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TEMA

TRUSTED
EXTREMELY PRECISE
MAPPING AND PREDICTION
FOR EMERGENCY
MANAGEMENT

Deliverable D6.1:
TEMA trials specifications

Project Information

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D6.1– TEMA trials specifications			
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Disclaimer

The TEMA consortium consists of the following partners:

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List of Terms and Abbreviations

Abbreviation Description

Abbreviation	Description
BMs	Building Blocks
D	Deliverable
DOA	Description of Action
DRIVER+	Driving Innovation in Crisis Management for European Resilience
EC	European Commission
EU	European Union
FR	First Responders
GDPR	General Data Protection Regulation
M	Month
NDM	Natural Disaster Management
ND	Natural Disaster
PPDR	Public Protection Disaster Relief
PPE	Personal Protection Equipment
RGB	Red, Green, Blue
SaR	Search and Rescue
UC	Use Case
UAV	Unmanned Aerial Vehicle
WP	Work Package
T	Task
TAP	Trial Action Plan
TEMA	Trusted Extremely precise MApping and prediction for emergency management
TGM	Trial Guidance Methodology
TMT	Trial Management Team
XR	Extended reality
WP	Work package

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Executive Summary

This document provides a comprehensive overview of the **trial specifications and planning activities** conducted under **Task 6.3** of the TEMA project, which aims to enhance natural disaster management (NDM) through advanced mapping, prediction, and decision-support tools. It details the methodology, particularly the **Trial Guidance Methodology (TGM**), a structured framework designed to plan, execute, and evaluate pilot trials effectively. Each trial is guided by a Trial Action Plan (TAP), which details the specific activities, responsibilities, timelines, risks, and logistical arrangements for each pilot.

A total of eight pilot trials are planned: four in 2025 (two historical and two hybrid) and four in 2026, focusing on flood and wildfire scenarios. These trials are structured to evaluate the TEMA system's technical components and its effectiveness from an end-user perspective. The document highlights key elements such as trial objectives, roles and responsibilities, scenario development, data collection methods, and the training of participants.

The project employs a comprehensive gap analysis to identify current shortcomings in disaster management, and research questions are designed to evaluate usability, information quality, efficiency, and decision support provided by the TEMA system. Data collection is decentralized and managed securely to ensure data integrity and accessibility.

Public relations strategies are tailored for each trial to maximize visibility and stakeholder engagement, helping to demonstrate how digital innovations can improve disaster response. For field trials involving real-time operations, necessary permits and authorizations are obtained in advance, especially for field activities like drone use or prescribed burnings.

This deliverable serves not only as a roadmap for trial implementation but also as a foundation for assessing the system's operational impact, usability, and potential for real-world deployment in emergency response contexts.

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1 Introduction

1.1 Purpose of the document

The purpose of this document is to present the development of the trial specifications and planning framework for the pilot activities within the TEMA project. It outlines the methodologies, objectives, and operational structures that guide the preparation and execution of eight pilot trials across Europe, focusing on flood and fire emergency scenarios. Developed as part of Task 6.3 within Work Package 6, the document ensures consistency and quality in the implementation of the Trial Action Plans (TAPs), supports the evaluation of TEMA's technical solutions, and facilitates alignment with end-user requirements and project goals.

1.2 Relation to other project work

Task 6.3 within WP6, titled "TEMA trials specifications", plays a crucial role in the overall project work by defining and planning the flood and forest fire trials that will occur in **Task 6.4**.

T6.3 is responsible for producing a trial specification and planning document, called Trial Action Plan, refining scenarios and evaluation criteria. This task directly builds upon the end-user requirements identified in **T2.1** as the trials aim to depict specific operations and integrate new socio-technical solutions, presumably addressing those requirements. Furthermore, **T6.3** will prepare for the assessment of the technical solutions developed in other work packages, particularly **WP3** (Explainable and robust analytics, Real-time semantic visual analysis, etc.), **WP4** (Precise phenomenon prediction, Response planning, etc.), and **WP5** (Precise Digital Twin, Geovisual analytics, Augmented Reality and rapid visualization), by **evaluating their performance in realistic scenarios**. The outcomes of these trials, specified in T6.3 and executed in **T6.4**, will also provide crucial feedback for **T6.2 (TEMA S/W integration)** for further development and refinement of the platform, and will ultimately contribute to the project's dissemination and exploitation activities in **WP7.**

1.3 Methodology: Trial Guidance Methodology (TGM)

The methodology chosen in DOA of the TEMA project is the **Trial Guidance Methodology (TGM).**

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The **TGM**[1] is a structured framework to plan, conduct, and assess pilot trials effectively. This methodology provides a harmonized approach to trial design, data collection, and evaluation, ensuring comparability and replicability across different pilot sites. When applied to pilot trials, it helps stakeholders define objectives, select relevant research questions, and establish protocols for implementation and assessment. The methodology emphasizes collaboration among stakeholders, alignment with broader project goals, and continuous learning through feedback loops, making it adaptable to different pilot contexts while ensuring high-quality, comparable results. For understanding and guidance through the methodology, a TGM handbook was used: TGM_Handbook_EN.pdf.

A key component of this methodology is the development of **Trial Action Plans (TAPs):** detailed, site-specific planning documents that outline the operational, technical, and organizational aspects of each pilot, serving as a bridge between the conceptual **trial specifications** and real-world implementation. While trial specifications define the overall objectives, scenarios, and evaluation criteria for a trial, the TAP translates these into actionable steps—detailing logistics, roles, schedules, technical setups, risk assessments, and data management procedures. It ensures that all elements needed to run the trial are clearly organized and aligned with the broader methodological framework, facilitating smooth execution and reliable outcomes.

These plans include timelines, roles and responsibilities, risk management strategies, and communication protocols, serving as the backbone for executing trials in a coordinated and efficient manner.

In TEMA, 8 pilot trials are foreseen: 4 for the flood use case, 4 for the fire use case. Each of the end-user partners is responsible for organizing and delivering 2 pilots in their respective countries. 4 of those pilots will be historical (using real historical data from real (disaster) events) and 4 are hybrid ones, during which new data will be produced with support from historical or pre-prepared data if needed.

Each of the 8 pilot trials will follow the same specifications (set by a **TAP template**) to ensure the same level of quality across all 8 pilots. For each of them, a separate TAP is produced. As TAP is a live document that follows the pilot preparations, it is not to be expected to have finished TAP much longer before the trial date: the internally agreed deadline to finish the preparations and thus TAP´s is about 2 weeks before each pilot. In case of last-minute changes in the last 2 weeks before a trial, those changes are also to be noted in respective TAP.

[1] Trial Guidance Methodology was developed through DRIVER+ project (Driving Innovation in Crisis Management for European Resilience) was financed by the EC under the Seventh Framework Programme for Research, Technological Development and Demonstration (FP7)

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The first 4 TAP´s that follow first 4 pilot trials scheduled for 2025 (M30-M36) are submitted as **Annex 1, Annex 2, Annex 3** and **Annex 4** in state of progress they achieved by mid-May 2025.

The following 4 TAP´s for the pilot trials 5- 8 scheduled for 2026 will be created when the planning for those trials begins.

The Trial Action Plan, that contains the trials specifications, is an adaptable document. After the first 4 pilots an evaluation of the pilots will be held among the TEMA consortium partners and if any changes in the specifications are needed, they will be made to TAPs for the second 4 pilots.

2 Pilot Trials Specifications (Trial Action Plans)

To report the work that was done within the T6.3 and some additional activities that were collaboration between different WP´s but didn't fit in with other deliverables, the similar chapter structure will be followed as it is in Trial Action Plans. Chapters will be similar in a way that for Deliverable purposes some subchapters of TAP will be described but will not appear as a subchapter of Deliverable 6.1.

Chapter "Purpose and Scope" of the TAP describes purpose of the document and the stages of the preparation as foreseen in the TGM:

1. Stage A – The initial stage, which ends with Deliverable D2.1.
2. Stage B – The main preparation stage which ends with Dry Run 1.
3. Stage C – The maturation stage which ends with Dry Run 2.
4. Stage D – The final preparation stage which ends with the Trial itself.
5. Stage E – The recapitulation stage which ends with the Trial evaluation report.

Stage A started in WP2 T2.1. of the TEMA project. Results of the work done in T2.1. are in deliverable D2.1. Stages B to E will be covered by work in WP6, more specifically: stages B and C will be covered within T6.3 and T6.4 and Stages D and E within 6.4 and reported in respective deliverables D6.1. and D6.2.

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2.1. General Information on the Trial

The general schedule of all pilot trials was created and agreed among the consortiums. According to DOA, 4 pilot trials are to be organized until the end of November 2025 (M36) and the next 4 are to be organized until the end of November 2026 (M48). Other conditions were to have 4 historical pilots and 4 hybrids, and that 4 are flood use cases and 4 are fire use cases. The following schedule was set:

Table 1: Pilots trials schedule

Trial No.	End User/ Pilot no.	Date	Type	Source of data
1.	KAHY Pilot 1	05/2025	Wildfire	Historical
2.	RAS Pilot 1	06/2025	Prescribed burnings	New data (Hybrid)
3.	D.MALIAN Pilot 1	10/2025	Flood	Historical
4.	BRK Pilot 1	11/2025	Flash flood	Historical
5.	RAS Pilot 2	04/2026	Wildfire	Historical
6.	KAHY Pilot 2	06/2026	Prescribed burnings	New data (Hybrid)
7.	BRK Pilot 2	09/2026	Flash flood	New data (Hybrid)
8.	D.MALIAN Pilot 2	10/2026	Flood	New data (Hybrid)

The schedule was set so that there is a minimum of 2 weeks between each pilot trial, allowing reasonable travel schedule for partners who are physically participating in more pilots and bringing equipment, allowing time to make progress in TEMA-System development and implementing some of the lessons learned between the individual pilots (if there are any).

For the **RAS Pilot 1** it was decided that it will be new data/Hybrid, even though all the other pilots in 2025 will be historical ones. The reasoning behind this decision was that both RAS and KAHY are having a fire use case and will use prescribed burnings to generate new data. Both indicated June as the month when prescribed burnings would take place. Considering the requirement that the exact date of the prescribed burnings can be set only when the weather and the vegetation conditions are right, there was a risk of having a clash in schedule between those 2 pilots. With additional limitation that equipment that will be needed for hybrid trials needs to be moved from one location to another (in this case to Finland and to Italy), and that same technological partners need to participate physically in both named trials, it was decided that first fire use-case, hybrid pilot trial, will take place in year 2025 and the second one in 2026.

The exact dates and location of each pilot are indicated in the respective TAP.

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Trial Purpose and Goals

The common challenge of TEMA project is the improvement of the NDM by providing a state-of-the-art disaster management support system, dynamically exploiting multiple data sources and AI technologies for providing an accurate assessment of an evolving crisis situation.

The common **purpose of all 8 pilot trails is to evaluate the solution** in several aspects:

- to assess whether natural disaster management capability gaps are closed
- to evaluate the performance of the TEMA solution in flash flood or fire scenario while using the historical data or newly produced data
- to evaluate if improvement in NDM using new digital technologies and extreme data analytics has been achieved.

End-users from different PPDRs (Public Protection Disaster Relief; in future reference they will be named end-user evaluators) with relevant background and experience in disaster response involved in the pilot trial will evaluate operational effectiveness by trialing the technology in simulated response to natural disaster caused by the flash flood or fire and missions under conditions as real as possible by using the historic or new data.

2.2. Methodology Application

2.2.1. Brief description of chosen gap assessment method

The gap assessment method applied in the TEMA project during WP2 was a multifaceted approach designed to effectively identify and analyze shortcomings in current natural disaster management practices. This method formed a critical part of the user requirement elicitation process and laid the foundation for tailoring the TEMA solution to real-world operational needs.

The gap analysis in TEMA was conducted using a triangulated data collection strategy, encompassing the following three components:

- **Literature Review**: A structured review of relevant academic, technical, and policy documents was conducted to identify prevailing challenges and unaddressed needs in the field of natural disaster management. The findings from this review helped establish a baseline for understanding what capabilities were lacking in current systems and informed the definition of user needs.
- **Grant Agreement Analysis**: The TEMA project's Grant Agreement was scrutinized to ensure alignment with its outlined objectives and commitments. This analysis helped to identify

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gaps between existing practices and the envisioned innovations proposed within the project framework, particularly in terms of technological integration and end-user readiness.

- **Storytelling by End Users**: Narrative accounts provided by the four end-user partners offered practical insights into real-life responses to natural disasters. This qualitative data highlighted operational gaps and inefficiencies as experienced by frontline organizations, bringing a human-centered perspective to technical analysis.

This triangulated gap assessment methodology ensured a comprehensive understanding of user requirements by merging empirical evidence, contractual benchmarks, and experiential knowledge. The findings directly informed subsequent phases of requirement gathering, including questionnaire distribution and collaborative meetings with end users, contributing to the robust design of the TEMA solution.

The complete list of identified gaps is available in D2.1.

2.2.2. Selected and Validated Gaps

The results of the gap identification conducted in WP2 were further developed by the end-user partners. From the comprehensive list of identified gaps, each end-user selected several that aligned closely with their specific use case. These selected gaps directly reflect the focus and objectives of their planned trials.

This process helped define the specific functionalities that end-users require or wish to see included in the trial system. Following this, an initial draft of the trial scenario was developed, illustrating how end-users envision the system being used in a realistic context. Following this, a collaborative discussion session was held with the technical partners. The result was that the list of desired functionalities and selected gaps was refined to align with the development roadmap and technical capabilities of the TEMA-System at the time of the pilot. This alignment ensures that the trials will be more targeted, relevant, and achievable within the system's scope.

The finalized list of gaps to be addressed in each specific trial is documented in the corresponding TAP.

The same approach will be applied during the planning of the second pilot phase.

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2.2.3. Research questions

Based on the objectives (defined in DOA), research questions are focused on understanding the end-user experience and the perceived value of the TEMA system for disaster response, especially in comparison to their current tools and methods:

- **Usability and User-Friendliness**: How do end-users perceive the usability and user-friendliness of the TEMA system compared to their current tools? This includes the ease of understanding information and labels, the intuitiveness of the tools, and the ease of customization.

- **Information Quality and Trustworthiness**: How do end-users rate the clarity, detail, accuracy, and reliability of the information provided by the TEMA system in comparison to their current systems?

- **Efficiency and Speed:** Does the TEMA system improve the efficiency and speed of disaster response tasks, such as accessing comprehensive maps, receiving updated information, gathering data, and displaying information?

- **Automation and Workload:** How does the level of automation in the TEMA system compare to the end-users' current systems, and does it reduce the amount of manual work required?

