimension

The objective of this evaluation in the solution dimension is, for each innovative solution, to provide a detailed answer to the question "Does the selected solution fulfil the expected functions during the Trial?"

In order to focus strictly on the gaps selected for Trial 1, not all of the solutions' functionalities were evaluated. The general feedback from the practitioners was that the solutions provided the trialled functionalities, and were rated as innovative having a serious potential to improve Crisis Management activities. There were no negative opinions of the practitioners on the trialled solutions. This was based both on their experiences from the solution training and using the solution during the Trial execution. However, on the following elements of the solutions the practitioners had a neutral opinion:

- Reduces workload.
- Is necessary to complete the given task.
- Is better than solutions currently used (baseline).
- Would be used by them again.
- Is easy to set-up/initialise.
- The solution is absolutely necessary
- The solution does everything I expected it to do
- The use of COP supports decision making at an operational level
- Learning how to use the solution is easy.

These results may suggest a need for further improving the interfaces of some solutions and/or additional training.

## 4.3 Crisis Management Dimension

Comparing the accomplishment of the tasks between baseline and innovation line after each run, gives an indication about the potential value of each new socio-technical solution. It was illustrated that the trialled Common Operational Picture solution (Socrates OC) has the potential to **improve communication through an increase of the quality of situational reports and as well the Request for Assistance.** Although the increase of quality of these documents is not related to all established criteria, the Trial showed that some criteria, such as reproducibility, were positively affected by the solution. Increasing this kind of feature in the operational documents leads to more effective horizontal (cross-border, cross-sector) and vertical (between hierarchical levels) communication during Crisis Management. This finding was confirmed in the opinions of the practitioners and the observers.
The **quality of communication during decision-making** can be improved by a dynamic modelling solution (3Di) and a visualization solution (Drone Rapid Mapping/DRM). 3Di showed to be a potential "game changer" in decision-making processes by limiting the number of information taken into account and prioritizing the information related to the time available for implementing response measures. It leads to shortening the decision time and through this supporting the coordination and resource management. DRM showed it can potentially shorten the time for **damage and needs aerial assessment** and through that accelerating coordination and resource management processes. Both solutions were positively assessed in the practitioners' and the observers' opinions.

## 4.4 Answers to the research questions

**I. How can visualisation of a chemical threat dynamics support communication and information exchange?**

Visualization of the chemical threat dynamics supports communication and information exchange with shortening decision-making time as well as making the decision easier through taking less number of factors into consideration (which are dominated by time oriented factors). It could lead to higher quality of the decision since the decision makers could more consciously manage the available time for the evacuation operation. Furthermore, it allowed formulating more operationally oriented decisions, with time frames for the operational task, which could be easier implemented in the field by first responders and lower level crisis managers. The increased quality of the decision improves the communication and information exchange in the crisis team as well.

**II. How can an integrated COP support decision-making processes at tactical and operational level?**

An integrated COP supports the decision-making process at tactical and operational level by improving situation reports quality only at the uniqueness criteria. The integrated COP used in the innovation line did not demonstrate its supportive role in shortening decision-making time at tactical and operational level; the average decision-making time achieved in the baseline is two times shorter than the time achieved in the innovation line. It reduces communication barriers, simplifying the decision process and information exchange.

Dynamic simulation models of threat development contribute to the COP as one important information input. Working on the models, which are shortening decision making time as well as making the decision easier through taking a smaller number of factors into consideration, bring a support to the decision making process at tactical and operational level. It could lead to higher quality of the decision since the decision makers could more consciously manage the available time for the evacuation operation as well as formulate more operationally oriented decisions, including time frames for the operational task, that needs to be completed by the first responders in the field and lower level crisis managers. Increased quality of the decision contributes positively to the communication and information exchange in the crisis team as well.

Finally, an integrated COP supports the decision making process at tactical and operational level through providing a positive impact on the quality of a Request for Assistance (reporting about required civil protection assets) and supports the decision making process by reducing communication barriers as well as the simplification of information exchanges.