- **Situational Awareness:** How does the TEMA system affect end-users' ability to establish situational awareness during a disaster, including the ability to work with different map views and combine intel from multiple sources?

- **Decision-Making Support:** How does the TEMA system support and enhance decision-making during disaster response compared to current tools, including the speed and effectiveness of decisions?

- **Perceived Benefits and Limitations:** What are the main perceived benefits and limitations of the TEMA system compared to current systems for Natural Disaster Management (NDM) from the end-users' perspective? What specific aspects of the TEMA platform are considered most beneficial?

- **Areas for Improvement:** What improvements or additional functions do end-users suggest for the TEMA system?

2.2.4. Data collection method and outline

The TEMA project adopts a structured and decentralized approach to data collection and management, ensuring secure, organized, and role-specific access to various categories of project data. This methodology facilitates efficient data sharing among partners while upholding data integrity, ownership, and accessibility throughout the project lifecycle.

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Data Collection Method

Data within the TEMA project is collected from multiple sources, including user interactions, collaborative activities, scientific research, dissemination processes, and project management. These data are categorized based on their origin, usage, and level of accessibility, and are systematically organized into designated repositories. Each dataset is tagged with metadata describing its source, format, and responsible curator, ensuring traceability and compliance with FAIR data principles.

The collection process involves:

- Aggregation of user-related inputs via tools such as questionnaires and interviews.
- Collection of scientific data from experimental trials, simulations, and secondary sources.
- Documentation of communication and dissemination activities.
- Compilation of project management documents and deliverables.

Data Storage and Curation Outline

TEMA data is distributed across the following secure storage infrastructures:

- **TEMA-Drive** (hosted by AUTH): Serves as the central repository for project management data and optionally for user and dissemination-related datasets. It is a collaborative platform ensuring real-time access and version control for internal stakeholders.
- **TEMA FTP Server** (hosted by KEMEA): Primarily used for storing scientific datasets. Curated by project partners, it enables the handling of large or sensitive datasets in a controlled environment.
- **Internal Partner Repositories**: Each TEMA partner maintains their own repository for datasets they create or curate, allowing for flexible data governance according to local policies and technical requirements.
- **TEMA ZENODO Community Page**: Functions as the public-facing archive for open-access research outputs, including scientific publications and datasets. It supports the dissemination and long-term preservation of publicly shareable results.
- **TEMA Website** (https://tema-project.eu/): Hosts public project deliverables, publications, and selected datasets, serving as a central communication hub for stakeholders and the general public.

This layered data management approach ensures that the diverse data types collected throughout TEMA's lifecycle are properly maintained, accessible to authorized users, and aligned with open science and data protection standards.

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2.2.5. Initial Scenario

The pilot trial scenarios are inspired by the same real-world disaster events outlined in the **DoA**. These events were previously analyzed in **WP2 for storytelling and gap analysis** and are documented in **D2.1.** Data collected from these events now serves as a foundation for the development of the TEMA system and the execution of historical trial simulations. The initial scenarios will be used as inspiration for the hybrid pilots.

The four scenarios are:

- **Central-European Regional Floods (Germany – BRK)** In July 2021, severe rainfall led to devastating floods in Ahrtal, Germany—the worst in a century. The event caused widespread infrastructure damage and overwhelmed emergency services. TEMA will support improved flood modelling and response through the integration of historical and real-time multimodal data.
- **Mediterranean Flash Floods (Greece – DMALIAN**) Post-wildfire geomorphological changes in the Mantoudi-Limni-Agia Anna region have increased the risk of flash floods. TEMA will enable enhanced forecasting and real-time response by combining localized flood modelling with live streamflow data.
- **Mediterranean Forest Fires (Italy – RAS)** The July 2021 wildfire in Montiferru, Sardinia, burned 15,000 hectares and exposed critical response gaps. Using data such as satellite imagery and drone footage, TEMA will simulate the event to improve situational awareness and post-fire risk assessment.
- **Nordic Forest Fires (Finland – KAJ)** The Kalajoki wildfire of 2021 underscored the vulnerability of Finland's forest-rich and sparsely populated Kainuu region. TEMA will integrate diverse environmental and historical datasets to strengthen wildfire response planning and decision-making.

Due to gaps in the data collected from the four historical disaster events—such as missing or unavailable drone imagery, ortho-aerial photos, infrared data, and vegetation condition assessments, some critical datasets could not be obtained or were not produced during the original events. To address these limitations, partners from RAS and KAHY conducted prescribed burning in 2024 to generate the missing or supplementary data. These controlled burnings not only filled data gaps but also served as simulated wildfire events for use in the hybrid pilot trials, enabling a more comprehensive and realistic evaluation of the TEMA system.

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2.2.6. Technical components in TEMA Solution

The TEMA-System is a complex platform comprising **26 technical components**, some of which are tailored for specific operational use cases such as fire or flood response. Additionally, several components are designed primarily for research purposes, and while they will perform as part of the system, they will not be included in the end-user evaluation.

From a technical integration perspective, the development of the TEMA-System will continue beyond M35, when pilot trials begin. As a result, not all components will be fully integrated or evaluated during the initial pilot phases. However, partners have agreed that each component will participate in at least two pilot trials, with some foundational components included across all pilots.

Each pilot trial will focus on a tailored selection of components, chosen based on the following key criteria:

- **Component maturity**: Ensuring that only those components which are sufficiently developed and stable are included for meaningful end-user feedback.
- **Pilot-specific needs**: Reflecting the gaps and priorities identified by each pilot owner, to ensure evaluations target areas where the TEMA-System can provide tangible improvements over current capabilities.
- **Relevant use case**: Aligning selected components with the designated use case of the pilot (e.g., fire or flood response), to ensure operational relevance.
- **Scenario alignment**: Tailoring the component selection to the specific activities, workflows, and information exchanges involved in each pilot scenario.
- **Consortium consensus**: all partners agree on the component´s selection for each pilot.

This focused and flexible strategy ensures that the end-user evaluation is both context-specific and aligned with the overarching goals of the project. It allows for targeted feedback on components that matter most to each pilot while supporting the iterative development of the TEMA-System.

The list of components included in each pilot is stated in the corresponding chapter of each TAP document.

2.2.7. Training on TEMA-System

Training on TEMA-System was developed to provide materials (training handbook) and tools (sandbox version of the TEMA-System) for end-users (project partners as well as end-user evaluators who are not involved in TEMA-System development) to be trained on how to use the system.

The development of the materials was done through several training and feedback sessions with end users (partners). Two in-person training and feedback workshops were organized in parallel

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with a partner meeting in Seville (October 2024), and the integration hackathon in Munich (March 2025).

To support the end users in their learning, a training manual has been developed (**Annex 6**). The initial versions, with insights from KAHY, were developed in September of 2024 and modified in February 2025. The input aided in designing and structuring training tasks to align with existing procedures and information needs during emergencies. Further feedback on the training manual was collected during the Munich meeting, as well as a meeting with BRK in April 2025. As development continues on the TEMA solution, the training manual will be updated to include the latest features.

The three main components of the **training manual** are:

- **Technology descriptions** – descriptions of each TEMA component and their functionalities.
- **A learning manual** – a step-by-step guide on how to use each TEMA component that has been implemented within the SmartDesk.
- **Learning tasks** – exercises to complete using the SmartDesk, which ensures that participants train with all TEMA functionalities.

Integral part of the training material is the **sand-box version of the TEMA-System** created specifically for the training purposes that can be installed on each computer locally.

The TEMA solution relies on data to visualize information for the end users. However, to allow for training prior to pilots, a sandbox version - containing relevant sample data from historical emergencies in the pilot regions - is periodically released. The third sandbox version was released on **April 10, 2025**; however, it is not the last planned release. Future versions of TEMA-sandbox will align with the ongoing development of the TEMA system and will be prepared for upcoming training sessions. The insights collected during end user training and feedback sessions are further used and fed into T5.3. The contributions and perspectives of end users provide valuable suggestions on designing and implementing the user interface of the TEMA solution in both the Smart desk and XR-based visualization prototype.

The training of the end-user evaluators, that will play the scenarios during the pilot trial and evaluate the System, will be implemented as a group or individual sessions, on-line or in person, dedicated to specific pilot trials and will be organized approximately two weeks prior to each of the pilot trials. Participants of these training courses will be end-user evaluators and if there is interest and need, end-user partners. Individual sessions allow the learning to focus on the specific needs of each pilot trial. Moreover, the sessions are organized approximately two weeks before each trial to educate participants on the latest version of the TEMA-system. The training is structured to include a brief introduction, with most of the time spent on hands-on training, and followed by a session to collect feedback and answer questions of the participants.

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Table 2: Training agenda

Duration	Activity
30 minutes	Introduction to the TEMA system, distribution of learning documentation, installation of SmartDesk application.
2 hours	Hands-on training, provision of support in learning.
1 hour	Completion of training activities, collection of feedback for further development.

With this plan, training will all together be conducted 2 times for the end-user partners (already implemented), 4 times to support trials in 2025, and 4 times to support trials in 2026. The project will therefore organize a minimum of 10 training sessions in total.

2.3. Trial Planning

2.3.1. Responsibilities and Command Structure During Trial

In line with the TGM, **responsibilities** during the pilot trials are clearly defined as ensuring efficient coordination and successful execution. The roles are:

- **Trial Owner** is an organization, an end-user TEMA partner, that is responsible for the overall organization and delivery of the trial, ensuring alignment with the defined objectives
- **Solution Providers** are technical and research TEMA partners that support the integration of their technical components and operation TEMA- systems
- **Technical Teams** manage equipment, data collection, and system interoperability during the pilot trials
- **Technical Director** provides critical technical support during the pilot trial, particularly when systems malfunction or fail to operate as expected. Acting as a liaison between the Trial Director, and technical support or solution providers, he ensures swift identification and resolution of issues to minimize disruption and maintain trial integrity. His role bridges practical implementation with strategic oversight, enabling seamless communication on technical matters across technical and operational teams.
- **Observer Coordinators** facilitate the participation of external stakeholders

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- **Evaluation Leads** oversee the assessment framework, ensuring that all data relevant to performance, usability, and impact is systematically captured.
- **Training coordinator** prepares learning material and training tasks. Participates online during the independent learning session to provide support.
- **Support group** consists of Security team, Medical team, Catering crew, Cleaning crew, PR team, VIP host. The complexity of the pilot trial will determine if those roles are needed. In TAP template they are represented as a reminder to be taken into consideration during the planning phase. If the complexity of the pilot and number of participants is low, it can be decided by the Trial owner that is not needed to have a dedicated person for each role, but to have tasks for hosting team that cover some of the functions of the Support group.

The command structure during the trial follows a centralized coordination model, reflecting real operational procedures while ensuring smooth trial execution.

- **Trial Management Team (TMT)** oversees the entire process, maintaining situational awareness and making real-time adjustments if necessary.
- **Trial Director** acts as the single point of command, supported by leads for scenario control, technical operations, evaluation, and logistics.
- **End-user evaluators** are operational actors—such as first responders and civil protection authorities—participate in the predefined trial scenario by engaging with the TEMA system and ultimately evaluating its effectiveness. They operate within their standard chain of command to ensure realism.

This dual-layer structure enables both realistic exercise dynamics and controlled observation, evaluation, and data collection.

Finally, the **trial participants** are all persons that are physically or on-line involved in pilot trial.

Each TAP, besides the definition of roles, contains the name of the exact person or organization taking the role. Historical trials, as they are less challenging, allow the possibility that the same person takes more roles.

2.3.2. Risk analysis and contingency planning

The **risk analysis** conducted aimed to identify, assess, and prioritize potential risks that could negatively affect the preparation or implementation of the trials. **Two dedicated risk analysis sessions** were held with all partners involved in T6.3, during the regular monthly meetings in September 2024 and February 2025. Some of the identified risks led to immediate adjustments in planning. In addition, **more detailed risk assessments** were carried out independently by each trial owner within their respective teams, focusing on the specific context of their trials. The outcomes of these analyses are documented in the respective TAPs.

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2.4. Local Platform facilities

Trial Action Plans contain information on the venue where the pilot will be held, location where each part of the scenario will be played out (for the hybrid trails) and other facilities needed to perform the activity. This will be highly dependable on the scale of the pilot, scenario and resources available to the hosting partner. Information of the facilities secured for each pilot is in respective TAP´s.

2.5. Solutions Utilization and Assessment

During the pilot trials, the solution is deployed in a controlled, real-world setting that reflects the intended operational environment. The implementation includes onboarding users, and ensuring the solution functions as expected in practice (in line with the current TEMA-System development stage).

Utilization is tracked through user feedback (guided discussion after the pilots), user evaluation (through evaluation questionnaire) and observer logs, which will deliver both qualitative and quantitative methods. Reports will be submitted to technical partners, not only as system evaluation, but also suggestions for improvement, and eventually in D6.2.

The insights gathered in this phase are critical to determining whether the solution meets its intended objectives, what refinements may be necessary, and whether it is ready for broader implementation.

In TEMA´s DOA there are goals set that are the basis of the development of the evaluation questionnaire:

Table 3: Selected specific TEMA Objectives

OC objectives (WP2-6): Improve NDM using new digital technologies and extreme data analytics. OC1) Reduce latency in NDM (WP2-6).
Use of the TEMA platform will result in measurable reduction in response time from the moment a dangerous phenomenon (flood, fire) becomes imminent until a concrete response strategy to actual emergency is set into motion.
OC2) Increase situational awareness in NDM (WP2-6).
Use of the TEMA platform will enable the human operator to form a clearer, objectively, more accurate and more complete picture of the current situation during an NDM Emergency.
OC3) Reduce mental load for human operators in NDM (WP2-6)

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Use of the TEMA platform will significantly remove manual workload from the human operator during NDM crises.

The primary goal is to determine the solution's effectiveness, usability, and relevance in addressing the identified needs, as well as its potential for wider deployment.

For the end-user evaluation purpose, an evaluation questionnaire was developed. The questionnaire will be similar for all 8 pilot trials (with the possibility of an update after the first 4 pilot trials). The option was given to end-user partners (trail organizers) to translate questionnaires from English to local language if there is a need to reduce language barriers.

The questionnaire is set on-line on the EU Survey platform.

An evaluation questionnaire is appended to this document as **Annex 5.**

Questions for the guided discussion with the end-user evaluation are appended to this document as **Annex 9**. Preprepared question for the observers during the trial are appended to this document as **Annex 10.**

2.6. Trial Scenario Building

All historical scenarios were built based on real historical events:

- July 2021, Kalajoki wildfire, Finland
- July 2021: Monitferru Fire, Sardinia, Italy
- July 2021: West Germany Flood at Ahr Valley (Ahrtal), Germany
- August 2023: Mediterranean Flash Floods at area Municipality of Mantoudi-Limni-Agia Anna, Greece

Scenarios for the historical trials were inspired by real disastrous events. Historical data collected supports the trial and is visualized using TEMA-Systema and played out for the trial's purposes.

Additional effort was made by collecting data from prescribed burnings in Italy and Finland in Summer 2024, to compensate for data missing from disastrous events chosen for scenario build-up.

For the historical pilots, detailed scenarios for the pilot trials simulate historical disaster events, incorporating specific geographical, meteorological, and infrastructural conditions relevant to each region. These scenarios include step-by-step timelines, data inputs (e.g., satellite imagery, sensor data, historical records, social media data and others), and expected decision points, enabling end-user evaluators to validate the TEMA-system´s tools and services in realistic operational settings. Scenarios are included in each Trial Action Plan.

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2.7. Organization and Logistics

2.7.1. Dry Run 1

Each trial preparation will include a **Dry Run 1**, which serves as the first rehearsal of the pilot trial. Its purpose is to validate the setup, coordination, functionality of all key components, preparation of the data, and to test the trial scenario. Particular focus is placed on reviewing the scenario flow, confirming participant roles and logistical arrangements as well as data injections. Dry Run 1 helps identify organizational or technical issues early, reducing risks during the actual trial. A short report summarizing the **lessons learned** from each Dry Run will be included in the respective TAP. These **insights may lead to updates, changes, or improvements in the planning process**.

2.7.2. Dry Run 2

Dry Run 2 is the final rehearsal before the execution of the pilot trial and focuses on validating the full trial flow under near-operational conditions. Dry Run 2 simulates the trial scenario as closely as possible, including timing, participant interactions, data and logistical elements. Any remaining issues or uncertainties can be identified and addressed at this stage. As most of the trial owners chose to have Dry Run 2 a day (or few days) before the trial day, **outcomes and lessons learned** will immediately be used for final adjustments before the live trial and later incorporated in the TAP´s.

2.7.3. Trial Actions and Timeline

Each pilot trial will follow a dedicated **Trial Timeline** or agenda, which outlines the sequence and scheduling of trial-related activities. Depending on the complexity of the scenario and the scope of the trial, these timelines will typically span **three to six consecutive days**.

The Trial Timeline provides detailed information, including:

- The exact dates and times when specific activities begin and end
- The **duration** of each activity
- The **location** where the activity will take place
- The **partners involved** and the **roles** assigned to each task or phase

The actual execution of the scenario—referred to as the **trial run** or **scenario play**—will generally occur over a few hours during one of the trial days. This phase will test the solution under near-operational conditions and simulate emergency decision-making in real time.

Each Trial Timeline is included as part of the respective **TAP** document.

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2.7.4 Communication plan

The Communication Plan is part of each TAP. The purpose is to ensure clear, timely, and effective information flow among all involved stakeholders during each trial. It explains which means of communication will be used between trial organizers, technical teams, and end-user participants. Special attention is given to hybrid trials, where real-time coordination during field activities is critical.

2.7.5. Auxiliary activities

Auxiliary activities enable successful organization of the trials, both for historical and hybrid pilots. For trials with **prescribed burning**, coordination with local fire authorities and/or environmental agencies, it is essential to secure permits, assess weather conditions, ensure proper safety measures are in place, as well as in-lining the measure of prescribed burning with pilot trail. As an example, in RAS Hybrid pilot, the essential is cooperation with local Forestal Corps who will, in fact, conduct prescribed burning.

Auxiliary activities done for the preparation of pilots might also include preparatory site visits, logistical arrangements for equipment deployment, risk assessments, additional meetings with project partners, end-user evaluators and other stakeholders, as well as training activities, arranging catering and venues, ensuring legal and ethical compliance, setting up technical infrastructure and etc.

Simultaneously, **historical data-based trials** require activities such as data validation, formatting, and integration into the TEMA system.

These auxiliary efforts ensure that both types of trials are realistic, safe, and methodologically sound, allowing for meaningful evaluation of the TEMA solution.

The list of auxiliary activities is included in each TAP.

2.7.6. Assets for the Trial

To support the successful execution of both the historical and hybrid trials, a comprehensive range of assets was identified, collected, and allocated. Several supporting tables were created and circulated among the partners to gather information on both the available resources within the consortium and the specific needs of each trial. This structured approach ensured efficient planning and minimized gaps in required infrastructure or materials.

For the **historical trials**, the focus was on re-creating and simulating real past disaster events. **Key assets included historical datasets**, **equipment** for setting up control rooms, **tools** for enabling online participation, and ensuring a stable and robust **internet connection** throughout the trial.

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These elements were crucial for providing a realistic environment and supporting remote or hybrid engagement where necessary.

The **hybrid trials** introduced a more complex setup, involving a broader range of assets. This included equipment contributed by project partners, pre-prepared datasets to fill any information gaps (if needed), and logistical support to facilitate the involvement of additional tools, technologies, and participants.

The outcomes of the asset mapping and needs analysis for each pilot are documented in the respective TAPs, providing a clear overview of what was required, what was available, and how any shortfalls were addressed (if any).

2.8. Other Organizational Aspects

2.8.1. Safety Plan

The safety of all participants and stakeholders during the TEMA pilot trials is a top priority. Each trial owner will create a Safety Plan that outlines the necessary measures to ensure secure and compliant execution of all trial activities. It needs to be taken in consideration a distinction between **historical trials**, which are primarily conducted in controlled environments such as command or control rooms and therefore pose minimal safety risks, and **hybrid trials**, which involve real-world field operations and require more comprehensive safety protocols. For hybrid trials, enhanced safety planning was done due to the involvement of physical deployments, equipment handling, and potential environmental exposure—such as during prescribed burnings or UAV operations. These plans include detailed risk assessments, clearly assigned safety roles, emergency response protocols, first aid arrangements, and the use of appropriate personal protective equipment (PPE). All participants will receive safety briefings before each trial, and designated safety officers will be present to ensure compliance with protocols and respond to any incidents. This tiered approach ensures that the safety measures are proportionate to the complexity and risk level of each trial type, providing a secure environment for both participants and technological assets.

Safety plans are included in respective TAPs.

2.8.2. Technical Helpdesk

The **Technical Helpdesk** will function as a critical support element ensuring effective execution of pilot activities. It will serve as the centralized contact point for all partners, delivering prompt assistance on technical issues related to the TEMA platform, including software and hardware components and data management. This service is vital for quickly resolving operational issues and maintaining continuity during simulations and emergency scenarios.

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Technical support will follow a structured management approach: the **integration team (ENG)** will coordinate support for specific TEMA platform components delivered by each component provider, ensuring all technological elements, from cloud-edge infrastructure to AI tools and interoperability modules, remain fully operational and properly integrated within trial environments. ENG will facilitate effective coordination among various component owner technical teams and oversee expert interventions across different platform components.

A special focus will be placed on supporting Smartdesk, a principal tool designed for end-users in emergency management and monitoring. The Smartdesk functions as an advanced operational interface through which end-users access TEMA platform capabilities for mapping, prediction, and interactive visualization. Given its strategic importance in trials, the **KAMK** team will provide dedicated support, handling technical assistance and training for Smartdesk usage, delivering continuous support to operators, ensuring end-users can fully leverage the tool's capabilities while addressing operational needs and customization requests promptly.

Through this integrated approach, the Technical Helpdesk, ENG's coordination, and KAMK's dedicated support will collectively enhance trial effectiveness, promote optimal utilization of TEMA's advanced technological solutions, and foster strong collaboration between technical teams and field operators.

2.8.3. Research Ethics and Informed Consent Forms

2.8.3.1 Identification and Recruitment of Pilot Participants

Participation in the TEMA Pilot Trials is strictly on a voluntary basis and involves no form of coercion or obligation. All individuals invited to participate are informed of their rights, including the right to decline participation or withdraw their consent at any point during the activity, without any adverse consequences.

In line with ethical standards and applicable legal requirements, no vulnerable individuals or minors will take part in the Pilot Trials. Participation is limited to competent adults (18 years and older), and no children or persons incapable of providing informed consent will be recruited or involved in the trials.

Recruitment of participants is carried out based on their relevance to the trial’s objectives and may include individuals internal or external to the TEMA Consortium. These individuals are selected due to their professional expertise, operational role, prior experience in the disaster response. Participants may include first responders, technology operators, or other relevant stakeholders with an interest in disaster response innovation.

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All personal data processing associated with the identification, recruitment, and participation of individuals is conducted in strict compliance with the General Data Protection Regulation (GDPR). This includes ensuring that participants are fully informed—via the Information Sheet and Informed Consent Form—about the types of personal data collected, the purposes of processing, legal bases, data retention periods, data sharing practices, and their rights as data subjects.

The recruitment process is thus designed to ensure ethical integrity, legal compliance, and full transparency for all participants.

2.8.3.2. TEMA Informed Consent Procedures

In the context of the TEMA project's Pilot Trials, robust procedures have been established to ensure the informed consent of all participants, in line with ethical, legal, and data protection requirements.

Description and Analysis of the Information Sheet:

Participants are provided with a comprehensive Information Sheet that covers two distinct areas: (a) research participation and (b) the processing of personal data.

1. **Research Participation:**

    - The Information Sheet clearly outlines the objectives and scope of the TEMA project, which seeks to improve Natural Disaster Management (NDM) through the integration of real-time semantic 3D mapping and AI-enabled disaster prediction tools.
    - It explains the structure and purpose of the Pilot Trial, including participants' roles (e.g., operators, evaluators), the nature and duration of the trial, and the use of innovative technologies such as unmanned aerial vehicles (UAVs) and AI systems.
    - Participants are explicitly informed that their involvement is voluntary and that they may withdraw consent at any stage without any consequence.
    - The document highlights any potential health and safety risks, particularly related to UAV operations, and specifies that relevant safety protocols and regulatory compliance measures will be in place.

2. **Processing of Personal Data:**
    - The Information Sheet details the types of personal data to be collected and processed before, during, and after the Pilot Trial. These include names, identity/passport numbers, images and voice recordings, and signatures.
    - It specifies the **purposes of data processing**, including secure site access, trial execution, dissemination and communication activities, and GDPR compliance.

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- The **legal basis for processing** is clearly identified, primarily relying on the participants' consent (pursuant to Article 6(1)(a) GDPR), with specific exemptions relying on Article 6(1)(e) for certain access control measures.
- Information regarding **data controllers, storage periods**, data sharing with the TEMA Consortium, and participants' **rights** under the GDPR (e.g., access, rectification, erasure, restriction, portability, objection, and complaint) is transparently provided.
- It is explicitly stated that some visual and audio material may be disseminated via the project's website and social media platforms for communication purposes.

3. Consent Process and Timing

The **Information Sheet** and accompanying **Informed Consent Form** are provided to each participant in advance of the trial. Participants are given adequate time to carefully review the documents, raise any questions, and make an informed decision regarding their participation and the processing of their personal data. A representative of the Pilot Trial organizer is made available to respond to queries and provide clarifications.

Only participants who voluntarily sign the Informed Consent Form will be allowed to participate in the trial. Consent includes both participation in the research activities and agreement to the specified personal data processing operations.

4. Annexes

The full **Information Sheet** and **Informed Consent Form** may be appended to this document as **Annex 7** and **Annex 8** for reference and verification of compliance with ethical and data protection standards.

2.8.4. Public Relations Plan

To ensure the full impact of the trials, targeted communication efforts are essential, not only to inform and engage stakeholders, but also to amplify the visibility of the TEMA's achievements and foster public trust in the solutions being developed. Therefore, a public relations plan will be developed to outline the communication strategy for each of the trails, based on local context and needs.

A well-structured public relations plan is essential to maximize the **visibility, impact, and long-term value** of a trial exercise. These pilot trials are not only end-user evaluations; they are public demonstrations of how innovation can directly improve lives in times of crisis. By strategically communicating the goals, activities and outcomes of the trials, the project can build public trust, secure stakeholder support and stimulate broader conversations around the role of digital tools in crisis preparedness. A strong communications strategy ensures that the trials do not remain an

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isolated event but rather contributes to shaping policy and encouraging adoption by public authorities.

Recognizing that each trial operates in a unique local context with different stakeholders, resources and communication priorities, **a dedicated public relations plan** will be developed for each of the eight pilots. These tailored strategies will consider the specific objectives, audiences and logistical capacities of the trial organizers, ensuring that outreach efforts are both realistic and impactful. By aligning the communication approach with local needs and availability, the project can maximize engagement, foster stronger community and institutional ties and ensure that the value of each trial is effectively communicated at both the local and European levels. The dedicated public relations plans are included as separate chapters in the TAP of each trial.

2.8.5. Authorization, Registration and Permits for Trial

Each trial organizer (or trial owner) is responsible for identifying and securing the necessary authorizations, registrations, and permits required to conduct their respective pilot trials. It is essential that all legal, administrative, and operational approvals are obtained well in advance to ensure the safe and compliant execution of the trials.

Historical trials are generally more straightforward in this regard, as they are typically conducted in a controlled environment (often simulating a command or control room) where little to no external authorization is needed. These trials rely primarily on the analysis of historical data and do not involve real-time field deployments.

In contrast, hybrid trials are more complex and require comprehensive planning and coordination. Trial owners assessed the specific needs of their use case and scenario, including any permits related to field operations, data collection, drone use, or public safety. This includes notifying and collaborating with relevant local or national authorities and ensuring compliance with data protection, safety, and environmental regulations.

Securing all necessary documentation, approvals, and permissions is reported in respective TAP.

3 Supporting activities

To ensure the successful execution of Task 6.3 – TEMA Trials Specification, additional activities were organized to support the process. In this section, it will also be reported on several related supporting activities which, although not strictly part of Task 6.3, contribute to the overall

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implementation of the TEMA project and preparations of the pilot trials. These activities do not align neatly with other deliverables, which is why they are included in D6.1.

3.1. Workshop on operational procedures

In March 2024, the end-user partners organized a **workshop** for the rest of the consortium to present the **operational procedures** they follow during disaster response in their respective countries. The aim of the workshop was to inform partners about how disaster response is handled, with a focus on specific topics such as first responders' tasks, communication, and damage assessment. Additionally, the role of the TEMA solution in natural disaster management was discussed, particularly in terms of how and when it could be deployed during various stages of disaster response. A total of 44 TEMA partners participated in the workshop.

3.2. T6.3. Kick-off Meeting

At the beginning of May 2024 (M18), an online kick-off meeting for Task 6.3 was held with all participating partners. The meeting included an in-depth presentation on the TGM to ensure a shared understanding among partners. This session covered the methodology required for establishing standards in pilot preparation, clarified the task objectives, defined roles, outlined meeting structures, assessed needs, and discussed the overall approach to executing the work.