**III. How can models of chemical threat dynamics support taking decisions sooner, faster and better?**

The model of threat dynamics gives a positive impact to create and be integrated into a Common Operational Picture and, in this way, supports the decision making process by making decisions sooner, faster and better. Chemical threat dynamics simulations need data input to provide models. The innovation line enables to measure the width of the destroyed embankment with higher accuracy. Such information might be used to calculate the intensity of the outflow. Better accuracy in measurements however, may need longer time to process the data and provide a 3D model or an orthophoto map. Using this solution might improve decision making by providing more accurate data but has a negative impact on the time until the decision can be made. The Drone Rapid Mapping provides outputs (3D model and 2D orthophoto map) which might serve other kinds of analyses as well (including distance, height or area measurements) by using different simulation tools.

**IV. How can models of cascading effects support taking decisions that minimise the impact on people, infrastructure and environment?**

The innovation line did not show the innovative potential in shortening the decision-making time which could decrease the risk of cascading effect. The model of threat dynamics gives a positive impact to the modelling of cascading effects and in this way supports taking decisions that minimize the impact on the dimension people, property, infrastructure and environment.

**V. How can cross-border resource management be supported through socio-technical solutions during multi-stakeholder long-term rescue operations?**

The innovation line implementation can support the cross-border resource management with a cross border shared COP, that enables sharing information about used and available resources of neighbouring the country. Cross-border resource management can be supported through the innovative socio-technical solution by sharing information about the use of resources across different countries and by supporting the process of formulating a Request for Assistance which increases the quality of the document.
Managing the resources of units from different countries, according to their specialization, requires a detailed identification of needs and tasks to be carried out. The innovation line can support this assessment by providing information in the form of a 3D model and orthophoto map of an area of limited accessibility. Identification of the needs of the population (by color-coded sheets) may enable better assessing the needs of the affected population to provide adequate assistance. The solution can partly support cross-border resource management during multi-stakeholder long-term rescue operations by providing 3D map of the affected area. The biggest constraint in this case is the time to provide outputs, especially in case of low data transfer at the area.

The Drone Rapid Mapping solution provides data which might be shown in COP tools as well, providing latest imaginary of affected area in form of orthophoto map.

**VI. How can information on needed and available resources of multiple stakeholders be shared to increase the operational performance?**

The innovation line with the cross border shared COP reduces communication barriers and simplifies information exchange between stakeholders in order to increase the operational performance. Information shared by the COP solution improves the quality of bottom-up reporting. Through this quality improvement the information about needed and available resources is more accurate, complete, better composed, formatted and easier to be reproduced. Information about needed and available resources of multiple stakeholders shared via a COP increases the operational performance. A shared COP reduces communication barriers and simplifies information exchange.

# 5. EU policy recommendations

The outcomes of the Trial provide ground to formulate the following recommendations related to EU policies, regulations and mechanisms:

Use of the integrated information systems providing Common Operational Picture may improve pooling and sharing civil protection assets during cross border disaster by better communication (incl. cross-border reporting). This may positively influence host nation support activities of the country affected by a disaster as information about shared resources will be available earlier at different levels of command.

Use of dynamic modelling for flood simulation may result in improved precision of emergency planning (risk management related to floods and to critical infrastructure). It may also improve forecasting of possible impacts in response phase – during the development of actual disaster.

Use of the integrated information systems providing Common Operational Picture between authorities of different levels (vertical configuration) may improve assessment of the operational needs and gaps and facilitate formulation of a more precise Request for Assistance under the Union Civil Protection Mechanism. Such approach increases participation of local and regional level authorities in formulation of the needs.

Capabilities enhancing use of drones, such as orthophotomap generation and 3D modelling, may support operations of the European Emergency Response Capacity assets (modules/teams) which have “searching competence”. Aerial observation and mapping may improve realization of post disaster needs assessment, especially in case of major, wide area disasters.