44 partners participated in the kick-off meeting.

3.3. Regular monthly meetings

From the beginning of May 2024 (M18) to the end of May 2025 (M30), partners held regular monthly meetings to monitor progress and coordinate the implementation of Task 6.3. These meetings were essential for ensuring alignment among all participants, addressing challenges in a timely manner, and maintaining momentum throughout the task's duration. Each month, excluding August and December due to vacations and holidays, two dedicated meetings were conducted:

- **Core Group Meeting**: This meeting involved only the end-user partners, KEMEA, and KAMK. As the core group responsible for trial preparation, they focused on detailed planning, operational alignment, and implementation strategies specific to the trials.
- **Full Task 6.3 Meeting**: This broader meeting included all partners involved in Task 6.3. It served as a platform to review overall progress, share updates, distribute responsibilities, and ensure that all contributors remained informed and engaged.

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These structured and recurring meetings played a critical role in facilitating collaboration, clarifying roles, resolving open issues, and ensuring consistency in applying the TGM and making progress in TAPs.

In addition to regular monthly meetings, dedicated sessions were organized to prepare for specific pilot trials—primarily RAS and KAHY—or to plan key tasks related to these trials, such as developing the PR plan, designing the evaluation questionnaire, drafting the training plan etc.

3.4. End-user feedback sessions (workshops, hackathons, early individual components feedback)

End-user feedback sessions—including hackathons and early evaluations of individual system components—played a crucial role in ensuring that the TEMA solution was developed with a strong user-centric foundation. These sessions offered structured opportunities for end user partners to engage with early-stage versions of the system, try-out functionalities, and provide direct, experience-based feedback. Their input was used for identifying usability issues, aligning system features with real-world operational needs, and refining technical components prior to full integration.

Beyond supporting technical development, these sessions also contributed to the learning process for end users. By gaining early access to the system, participants were able to explore its functionalities, simulate real-world use cases, and understand how TEMA could be applied in disaster response scenarios. This hands-on engagement helped users build familiarity and confidence with the system's capabilities. As a result, end users were better prepared and more informed, which significantly contributed to the quality and effectiveness of the trial preparations.

The structure of each feedback session was designed to maximize interaction and value. Technical partners would first demonstrate individual components—or, depending on development maturity, several integrated components—of the system. Following the demonstration, end users had the opportunity to interact with the system independently. The session would then conclude with a structured feedback discussion, guided by a set of pre-prepared questions from the technical partners. Feedback collected during these sessions was consolidated and shared with the relevant technical partners for further development and refinement of the components or the system.

These sessions were conducted both online and in person between March 2024 and April 2025. While some form of feedback sessions is planned to continue up to the final pilot trials (M47), only those organized up to April 2025 are covered in this report (D6.1).

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The list of all feedback sessions:

28.03.2024- End-user feedback to Digital Twin Technology, on-line

16.04.2024- End-user feedback to 3Di from Nelen&Schuurmans, on-line

08.05.2024- User experience workshop, hybrid during the Messina Meeting

09.10.2024- End-User Experience Workshop (training and feedback workshops on the TEMA-System visualization), in-person during Sevilla Meeting

16.01.2025- System demonstration for end-users and feedback, on-line (post-December Hackathon)

19.03.2025- Training and end-user feedback session, in-person during the Munich Hackathon Meeting

3.5. Munich Hackathon Meeting – integrations meeting and pre-validation test

3.5.1. Objectives of the hackathon

The primary objective of the hackathon, held in March 17-20 2025 in Germany, Munich at the premises of DLR, was to conduct preliminary tests of the communication infrastructure and evaluate the interaction mechanisms between edge and cloud components. Over the course of four days, participants engaged in intensive development and testing activities aimed at validating key technological assumptions, identifying integration challenges, and refining system interoperability. This early-stage validation was crucial to ensure that all components could reliably exchange information under realistic conditions, thus laying the groundwork for subsequent large-scale deployment, specifically, RAS trial in June 2025.

The organization of a hackathon plays a critical role in the preparation for a major pilot trail. By bringing together the teams in a focused, time-constrained environment, the hackathon facilitated rapid iteration, collaboration, and enabled the early detection of technical and operational issues. As a result, there is an objective to mitigate risks associated with complex system integration and enhance the overall readiness for the full-scale experiment in Italy.

3.5.2. Location and teams

The hackathon was designed to include two teams: the Edge Team and the Cloud Team, each fulfilling specific and complementary functions essential for the evaluation of the communication infrastructure and system interactions. The dual-team configuration effectively replicated the

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distributed operational structure anticipated for future large-scale experiments. It enabled the validation of communication channels, the identification of integration challenges, and the refinement of collaborative workflows between edge and cloud components. By ensuring a relatively high degree of realism, such a setup significantly contributed to the overarching goal of de-risking future experimental activities.

The *Edge Team* was stationed at a remote site — a former military base — providing a realistic and controlled environment for experimental activities (see Figure 1.)

Figure 1: EDGE Team test site at Erding, Germany

Within this setting, the team conducted tests of the communication channels between edge devices and the cloud platform, focusing on the reliability, latency, and resilience of data transmission under field conditions. To this end a communication solution based on StarLink satellite terminal and 4G/5G modem was developed to enable connectivity of the Edge.

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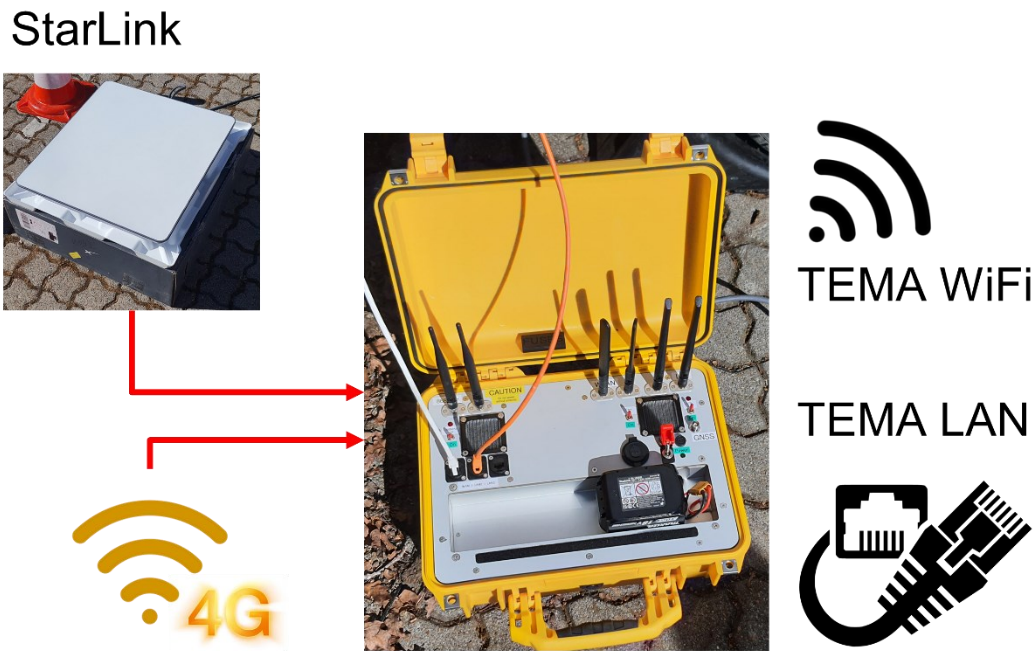

Figure 2: Developed communication solutions for the EDGE, which includes StarLink and 4G/5G modems

Such setting allowed testing the connectivity of the remote location even in the absence of the 4G/5G coverage, and thus enabled the simulation of operational scenarios in which edge components must function independently while maintaining robust connectivity with cloud-based services. The performance achieved is summarized in **Figure 3** below. The test has been performed using LibreSpeed test service. The latter is a very lightweight speed test implemented in JavaScript, using XMLHttpRequest and Web Workers. It works over a browser interface (frontend); the service supports all typical browsers as well as diverse mobile versions. Note that the test performed here does reflect a typical speed expected, yet at the operation site these might differ significantly from those reported below.

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Figure 3: Computed snapshots of recorded transmission speeds using LibreSpeed.org service. The tests were performed at the Edge Site using a Ubuntu-running laptop connected through the corresponding network

During the course of the hackathon, several experiments at the EDGE were performed. The Wind/Smoke/Solar sensor module was tested, providing valuable insights into its performance and integration readiness. While the basic functionality was successfully demonstrated, several integration issues were identified that will require further attention to ensure seamless system behavior. Similarly, the integration of the RGB/Thermal camera module was initiated and tested (see **Figure 4**). Although the initial tests confirmed the correct operation of the hardware components, additional efforts are required to resolve outstanding integration issues to achieve full system compatibility. Data collected from the RGB/Thermal sensors were successfully transmitted to the cloud using the Starlink satellite communication network, mirroring the approach validated for the Wind/Smoke/Solar sensors.

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Figure 4: Above- Thermal (left) and visible (right) imaging on site at Erding. The grill is clearly visible in thermal imaging.

The transmission of historical data from the remote edge site to the cloud was successfully validated using the Starlink satellite communication network, confirming the feasibility of using satellite links for non-real-time data synchronization. For real-time data transmission, however, further debugging and refinement of the ROS–Digital Enabler interface is necessary to achieve the required performance and reliability. Additionally, the mechanisms for offline data transmission were validated, confirming the system's capability to store and forward data when immediate communication is not available, thereby enhancing operational robustness.

These experimental results provide a critical foundation for subsequent development phases, offering concrete technical directions and highlighting areas requiring further refinement to ensure the success of upcoming large-scale trials.

Concurrently, the Cloud Team operated from the premises of the German Aerospace Center (DLR), where it simulated the role of an end-user control room.

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Figure 5: Integration Testing of Cloud Team.

Central to the Cloud Team's activities was the deployment and management of the TEMA platform, which served as the primary interface for monitoring, controlling, and debugging the system. In addition to its technical functions, the platform facilitated live demonstrations for project end users as well as invited guests from German SaR and disaster response organizations. These demonstrations provided critical opportunities for collecting early feedback on system functionality, usability, and performance, thereby informing subsequent development iterations.

3.5.3. Hackathon results

The hackathon successfully validated the core communication solution between edge and cloud components. Upload speeds from edge to cloud were measured to be approximately 10 Mbit/sec, enabling the transmission of one full HD image roughly every two seconds (see Edge Tests above). This level of performance is deemed sufficient for a variety of operational scenarios, particularly for non-time-critical data flows. The deployment of the measurement bus equipped with mobile power supply proved to be a valuable asset for in-field trials. It provided operational flexibility, allowing the experimental setup to be conducted independently of fixed power infrastructure. However, the experiments also revealed practical constraints: road accessibility to remote sites must be guaranteed, and due to limited transport capacity, the use of multiple vehicles was necessary to support the full experimental setup.

Operationally, the setup time required for establishing the experimental environment was approximately 1.5 hours, assuming a team of four persons. This figure provides an important baseline for planning and resourcing future deployments under similar conditions. Due to the ongoing integration efforts, certain tests — notably those involving in-situ sensor validation and

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drone-based data acquisition — were partially deferred or conducted without full physical trials. These activities will continue in subsequent project phases once the integration issues are fully resolved.

During the hackathon, the Cloud Team achieved several important milestones that significantly contributed to the overall success of the event. The infrastructure provided by UNIME proved to be a major asset, delivering reliable and effective support for cloud components and enabling a seamless integration between Edge and Cloud environments. This solid foundation allowed the cloud-based services to operate efficiently and facilitated smooth communication with the remote edge systems. A key technological success was the performance of the Digital Enabler platform. It ensured robust data storage and integration through the use of the context broker, successfully passing load and functional tests. Furthermore, it supported the real-time feeding of data to the visualization layer, thereby validating the end-to-end data flow from the edge devices to the end-user interfaces. Nonetheless, several areas for improvement were identified. The logic behind the execution of Building Blocks (BMs) requires refinement, particularly concerning the definition of recurring schedules and coordination signals between distributed components. Clearer coordination rules and execution scheduling mechanisms are essential to enhance the system's orchestration and overall responsiveness. Additionally, the need to support the management of multiple missions simultaneously emerged as a critical aspect for future development. This will require the refinement of naming conventions, data handling strategies, and operational protocols to enable parallel mission management effectively. Comprehensive testing of these multi-mission capabilities will be essential to ensure the system's scalability and robustness in more complex operational scenarios.

The hackathon thus provided critical technical insights and operational experience, laying a solid foundation for the refinement of both system components and deployment procedures ahead of future large-scale experiments.

3.5.4. End-user training and feedback session

This session took place on March 19, 2025, during the Munich Meeting, running in parallel with the hackathon and integration testing activities.

For the first time, end-users who were not part of the core project team—but may be employees of the partner organization—participated in the end-user training and feedback session alongside with end-users who are project partners. A total of 15 end-users attended, including 5 who had no prior involvement in the project. Those 5 were end-user guests from German first responder organizations: Bavarian Red Cross, German Red Cross and Mountain Rescue. All end users received training on the TEMA system (the state it achieved by early March 2025), a short task that

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demonstrated the usage of the system and were involved in feedback session on both the system and the training itself through a guided discussion.

Prior to the training session, participating end-users were given a brief presentation on the TEMA project, outlining the current stage of system development and the collaborative design approach. The presentation emphasized the importance of their feedback in shaping the system during its early development phase.

Key Insights & Recommendations collected from the end-users:

- **First Responder Tracking**
  Users emphasized the importance of being able to collect and visualize the real-time positions of first responders within the system to enhance coordination and situational awareness during emergencies.
- **Information Management & Update Frequency**
  There is concern about information overload. Users noted that real-time updates every minute are unnecessary and can be counterproductive. The current practice of updating three times per day is sufficient in many cases, with the option for manual refresh or notification-based updates preferred.
- **Training is Crucial**
  All participants agreed that comprehensive and scenario-based training is essential for effective use of the platform. This should be integrated early in the rollout process and accompanied by follow-up feedback sessions.
- **Simplified Language & User Guidance**
  Platform functionalities need to be explained in user-friendly, non-technical language, especially during onboarding and training. Tooltips, hover-over hints, and visual guides should be prioritized.
- **Visualization of Critical Infrastructure**
  There is a strong need to clearly map and highlight critical infrastructure, such as hospitals, power lines, and water sources. The ability to prioritize or rank infrastructure based on importance was also noted in earlier feedback.
- **End-User Data Integration**
  Users asked for a simple and secure method to upload their own datasets (e.g., shapefiles, JSON/KML formats) into the platform. This is essential for tailoring TEMA to local contexts and operational requirements.
- **Manual Coordinate Input**
  In addition to drawing polygons on the map, users would like the option to enter

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coordinates manually—particularly useful for precision planning or data entry based on external sources.

- **Multi-Device Mission Viewing**
 The ability to view the same mission simultaneously on multiple devices (e.g., multiple PCs) was requested to support distributed coordination across teams or control centers

3.5.5. Conclusion

The feedback highlights a clear direction for future enhancements: greater usability, operational relevance, and adaptability. Simplifying the interface, providing robust training, and allowing for local data integration are key to ensuring the TEMA system meets the real-world needs of its end-users.

3.6. TEMA demonstration and the feedback session during MODEX Sardinia 2025

Witness the EU Civil Protection Mechanism in action, ITA EU MODEX 2025 exercise took place in Nuoro, Sardinia, Italy from **April 7-11, 2025**. There were 7 modules in total: **6 specialized in fighting fires on land from Austria, Bulgaria, Greece, Romania, Slovakia and Slovenia, the remaining one - also from Greece - specialized in fighting fires with air vehicles**. Each module was self-sufficient, as happens in the case of a real international emergency. And it will be composed of about 50 operators each, including experts in extinguishing and logistics and 75 vehicles. About 500 first responders participated in the exercise.

On 10. April 2025 TEMA partners ENG and RAS demonstrated the TEMA System to first responders involved in the MODEX.

TEMA was showcased as an emergency management platform through an interactive workshop, replacing a conventional presentation with a hands-on session. This format enabled participants to provide real-time feedback, fostering productive exchanges between developers and field operators that generated insights beyond traditional lab testing.

Key Insights from User Feedback

- **Time-Critical Decision Support**

  Participants proposed "impact clocks": countdowns showing when fires may reach critical sites like hospitals or schools. This would support more precise deployment and evacuation decisions.

- **Improved Visual Clarity and Data Responsiveness**

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Users recommended clearer color schemes to highlight danger zones and variable refresh rates: updating dynamic data (e.g., fire perimeters) more frequently while reducing updates for static information to maintain clarity and speed.

- **Realism and Tactical Integration**

  Suggestions included incorporating real-time humidity data to reflect fire behavior more accurately and allowing users to draw virtual "defense lines" that would influence the simulation in real time.

- **Building a Field-Ready Platform**

All feedback pointed to a shared goal: making TEMA a true “eyes on the field” tool for decision-makers. By prioritizing user-driven features, the platform is evolving into a responsive, operationally relevant solution for both current and future emergency management needs.

4 Conclusion

This document, **Deliverable D6.1**, presents the **comprehensive framework and specifications** for the TEMA pilot trials, developed under Task 6.3 within Work Package 6. Utilizing the Trial Guidance Methodology **(TGM)** and detailed Trial Action Plans **(TAPs)**, substantial progress has been made in planning the **four pilot trials scheduled for 2025**, and setting a **template** for following **four pilots scheduled for 2026**, focusing on flood and fire scenarios using historical and hybrid data. **Supporting activities**, including end-user feedback sessions, technical integration hackathons, and workshops, have provided crucial insights, fostered collaboration, and refined the TEMA system, preparing it for **realistic operational evaluation**. The specifications and planning detailed herein serve as a critical roadmap for executing the trials in Task 6.4, assessing the TEMA solution's operational impact, usability, and effectiveness in addressing identified Natural Disaster Management (NDM) capability gaps, thereby guiding future development and deployment efforts.

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5 Annexes

Annex 1: TAP RAS Trial 1

Annex 2: TAP KAHY Trial 1

Annex 3: TAP BRK Trial 1

Annex 4: TAP DMALIAN Trial 1

Annex 5: Evaluation Questionnaire

Annex 6: TEMA Training Handbook

Annex 7: Template- Information Sheet

Annex 8: Template- Informed Consent Form

Annex 9: Guided Discussion Questions

Annex 10: Observers questions

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6 References

Drive+ Project The DRIVER+ project for Crisis Management

Trial Guidance Methodology DRIVER+ – Trial Guidance Methodology

Trial Guidance Methodology Hanbook TGM_Handbook_EN.pdf

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TEMA

TRUSTED
EXTREMELY PRECISE
MAPPING AND PREDICTION
FOR EMERGENCY
MANAGEMENT

Annex 1

Trial Action Plan (TAP)

RAS Trial-1

TEMA
TRUSTED
EXTREMELY PRECISE
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FOR EMERGENCY
MANAGEMENT

Project Information

Project acronym:	TEMA
Project full title:	Trusted Extremely Precise Mapping and Prediction for Emergency Management
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WP:	**6**	**T6.3.**	
Author(s):	Salvatore Cinus, Fabrizia Soi, Antonio Usai, Fabio Casule, Barbara Beccu, Francesco Loi, Francesco Tony Nasir, Stefano Loddo, Mario Uda, Domenico Sanna, Valeria Coraini, Fabio Dessì, Renata Brattina, Elvira Corona		
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Disclaimer

The TEMA consortium consists of the following partners:

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2	DEUTSCHES ZENTRUM FUR LUFT – UND RAUMFAHRT EV	DLR	DE
3	ENGINEERING - INGEGNERIA INFORMATICA SPA	ENG	IT
4	ATOS IT SOLUTIONS AND SERVICES IBERIA SL	ATOS IT	ES
4.1	ATOS SPAIN SA	ATOS SP	ES
5	UNIVERSIDAD DE SEVILLA	USE	ES
6	TECNOSYLVA SL	TSYL	ES
7	NORTHDOCKS GMBH	ND	DE
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Version	Description	Contributions
0.1	TEMA TAP Template	Margareta Mihalic Dogan
0.2	TEMA TAP RAS	Salvatore Cinus, Fabrizia Soi

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Reviewers

Name	Organisation

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List of Terms and Abbreviations

Abbreviation	Description
TAP	Trial Action Plan
TEMA	Trusted extremely precise mapping and prediction for emergency management
TGM	Trial Guidance Methodology
CFVA	Forestry and Environmental Monitoring Corps - Corpo Forestale e di Vigilanza Ambientale
Forestas	Wood Agency - Agenzia Forestas
CFD	Alert risk center for Sardinia - Centro Funzionale Decentrato di protezione civile
RAS	Civil protection Directorate Sardinia region - Regione Autonoma della Sardegna - Direzione generale della Protezione Civile
SOUP	Regional forest fire operating room - Sala operativa unificata permanente
AREUS	Regional Emergency Company Sardinia - Azienda regionale Emergenza Urgenza Sardegna

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Executive Summary

This report contains the main elements of the Trial in Sardinia. The exercise will involve both the partners of the European Tema project, but also the Forestry and Environmental Monitoring Corps (CFVA), the Forestas agency and civil protection volunteers.

The exercise will be based on a real case, a prescribed fire land strip will be burned in the Pabarile forestry site by the Forestry and Environmental Monitoring Corps, the Forestas agency and civil protection volunteers.

The chapters of this TAP describe the most peculiar aspects of the test case, starting from the objectives, the gaps of the current system for which the tools developed in the Tema project can provide support, the methods used to collect data, the technical components used, the methods of organizing the test case in Sardinia.

The exercise will allow for a first test on a real case of the usefulness of the platform for managing a fire, based on the data acquired (in particular via drones) and the analysis and modeling tools of the same.

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1 Introduction

The Sardinia Region is characterized by fires of particular severity during the summer season, typically from 1st of June to 31 of October.

In particular, with a surface area of 24,086 km2, the average burned surface in the period 1998/2024 was 16,195.60 ha/year. The ignition points are approximately 2,800/year. During 2024 we had 11,545.73 ha burned of which 2,846.43 ha of wooden surface.

Natural Disaster Management (NDM) is crucial to prevent these events from becoming life-threatening. In light of such urgency, and under the advancements in science and technology that have been achieved in recent years, the TEMA research project will develop **beyond-state-of-the-art** methods and technologies to facilitate disaster management procedures, in particular by developing automated means for precise semantic area mapping and phenomenon evolution predictions for Natural Disaster Management in (near-)real-time. This will be achieved by **AI systems** that receive multiple heterogeneous data modalities, like geosocial media, topographical, or official meteorological data as input. Using AI technologies and multiple data sources, TEMA will provide a map-based emergency decision support system able to make an accurate assessment of an evolving crisis situation while also giving automated response recommendations.

TEMA has 3 main goals:

1. Improve Natural Disaster Management using **new digital technologies** and **extreme data analytics.**
2. Improve and accelerate extreme data analytics, by increasing **trustworthiness**, **accuracy** and **responsiveness** of extreme data analysis algorithms.

- Improve and accelerate emergency phenomenon **modelling**, evolution **predictions**, simulation and **interactive visualization.**

After the pilot case in Finland, the second test case in Sardinia will allow testing the methodologies developed in the Tema project in a real fire case (it will be a prescribed fire), real-time data collection and transmission and real-time processing of the same data by the wildfire propagation model available in the platform, all for the purpose of supporting decisions and strategies.

The indications that will result from this test case in Sardinia will allow improving the platform and its management systems, in order to be able to introduce any improvements in the subsequent tests planned in the project.

With the platform and the tools that will be developed in the project, it is expected to be able to significantly impact the management of emergencies both in Sardinia and in Italy and throughout Europe.

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It is specifically recalled that TEMA aims to have a significant impact on a) scaling-up European capacity for extreme data analytics, b) producing explainable, robust and humanly verifiable analytics, c) providing fast and precise phenomenon prediction and response planning, d) reducing the emergency response times during Natural Disaster Management, e) improving the decision making during Natural Disaster Management, f) boosting the EU policy agenda in the Data Spaces domain, as well as in the adoption of Decision Support Systems for emergency management, g) opening up a new market segment via the envisioned Extreme-Analytics-as-a-Service, which makes select TEMA methods available to external users via the cloud and standardized interfaces.

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2 Purpose and Scope

The purpose of the Trial Action Plan (TAP) is to provide a detailed plan for the organization of the trial and to facilitate the monitoring of the trial preparation activities, as well as an evaluation plan for the TEMA project. The completion of the TAP chapters serves as an indicator of progress in the trial preparation.

2.1 Trial Stages

The Trial event stages, which reflect the stages of Trial preparation, include 5 steps:

1. Stage A – The initial stage, which ends with Workshop “0”
2. Stage B – The main preparation stage which ends with Dry Run 1.
3. Stage C – The maturation stage which ends with Dry Run 2.
4. Stage D – The final preparation stage which ends with the Trial itself.
5. Stage E – The recapitulation stage which ends with the Trial evaluation report.

The preparation stages and the activities undertaken during each stage are presented in the table below (Table 2 in chapter 2.2.).

Stage A was started in WP2 T2.1. of the TEMA project. Results of the work done in T2.1. are in deliverable D2.1. Stages B to E will be covered by work in WP6, more specifically: stages B and C will be covered within T6.3 and Stages D and E within 6.4 and reported in respective deliverable D6.1. and D6.2.

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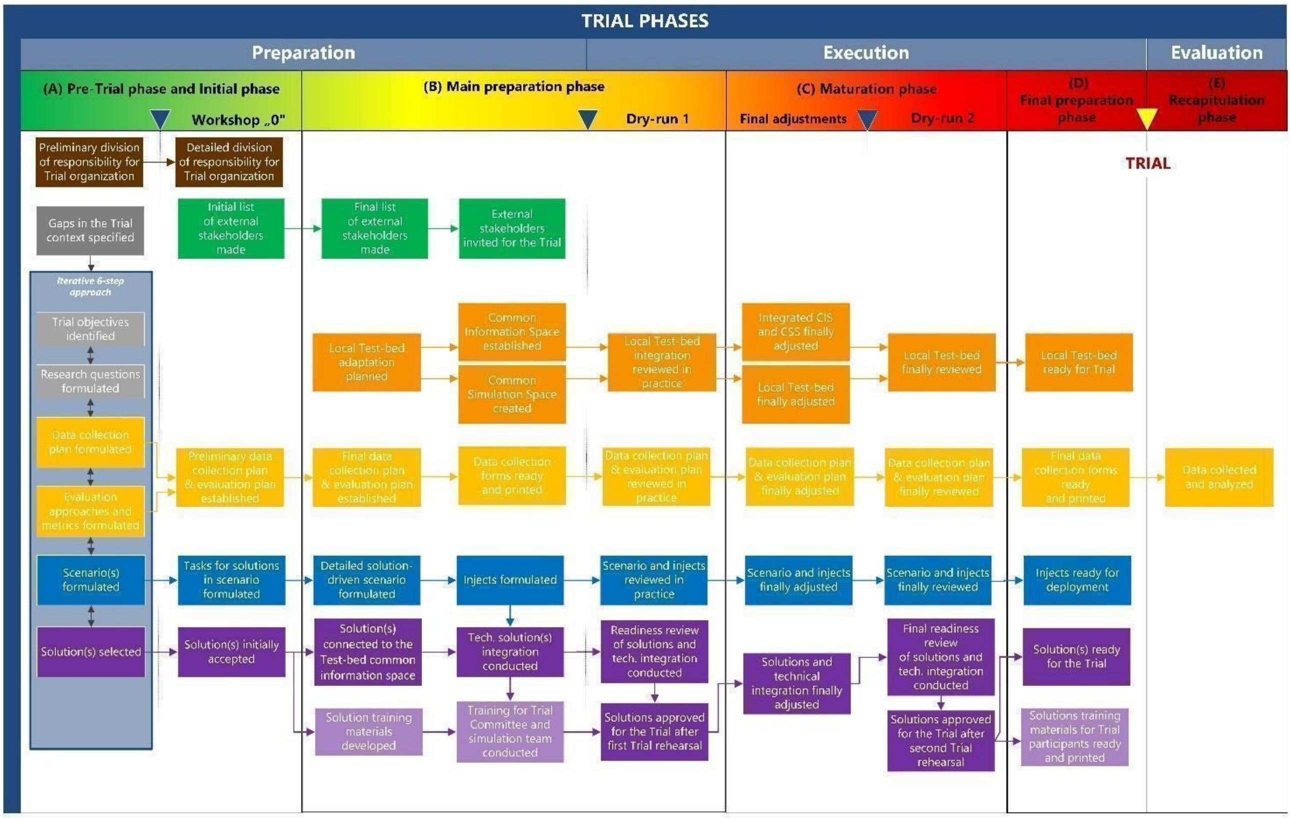

Figure 1. Trial Phases

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2.1. TAP completing schedule

Table 1: TAP review schedule and monitoring

	Deadline	Description	Contributor
1	16.5.2025	Chapter 1	RAS
2	21.2.2025	Chapter 2	RAS, KAHY, BRK
3	6.3.2025	Chapter 3	RAS, KAHY
4	19.3.2025	Chapter 4	RAS, KAHY, BRK, KEMEA
5	22.4.2025	Chapter 5	RAS
6	30.4.2025	Chapter 6	RAS
7	30.4.2025	Chapter 7	RAS
8	30.4.2025	Chapter 8	RAS
9	5.5.2025	Chapter 9	RAS
10	5.5.2025	Chapter 10	RAS, LC
11	16.5.2025	Chapter 11	RAS

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3 General Information on the Trial

The Trial will be arranged in the location of Badde Urbara (Pabarile Toponym) in the municipality of Santu Lussurgiu. The location has been affected in the past by severe wildfires.

Table 2. General information on the trial

Location (Test bed)	Municipality of Santu Lussurgiu - location Badde Urbara Pabarile.
Date	17.06.2025-20.06.25
Organizer	RAS
Trial type	Hybrid (new data), field

3.1 Trial Purpose and Goals

The common challenge of TEMA project is the improvement of natural disaster management (NDM) by providing a state-of-the-art disaster management support system, dynamically exploiting multiple data sources and AI technologies for providing an accurate assessment of an evolving crisis situation.

Sardinia in summer is subject to numerous fires due to the favorable climate characterized by high temperatures, wind and low humidity. Even the area that is the subject of the test case has been subject to major fires in the past, including that of 2021 in which more than 12,000 hectares of land burned in July 2021.

During the development of the test case in Sardinia in Montiferru, we aim to test the platform developed in the Tema project, the communications system, the fire propagation modeling and the field data collection system, all in order to better understand how Tema innovative tools are able to improve the current system with which large fires are faced in the field in Sardinia.

The exercise will be preceded by a press conference with the aim of making the local community aware of the important efforts of the Sardinia Region and more generally of all the project partner countries to improve the active fire fighting system.

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3.2 Outline of the Trial Scenario

The location of the exercise is in the area of Badde Urbara, in the Municipality of Santu Lussurgiu; this area has been prone to important wildfires in the past.

The specific trial is based on a real fire due to operation of prescribed fire managed by Forestal corp (CFVA) and Forestas.

During the exercise, a strip of vegetation measuring approximately 500 x 25 meters will be burned. The land strip will also contain a local pile of wood for which the development of larger flames is foreseeable.

The land strip will be re-burned every year and will have the purpose of protecting the buildings owned by the Forestas agency in the Pabarile construction site.

In the scenario described in the paragraph below, it is imagined that the prescribed fire is an out-of-control fire that risks becoming of significant dimensions and that the platform, tools and procedures developed in the Tema project are used to deal with the event that is developing.

In particular, all the data and information that can be collected on the prescribed fire in progress are transmitted to a control room (advanced command post in a real case) in order to be examined directly and through a specific fire propagation model. During the exercise, 10 people with high levels of experience in the field of fires will operate in the control room, including participation in forest firefighting operations rooms such as the SOUP (regional forest fire operating room).

These personnel, trained in the use of the platform during the day of May 30, 2025, will use the tools available in the Tema platform and evaluate how they can be used in real cases to coordinate forces and deal with the progression of a fire, as well as provide useful suggestions on how to improve the Tema user platform.

3.3 The Scenario

In the Municipality of Santu Lussurgiu, a major fire breaks out and after a few hours reaches the Pabarile forestry site, where it threatens the buildings and appurtenances of the Forestas Agency.

The fire also puts local communities at risk.

Forest rangers and other first responders are activated to fight the fire and secure the population and sensitive buildings.

An advanced command post is activated near the site affected by the fire in order to coordinate the extinguishing operations.

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The decision-making activity concerning the areas where to concentrate the extinguishing forces, the safety of the inhabited areas, the evaluation of the timing of the progression of the fire, is entrusted to the control room that is part of the advanced command post and coordinated by the incident commander.

In the control room, data on the ongoing fire is acquired thanks to the flight of drones that produce, among other things, videos and photos of the event.

The population potentially threatened by the event sends messages via social media, these messages also flow to the control room where they are examined.

In the control room, thanks to the fire propagation modeling, the evolution of the event in the next few hours is evaluated and the intervention strategy and the safety of the territory is decided.

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4 Trial Guidance Methodology Application

The identification of gaps when facing natural disasters like fire, flood, and relative to the purpose of TEMA project and pilots, should take into consideration the gaps from the academic literature as well as the gaps stemming from the Grant Agreement and the Storytelling.

In the TEMA project, gaps have been identified and assessed in the context of D2.1 as part of the story telling procedure. There the vulnerabilities of the response mechanism as well as proposed solutions offered by TEMA technologies have been stressed out.

In general, there is also a distinction between qualitative and quantitative gaps in a natural disaster.

- A qualitative gap is for example the political profile of a disaster, or the availability and the time to deploy resources for the disaster. There is also the need for improved management and coherent coordination in order to provide an overview of the situation and act fast.

- Quantitative gaps for floods or fires can be summarized to the lack of resources for the repression and interception of the natural disaster, the lack of sufficient quantities regarding shelter capacity, hospital modules, mobile units of equipment, lack of capacity for rescue and research, limited aerial fire-fighting capacity, as well as the lack of organization and preparedness of the resources that are engaged in the response mechanism, therefore a gap in the quantities of aerial and terrestrial resources deployed in the fight against the natural disaster.

Grant agreement:

- Information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.
- Low visibility and health hazards due to smoke. Scarcity of accurate information regarding the wider area, leading to suboptimal response strategies.
- Accurate information is crucial in planning, prioritizing and managing response actions.
- Access to trustworthy information is crucial for FRs/PPDR (Public Protection and Disaster Relief) organizations.

Gaps from Storytelling:

RAS (Forest Fire): To improve emergency responses, several key systems need to be put in place:

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A **geolocation system** could help quickly identify people in danger, enabling first responders to offer immediate assistance. Coupled with a **text messaging system**, citizens would receive real-time instructions on how to stay safe, evacuate, or avoid hazardous areas.

It's also important to have alerts for the **closure of schools and public facilities**, especially during severe weather events like heavy rain, to prevent unnecessary travel on dangerous roads. Additionally, knowing the **exact size of the affected area** allows for better resource allocation and faster recovery.

During recovery operations, having **adequate equipment and specialists** is crucial to address the local challenges. Coordination is key, and sharing the **local civil protection plan** and real-time data across all agencies ensures everyone is aligned. **Shared communication channels** help rescue teams avoid redundant efforts and stay coordinated.

Using **drones** for aerial reconnaissance would provide valuable insights, even at night or in poor weather conditions. Real-time access to **live monitoring systems** would allow decision-makers to track on-the-ground events, improving the efficiency of rescue operations.

Improved **satellite imaging** could help interpret storm phenomena more clearly, pinpointing areas affected by disasters. **Real-time maps** that can be shared between authorities would avoid duplication of efforts and ensure that resources are deployed where they're needed most.

These systems, when combined, would streamline emergency responses, reduce risks, and speed up recovery efforts.

4.1 Brief description of chosen gap assessment method

The identification of gaps when facing natural disasters like fire, flood, and relative to the purpose of TEMA project and pilots, should take into consideration the gaps from the **academic literature** as well as the gaps stemming from the **Grant Agreement** and the **Storytelling**.

In the TEMA project, gaps have been identified and assessed in the context of D2.1 as part of the storytelling procedure. There the vulnerabilities of the response mechanism as well as proposed solutions offered by TEMA technologies have been stressed out.

In general, there is also a distinction between qualitative and quantitative gaps in a natural disaster.

- A qualitative gap is for example the political profile of a disaster, or the availability and the time to deploy resources for the disaster. There is also the need for improved

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management and coherent coordination in order to provide an overview of the situation and act fast.

- Quantitative gaps for floods or fires can be summarized to the lack of resources for the repression and interception of the natural disaster, the lack of sufficient quantities regarding shelter capacity, hospital modules, mobile units of equipment, lack of capacity for rescue and research, limited aerial fire-fighting capacity, as well as the lack of organization and preparedness of the resources that are engaged in the response mechanism, therefore a gap in the quantities of aerial and terrestrial resources deployed in the fight against the natural disaster.

Grant agreement:

- Information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.
- Low visibility and health hazards due to smoke. Scarcity of accurate information regarding the wider area, leading to suboptimal response strategies.
- Accurate information is crucial in planning, prioritizing and managing response actions.
- Access to trustworthy information is crucial for FRs/PPDR (Public Protection and Disaster Relief) organizations.

Gaps from Storytelling:

RAS (Forest Fire): To improve emergency responses, several key systems need to be put in place:
It would be useful to know which teams are involved during a fire event, where they are located and which tasks they are performing at a given moment. To better understand the extent of a fire event and how it is developing, we would like to have footage in the control room acquired by teams on the ground. We would also like to have tools to determine if the fire has been properly extinguished or if it is still burning beneath the surface.

It is important to have high resolution maps in which meteorological variables such as wind, temperature and relative humidity are available on an hourly basis or less, not only through forecasts but also through measurements.

During a fire event, it would be helpful to have sufficient data and information to understand how and where a forest fire is evolving. A fire propagation model could be useful for the operators in the control room. In addition, tools and technologies that detect forest fires as soon as they start would be useful. At present we have only human lookouts, we have no automated technologies that are competitive or better than human operators.

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Gaps assessment method is to be shortly described using the information from the Deliverable 2.1. Add a link to the final version of the D2.1.

Link: https://drive.google.com/file/d/1OWm1eCl6tDl3jv6cnBDTWsAOnkdvkAWN/view

4.2 Selected and Validated Gaps

A complete and detailed gaps analysis was conducted as part of the analysis in WP2 and is described in Deliverable D2.1. For the needs of the RAS Trial 1, Montiferru Wildfire use case, the gaps most relevant to this specific use case, which will be validated in the same pilot trials, have been selected. The selected gaps are described in Table XY. The priority of the following list of selected gaps is high.

Table XY: selected gaps

Gap description	Interdependencies with other gaps	Method of verification
6. Information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.	6-10-11	TEMA-System in total
10. It would be useful to know which teams are involved, where and with what tasks.	6-10-11	TEMA-System in total
11. Furthermore, it would be useful to have footage in the local control room that could be acquired by the teams on the ground to understand the extent	6-10-11	TEMA-System in total

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of the event and how it is developing.		
12. As reported at the start of section "Story", the initial fire that seemed to be extinguished, restarted the day after. Therefore, a technological solution could help to monitor the area of interest and provide early warnings of a possible fire revival.	12-13	TEMA-System in total
13. It is important to achieve a local map with the variable wind and temperature described hour by hour (currently is available only at regional level by meteo models).	13-14-16	TEMA-System in total
15. During an event of fire it would be nice to have sufficient data and information in order to understand how and where the fire is evolving and also detailed information regarding the available as well as the already deployed fire fighting forces in the field.	13-14-16	TEMA-System in total
16. It can be useful to use a model of fire propagation in SOUP room during a big fire.	13-14-16	TEMA-System in total
17. Tools- instruments technologies to reveal fires as they start (as soon as possible, to have quick information) - at	17-18	TEMA-System in total

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present they have only human lookouts (they have not yet found technologies better than the human operators).		
18. It would be useful to have aerial photos (would also satellite photos be sufficient?) of the area of interest during the fire event in order to better decide on the evacuation or not of the population.	17-18	TEMA-System in total

4.3 Trial Specific Objectives

Ensure the accessibility of information also to the regional operations room of the Civil Protection for decision support and intervention planning: provide reliable and real-time data on access conditions to the affected area (such as road network, bridges, barriers) to support the decision-making and planning chain also for the optimal management of urgent rescue. Improve the collection of information on the status of the places affected by the event to ensure that rescue teams have clear and detailed objectives aligned with actual needs.

Determine the scope of the affected area: Establish a reliable method for assessing the size and boundaries of the affected area to allocate resources efficiently.

Clarify the needs and objectives of the mission. Improved data integration: provide integrated access both across platforms and databases that are seamless (e.g., satellite imagery, UAV reconnaissance) to improve the accuracy of situational assessments.

Simulate the impact of the evolution of the phenomenon using tools designed ad hoc, such as acquiring the coordinates of the ignition point, evaluate how the fire can spread and affect nearby anthropogenic structures and then be able to visualize this simulation and the derived outputs in the operations room in order to improve the timeliness of information and related decisions.

Improve decision support in the operations room: Solutions should improve the ability of emergency management teams to make informed, data-driven decisions.

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Optimize assessment for effective rescue and care: Develop an effective system for assessing the urgency and priority of affected areas, allowing officers and operators in the room to make more accurate decisions and first responders to focus on the most critical positions.

Improve situational awareness for response actions: Provide accurate and up-to-date information to facilitate better planning, prioritization, and management of response efforts.

4.4 Research questions

Based on the objectives (defined in DOA) research questions are focused on understanding the end-user experience and the perceived value of the TEMA system for disaster response, especially in comparison to their current tools and methods:

Usability and User-Friendliness: How do end-users perceive the usability and user-friendliness of the TEMA system compared to their current tools? This includes the ease of understanding information and labels, the intuitiveness of the tools, and the ease of customization.

Information Quality and Trustworthiness: How do end-users rate the clarity, detail, accuracy, and reliability of the information provided by the TEMA system in comparison to their current systems?

Efficiency and Speed: Does the TEMA system improve the efficiency and speed of disaster response tasks, such as accessing comprehensive maps, receiving updated information, gathering data, and displaying information?

Automation and Workload: How does the level of automation in the TEMA system compare to the end-users' current systems, and does it reduce the amount of manual work required?

Situational Awareness: How does the TEMA system affect end-users' ability to establish situational awareness during a disaster, including the ability to work with different map views and combine intel from multiple sources?

Decision-Making Support: How does the TEMA system support and enhance decision-making during disaster response compared to current tools, including the speed and effectiveness of decisions?

Perceived Benefits and Limitations: What are the main perceived benefits and limitations of the TEMA system compared to current systems for Natural Disaster Management (NDM) from the end-users' perspective? What specific aspects of the TEMA platform are considered most beneficial.

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Areas for Improvement: What improvements or additional functions do end-users suggest for the TEMA system?

These research questions are the basis for the evaluation questions.

4.5 Data collection method and outline

Data will be collected throughout all the real case exercise by means the drones that will fly and by various measures that could be carried out by sensors, mainly installed on the drones too.

4.6 Initial Scenario

The trial is based on a real fire due to operation of prescribed fire managed by Forestal corp (CFVA).

The location of the exercise is in the area of Badde Urbara, located in the Municipality of Santu Lussurgiu. Here, in the compendium of Forestas Agency a forest fire starts.

The day before The Sardinian Fire Hazard Office (CFD) forecasts very high temperatures, strong winds and low air humidity for the following day. In addition to this, through satellite images, vegetation is seen to be very dry (NDVI index method).

CFD predicts extreme fire hazard for the day after in the North-west of Sardinia, including Santu Lussurgiu Municipality. Therefore it alerts institutions (regional authorities, municipalities, agencies etc.), citizens by means of a fire hazard bulletin: this information is sent out by official website, email, certified email, TV news etc.

The day of exercise, human lookouts notice a beginning of fire and alert the forestal corp.

The fire spread very quickly due to the high temperature (over 37- 40 degrees Celsius) and low relative Humidity (under 20 %), wind over 50 km/h, the vegetation being dried by a long heat wave.

Forestal rangers and other first responders are activated to fight the fire.

Sensitive buildings are very close to the wildfire and need to be protected, further the fire is moving toward the inhabited areas of Santu Lussurgiu and Cuglieri.

Populations write messages through geosocial media regarding the progress of fire.

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4.7 Technical components in TEMA Solution

In order to improve the effectiveness of the interventions in the scenario foreseen for the Montiferru area, the following technologies will be tested during the exercise:

1) “drones equipped with sensors” to gather during a wildfire several pieces of information: (the involved area is the one with flames and smoke); sensor that could be tested: infrared, wind. Footages and photos will support understanding the field conditions in the control room.

2) Volunteers will use geosocial media writing messages from the boundaries areas. These messages generate a sort of alerts that will be analysed by means of “Geosocial media Analysis”. It is possible that this part of the exercise will be arranged using synthetic data, due to the difficulties of organising this system.

3) In the control room the “smartdesk” will be used to visualise all the information. The information could be visualised by means of a 3d computer vision (digital twin+PDM05 Information fusion)

4) The progress of fire could be evaluated by first responders in the control room using the “forest fire simulation+ Geovisual Analytics”. Strategies to face the wildfire could be implemented taking into account this information.

4.8 Training plan on TEMA Solution

The training plan on the TEMA solution consists of a minimum of two hands-on sessions organized by technical partners and delivered to end users. Hands on training encompasses a dedicated time slot where end users learn how to use the TEMA solution. The technical partners prepare the learning materials and organize the time slots.

The first round of training is delivered to all end users simultaneously to ensure that all of them can receive in person support and guidance, the technologies can be thoroughly demonstrated, and the end users learn.

To support the training process, three documents are prepared and shared with the end users:

1) Technology descriptions – plain language descriptions of each TEMA component and their functionalities
2) A learning manual – a step-by-step guide on how to use each TEMA technology that has been implemented within the SmartDesk.

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3) Learning tasks – several exercises to complete using the SmartDesk, which ensures that participants train with all TEMA functionalities.

In addition to the documentation, a sandbox version of the SmartDesk is created specifically for training. The purpose of the Sandbox version is to ensure that each technical component includes sample data for learning and testing of the features. This ensures that prior to the pilot exercises and field use of the TEMA solution, the end users are able to navigate the SmartDesk and fully utilize the TEMA functionalities.

The training documentation will be updated in the future to ensure that all the developed features and functionalities are explained and practiced.

5 Trial Planning

In order to allow the exercise to be carried out correctly, various roles and responsibilities have been assigned to people participating in the exercise, also on the basis of the interaction of the exercise with the prescribed fire activities that will be contemporary with the tests on the platform and to ensure complete communication and coordination in this sense.

5.1 Responsibilities

The tables below identify key people for various roles during the conduct of the exercise.

5.1.1 Trial committee

Table 3. Trial committee

Role	Name	Scope of responsibility
Trial Owner	Salvatore Cinus	He is the main contact person for the organization of the Italian pilot.

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Technical coordinator - Solution Coordinator	Antonio Filograna	The main contact person that is overseeing the technical preparation and performance of the TEMA solution during pilot testing.
User coordinator (Platform)	Antonio Filograna- Francesco Arigliano	The main contact person that is overseeing the technical preparation and performance of the TEMA solution during pilot testing.
Technical coordinator (Test-bed) Testbed Infrastructure support	Nicola Colosi - Lorenzo Carnevale	He oversees the individual components in the pilot trial and provides technical support if needed.

5.1.2 Trial organizer support

Table 4. Trial organizer support

Function	Name	Scope of responsibility
Main organizer (Trial Owner)	Salvatore Cinus	He is the main contact person for the organization of the italian pilot.
Trial director and supervisor	Salvatore Cinus	Coordinates the execution of the various phases of the Tema exercise. Ensures the correct execution of the exercise also by ensuring correct communication between the prescribed fire operations in the field with the various activities related to the flight of the drones and the Control Room. Plan and oversee the scenario and trial activities.

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Function	Name	Scope of responsibility
Deputy Trial director and supervisor	Fabrizia Soi	Support the Trial director and supervisor. Coordinates the execution of the various phases of the Tema exercise. Ensures the correct execution of the exercise also by ensuring correct communication between the prescribed fire operations in the field with the various activities related to the flight of the drones and the Control Room. Plan and oversee the scenario and trial activities.
End users coordinator	Francesco Tony Nasir Stefano Loddo	He interfaces with evaluators during the exercise providing support for the correct use of the platform if necessary.
Prescribed burn coordinator	Gianfranco Putzulu Lino Magari Efisio Pala	Coordinates field burn activities and interfaces with the trial director and field activity coordination staff to ensure proper timing of the exercise in compliance with safety.
Field activities coordination staff (prescribed burn)	Antonio Usai Barbara Beccu	Interfaces with the personnel involved in field activities related to prescribed fire, in particular with those of the CFVA in order to ensure the correct execution of the exercise.
Technical Coordinator (Local platform)	Viktor Bezsmertnyi	Provides front-end support for the TEMA platform and graphical user interface.
Training coordinator	Filip Sever	Prepares learning material and training tasks. Participates online during the independent learning session to provide support if necessary
Logistic coordinator	Renato Boi Maurizio Zucca Domenico Sanna Mario Uda	Organizes venue, catering and facilities for the pilot trial. Supporting people to reach the trial site if necessary
Drone operations coordinator	Dimitriy Shutin	Coordinates the operations of the DLR and University of Seville drones in the field and ensures the correct data sending to the control room

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Function	Name	Scope of responsibility
Drone operations Sardinia	Fabio Casule Gavino Canu	Supports the drone coordinator's activities if necessary and organizes the external filming activities of the exercise also in collaboration with the CFVA.
Safety officer	Filippo Murtas (Forestas) Gianfranco Putzulu Francesco Loi Fabio Dessi	Responsible for safety during the pilot trial, particularly regarding the possible interferences between trial activities and prescribed burn activities .
Evaluation and review coordinator	Salvatore Cinus Fabrizia Soi Antonio Usai	Facilitates briefing, debriefing, particularly the feedback from participants and evaluation sessions. Italian session
Media Officer	Elvira Corona Daniela Pani	Captures content on the pilot activities and communicates with media. Communicates with the media and publishes pilot content. Facilitate the press conference
Venue Officer -Vip Host	Valeria Coraini Renata Brattina	Handles the reception of participants and resolves critical issues related to the organization. Handles the participation of external stakeholders
Communication exercise	Lorenzo Carnevale Gianfranco Schirru	It ensures that communications are working correctly, both the voice channel and the data channel (radio/starlink), as well as the correct sending of information via telegram or Whatsapp

Table 5. Support Group

Support group	Name/Company and contact details	Scope of responsibility
Security team	FORESTAS RAS CFVA	This team ensures that there is no interference between the prescribed fire operations and the theme exercise. Ensures that all safety measures are applied for the correct conduct of the prescribed fire operations.

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Medical team	AREUS	It provides medical support, and in particular rapid intervention by rescue personnel in case of emergency
Volunteer Coordinator	Emilio Garau	Coordinates the support activities of civil protection volunteers, including catering activities, and support for the transportation of people

In case of necessity different from those here indicated, the contact person is Valeria Coraini of RAS.

5.1.3 Trial participants

Table 6. Trial Participants

Participating group	Confirmation of participation[1]	Number of anticipated participants	Comments (e.g. limitations - conditions of availability)
KAMK			
ENG			
TSYL			
AUTH			
UNIME			
UNISE			
BRK			

External partecipants (prescribed burn)

[1] Status: initially informed / invited / confirmed / to be confirmed later (date) / conditional availability (explain) / other (with suggested action)

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Participating group	Confirmation of participation	Number of anticipated participants	Comments (e.g. limitations - conditions of availability)
CFVA	Yes	30	
Forestas	Yes	10	
Volunteers	-	20	

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[1] Status: initially informed / invited / confirmed / to be confirmed later (date) / conditional availability (explain) / other (with suggested action)

5.2 Command structure during Trial

The following diagram describes the command structure during the exercise.

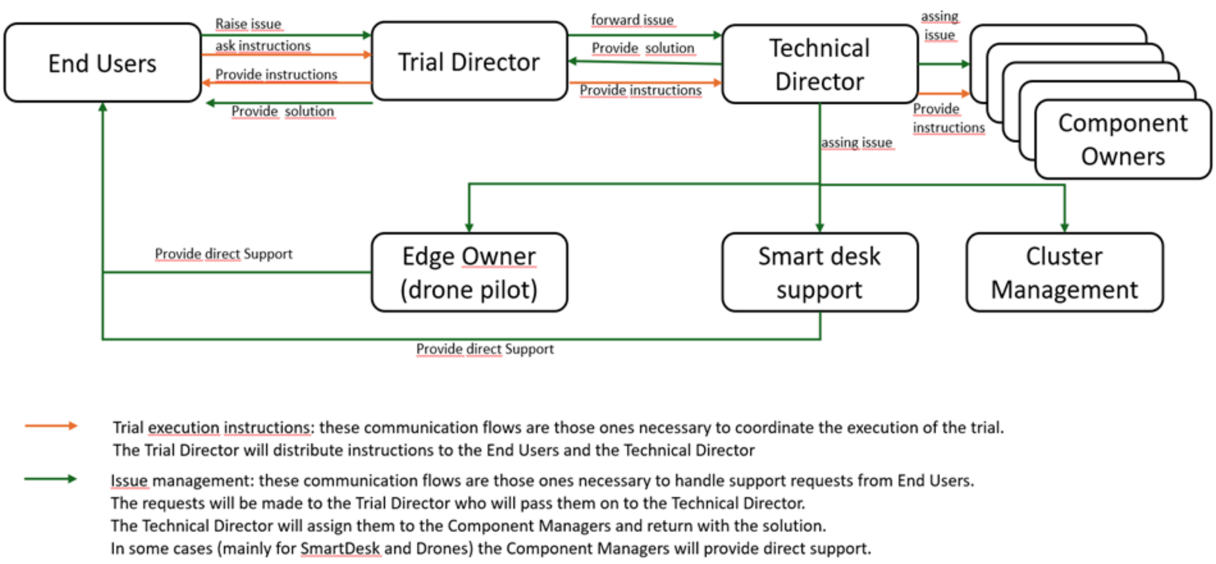

Figure 2. Command structure during Trial

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Participants operate in the field and in the control room. The main communications are ensured by the radio system provided by RAS, by normal telephone communications and by the telegram channel (or whatsapp). Participants operating in the control room communicate in real time face to face.

5.3 Timeline of Preparatory Activities

Table 7. Timeline of preparatory process

DATES	ACTIVITIES	Contributor	Needed for
12.02.2025	Survey of Badde Urbara Montiferru Trial area	CFVA, Forestas, DG Protezione Civile	RAS trial
12.02.2025	Speed test based on UNIME technology	UNIME, RAS	All trials
10.04.2025	Environmental authorization	Landscape protection office-Forestal Corp	Prescribed burn authorization
10.04.2025	Modex exercise -presentation of Tema Project	AUTH, ENG, RAS, UNIME	Make known the Tema project to participants to Modex exercise
30.04.2025	Ras Send invitation letters for validator operators	RAS	Evaluators of Control rooms

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30.05.2025	Training for evaluators of control rooms	RAS, KAMK, CFVA, Forestas	It is necessary for use platform and other instruments-tools of the project
28.05.2025	Signing of protocol between Forestas, Civil Protection and CFVA	RAS, CFVA, Forestas	It is propedeutic to field activities
6.06.2025	Meeting with the municipalities participating in the exercise	RAS, CFVA,Forests, Santu Lussurgiu Municipality, Cuglieri Municipality	The meeting is aimed at sharing the project with the territory that hosts it
07.06.2025	Preparation of area for prescribed burn	Forestal Corp, Forestas Agency	These operations are required for the prescribed burn
12-13 .06.2025	Pre test of Seville Drones in the area of Montiferru	RAS, Forestas Agency	Carry on the trial
18.06.2025	Start of the prescribed burn	All partners	
19.06.2025	Tema field exercise	All partners	

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5.4 Risk analysis and contingency planning

- **Risk 1**: Overlaps in pilot trail schedules

  Contingency planning: It was agreed among the partners that there should be a minimum gap of two weeks between individual pilot trials. This allows partners who need to be physically present to plan their travel more reasonably and ensures there is sufficient time to transport equipment between locations. A table outlining the schedule for all pilot trials has been created, maintaining at least a two-week interval between each and avoiding months when most partners are typically on vacation.
  Identified: 16.05.2024

- **Risk 2**: Overlap in the schedule for fire use case, hybrid pilot trials

  Contingency planning: Both KAHY and RAS identified June as the month for conducting prescribed burning to generate new data for the hybrid pilot trials. However, this posed a risk of scheduling overlap, which could create significant challenges for technical partners who need to be physically present at both trials and whose equipment must be transported to the trial locations. To avoid these conflicts, it was agreed that the RAS fire use-case hybrid pilot trial will take place in June 2025, and the KAHY trial in June 2026.
  Identified: 16.05.2024

- **Risk 3**: Available bandwidth not sufficient to conduct the pilot trial

  Contingency planning: Trial owners were tasked with conducting bandwidth measurements at their respective pilot locations and submitting the results to the technical partners. These measurements will be evaluated to determine whether the available connection is sufficient to support the requirements of the hybrid pilot trials. If the bandwidth is found to be inadequate, additional technical support or alternative connectivity solutions will need to be discussed and arranged in coordination with the relevant partners.
  Identified: 20.06.2025

- **Risk 4: Inability to conduct prescribed burning due to vegetation humidity conditions**

  Contingency Plan: If prescribed burning cannot take place due to high humidity or other environmental factors, an alternative fire source will be arranged—such as igniting prepared logs in multiple controlled locations. This setup will serve as a simulated fire source that sufficiently mimics the conditions of a real forest fire for the purposes of the pilot trial. The alternative fire arrangement will be prepared in advance as a backup or

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used in situations where additional days are required for equipment setup and pilot preparation.
Identified: 20.02.2025

The following list represents some of the main risks that could be encountered during the trial:

- The fire strip represents a big factor or risk, especially if personnel and teams on the ground do not keep a safety distance from the fire itself. The fire could cause burns or injuries due to high temperatures.
- Smoke from the fire can be dangerous to people who are attending the trial.
- Personnel or teams that do not position themselves in appropriate locations during the trial can be a hazard to themselves and others.
- Non authorized movement of people or vehicles on the test site during the trial and in general.
- Drone flights can be a factor of risk. Drones might crash one with the other, especially if they do not belong to the same team. Drones might fall and crash on the ground due to flames, high temperatures or any technical failure.
- Not receiving immediate aid, help and support if someone is injured.
- If meteorological conditions (i.e., wind velocity, humidity and temperatures) are above safety thresholds, the prescribed fire could be difficult to control and manage. This can be a hazard also for flying drones.
- High temperatures due to environmental conditions could be a hazard for the wellbeing of people attending the trial.

6 Local Platform facilities

The location chosen for the exercise is located in the premises made available by the Forestas Agency in the Pabarile forest site in Badde Urbara (Santu Lussurgiu municipality).

These premises consist of:
- A suitable space for parking cars and vans;
- A room where it will be possible to arrange inside presumably 10 workstations for PCs and related supports
- a space equipped with benches and tables useful for those who want to work outside if the day of trial allows it;

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- A space identified as a canteen;
- One or two gazebos to be used both as a shelter from the sun and as a safe observation point near the exercise space;
- three toilets

7 Solutions Utilization and Assessment

The TEMA system will be tested through a structured pilot trial, following a multi-stage process to gather detailed feedback from users and observers.

1. **Scenario-Based Testing**
End-users will interact with the TEMA system in a predefined scenario to assess its functionality.

2. **Observer Feedback**
Designated observers will monitor the session, documenting interactions using a standardized set of reflective questions (refer to Annex xy: TEMA Observers Questions) to maintain consistency in evaluations.

3. **Online Survey**
After the scenario, evaluators will complete a standardized online questionnaire via the EU Survey platform (LINK). To ensure clarity for Italian participants in RAS Real Trial, the original English questionnaire will be professionally translated.

4. **Structured Debriefing Session**
A guided discussion with evaluators and observers will follow, based on prepared questions (see Annex xy: TEMA Guided Discussion Questions). This session aims to explore deeper insights and clarify feedback from the survey and observations.

5. **Consolidated Evaluation Report**
The final report will synthesize findings from:
  - Observer notes

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- Quantitative and qualitative survey analysis
- Key takeaways from the discussion session

This comprehensive approach ensures a balanced evaluation, combining measurable data and in-depth feedback for a thorough assessment of the TEMA system.

8 Trial Scenario Building

8.1 Scope

The pilot test will be conducted in an area where a large-scale wildfire, known as the *Big Fire*, occurred in July 2021. Historical data from the Montiferru region was used to identify the actual training site.

The activities will be divided into two categories:

- **Field operations** in the forested area of Pabarile, where a simulated fire will take place. Forest teams will use controlled burning techniques, and TEMA drones will fly over the fire.
- **An operational control room** set up in the Forestas facility, also located in Pabarile, where technical and IT-related work will be concentrated.

Field activities will last **2 test days** (including setup and a dry run), plus **1-2 day for pre-testing** and **1 day for debriefing**.

Main objectives:

- Assess the effectiveness of TEMA technologies in supporting emergency responders
- Evaluation by participating observers: Forestry Corps personnel, firefighters, forestry technicians, researchers, professors, media, and authorities
- Feedback from end-users and technical partners on the tested technologies

Location:

- Scenario based on data collected during a controlled burn in 2021
- Exact coordinates: Pabarile area, Municipality of Santu Lussurgiu (40°09'26.0"N 8°37'38.9"E)

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- Participant accommodations: Free choice among nearby hotels in surrounding towns

8.2 Operational Scenario

A large-scale wildfire breaks out in Montiferru, proving difficult to contain. Responders must:

1. Detect the ignition and predict fire progression based on sensor data
2. Provide real-time simulations
3. Collect field data and generate processed outputs regarding fire spread estimates and forecasts
4. Map residential areas and exposed zones at risk of evacuation
5. Coordinate with the simulated field control room to plan interventions

Role of TEMA:

- Provides precise fire spread forecasts
- Transmits updated situational data
- Prioritizes residential areas for evacuation
- Tests how these functionalities can optimize emergency procedures

8.3 Scenario Elements

The simulation will follow wildfire operational procedures as defined by RAS (Regional Sardinian Regulations) and outlined in the *Sardinia Regional Firefighting Plan*, integrated with the TEMA solution to:

- Enhance situational awareness
- Accelerate information flow and decision-making
- A detailed sequence of technology use is specified in **Annex xyz (table)**

Notes:

- All geographic coordinates are verifiable
- Duration includes preliminary technical setup

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- The historical scenario ensures realism, allowing evaluation of actions needed for firefighting with advanced technological tools

9 Organization and Logistics

Duration of exercise: 5 days

Dates: 16-20 June. Estimated number of participants to exercise and meetings: 50 people

TRANSPORT AND ACCOMMODATION

The participants in the exercise will arrive in Sardinia by air flights at the airports of Cagliari or Alghero or Olbia, or by ship in the ports of Olbia or Porto Torres.

The proposed hotels are located in the city of Oristano, about 50 km away from the place of the exercise, with a travel time of about an hour. All travel from the hotel to the training site and back will be guaranteed by the DGPC-RAS through civil protection volunteer organizations.

Briefing and debriefing meetings will be held in the “Seminario” room in Cuglieri Municipality.

Each participant must communicate in time the methods of arrival in Sardinia, the availability of an autonomous means of transport and in this case the possible desire to independently book accommodation. To this end, there are several small accommodation activities in the villages of Santu Lussurgiu and Cuglieri where participants can book accommodation directly.

Suggested Hotels:

- Hotel Mistral
- Hotel Mistral 2
- Rodia Inn

FIELD LOGISTICS

The Forestas agency will provide the premises of the "Pabarile" forest complex:

- Meeting room with wi-fi connection with external loggia;
- Vehicle shelter to be used as a canteen;

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- Toilets.

The observation points near the nearby trial area will be reached by the participants with the means made available by the DGPC.

A gazebo will be set up at each observation point with tables, chairs and chemical toilets available to operators and the connection of laptops and drones via satellite network will be guaranteed.

The canteen service during the exercise days will be ensured by civil protection volunteer organizations or by a special catering service.

BRIEFING AND DEBRIEFING IN THE SEMINARIO OF CUGLIERI:

The operational **briefings** and **debriefing** will take place at the Ancient Seminary of the Municipality of Cuglieri in a room equipped with:

- Video projection system and interactive connection;
- Adequate capacity to accommodate all participants;
- Possibility of remote connections for any external interventions.

LUNCH CANTEEN SERVICE

The solution we are supposed to implement is a Field canteen guaranteed by civil protection volunteer associations.

OTHERS

To ensure the comfort and safety of participants, the following will be provided:

- Chemical toilets in the exercise area;
- Any rest areas equipped with shaded areas and water points, depending on the logistical configuration of the site.

9.1 Dry Run 1

Dry Run is meant to be a rehearsal before the Trial. The goal is to find potential issues and check processes for optimization.

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1st Dry Run is conducted to realistically check assumptions and arrangements for the Trial. Therefore, it should be conducted with an “as-realistic-as-feasible” approach. This means – organiser should try to act as he plans to during upcoming Trial, however re-does and time-brakes are allowed if productive.

It is advised to merge Dry Run with technical component test deployment and integration. However, that might also be held as a separate face to face meeting.]

This is the first test (carried out at the trial site) performed once the trial design has been developed. Its purpose is to test and ensure the proper functioning of all components that make up the TEMA platform. With Dry Run 1, in addition to highlighting areas that need improvement, it provides the application developer with useful information to address identified issues.

Dry Run 1, will be conducted on site, it will involve TEMA’s end users and technical partners. It will also involve some of the staff of RAS (Civil Protection, Forestry Corps, Forestas Agency, Volunteers). The test site will be held in Montiferru (west-central part of Sardinia), in a forest area managed by Forestas Agency. During the dry run, the technical issues will be pretested and verified: internet connection issues, communications amongst participants, logistics etc.

The evaluators will be placed in the nearby Forestas offices. The offices will be equipped with at least 10 computers in order to utilize the TEMA platform. Internet connection will be tested together with radio communications. In order to communicate between partners an instant messaging application will be used, so this will be tested beforehand.

The prescribed fire/controlled fire will be performed by the Forestry corps and Forestas Agency together with volunteers and Civil Protection staff.

The onsite position of the technical partners (mainly USE and DLR-KN) that will fly drones, will be tested to see if it is appropriate, both for safety and for functionality. Also RAS staff will be nearby to help technical partners.

Face to face meetings will be held to assess if all partners are satisfied with the dry run 1 results.

All instrumentations will be checked and tested.

9.1.1 Dry Run 1 review checklist

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Table 8. Dry Run 1 checklist

Review name	Responsible person (name, e-mail, mobile)
Distaff training on Trial realization conducted	
Data collection plan & evaluation plan reviewed in practice	
Scenario and injects reviewed in practice	
Training on solutions for Trial simulation team conducted	
Readiness review of solutions and technical integration conducted	
Local Testbed adaptation reviewed in practice	
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	
Number of external stakeholders and their role reviewed in practice	

9.1.2 Conclusion and Lessons Learned

The list of conclusions and most important notes extracted from the review sessions. This subchapter should be filled as a list of short points.

The broader list (with a complete explanation contacting: description (what happened), results (why it is important) and the lesson) may be provided in the documentation of Reviews as an Annex

9.2 Dry Run 2

9.2.1 Dry Run 2 review checklist

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Table 9. Dry Run 2 checklist

Review name	Responsible person (name, e-mail, mobile)
Distaff training on Trial realization conducted	
Data collection plan & evaluation plan reviewed in practice	
Scenario and injects reviewed in practice	
Training on solutions for Trial simulation team conducted	
Readiness review of solutions and technical integration conducted	
Local Testbed adaptation reviewed in practice	
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	
Number of external stakeholders and their role reviewed in practice	

9.2.2 Conclusion and Lessons Learned

9.3 Training Agenda

The training session will take place online on the 30th of May. It will be conducted from 10 AM to 1:00 PM. At this session personnel with great experience of wildfires will participate, personnel coming from Civil Protection Directorate, CFVA, Forestas and a Italian research center (CNR -IBE)

Table 10. Training Agenda

Duration	Activity
30min	Introduction to the TEMA system, distribution of learning documentation, installation of SmartDesk application.
1,5 hours	Hands-on training, provision of support in learning.

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1 hour	Completion of training activities, collection of feedback for further development.

9.4 Trial Actions and Timeline

Table 11. Trial Actions and Timeline

Day, date (UTC+03:00)	Activity	Location
Monday: 16.06.2025	Travel day and Press Conference	Cuglieri Sala Seminario
11:00	Press Conference	
Tuesday: 17.06.2025		Pabarile near Santu Lussurgiu
9:00-9:15	TEMA team meeting welcome	
9:15-9:30	RAS’s staff join, Introduction	
9:30-13:00	Survey and first tests	
13:00-14:00	Lunch break	
14:00 – 16:00	Survey and first tests	
16.00-16.20	Group photo and coffee break	
16:20 - 17:30	Debriefing and feedback for the session day	
Wednesday 18.06.2025		Pabarile near Santu Lussurgiu
9:00-9:45	RAS’s staff join, Introduction	
10:00-12:00	Briefing and final test activities	
13:00-14:00	Lunch break	
14:00-16:00	Briefing and final test activities	
16:00-17:00	Evaluation and discussion	

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Thursday 19.06.2025		Pabarile near Santu Lussurgiu
09:00-13:00	Trial in the field	
13:00-14:00	Lunch break	
14:00-17:00	Trial in the field	
19.00-22.00	Social dinner	Albergo Ristorante Desogos - Cuglieri - quota 25 euro
Friday 20.06.2025		Cuglieri Sala Seminario
09.00-12.00	Debriefing	

9.5 Communication plan

9.6 Auxiliary activities

The pilot project will take place in the Pabarile area in the Municipality of Santu Lussurgiu, where basic auxiliary services will be available. These include, for example, cleaning, venue facilities, internet access, first aid, and security services.

9.7 Assets for the Trial

RAS will provide:

- Trial site (Forest area provided by Forestas Agency).
- Buildings with offices equipped with computers, internet connection, furniture, toilets and all fundamental commodities, electricity connections, water, all primary services.
- Gazebos for technical partners that will fly drones and for Civil Protection staff.
- Portable toilets.

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- Emergency vehicles, off-road vehicles, fire trucks, vehicles for transport of people and Equipment.
- Burning material and fire extinguishing vehicles and tools, that will be managed and utilized exclusively by the Forestry Corps.
- Radio communications (walkie talkies).
- Pilot agenda.

10 Other Organizational Aspects

10.1 Safety Plan

- The area that is not accessible (i.e., where the fire will be performed and in proximity of it) will be clearly demarcated by using wire, duct tape or other delimiters.
- Wind direction must be evaluated for the whole duration of the trial, smoke can be very dangerous for teams and personnel that are attending the trial. People must be positioned so that they don't receive large amounts of smoke.
- The lookout towers for the teams will be fully equipped with gazebo, chairs, toilets.
- People should position themselves in areas or look out towers that have been approved beforehand.
- Movement of people from one point to the other should occur only on well delineated paths; transfers should be requested by radio and performed only by using civil protection vehicles or requesting beforehand the authorization to use private vehicles which will be accompanied by civil protection.
- The same is true for drone flights performed by teams that do not belong to civil protection, e.g., DLR and Sevilla University. All flights should be requested and authorized.
- The flight area is freely accessible to drone pilots. Nevertheless, it is necessary to produce flight plans and a description for each mission one intends to perform. In general, it could be useful to divide the airspace above the prescribed fire in 3 independent volumes:

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- Flight area reserved to DLR. It is important to specify the flight altitudes so that drones do not interfere with those of other organizations and do not get damaged by the flames.

- Flight area reserved to Sevilla University.

- External flight area reserved to RAS in order to provide documentary evidence through videos and photos.

- Flight areas (volumes) relative to each team should not intersect each other, furthermore there should be a security buffer zone between each flight area and between flight areas and the position of teams and people on the ground. As stated above flight altitude must be different for each team to guarantee maximum security.

- Drones should fly in a safe manner; potential failure or loss of control due to technical or environmental factors should be considered.

- Drone operations must be performed by keeping visual flight.

- Lookouts and work areas for drone take off should be determined beforehand and determined by the teams on the ground as a whole.

- An ambulance will be readily available in the case of injuries and assistance, e.g., due to burns or high temperatures.

- Meteorological conditions should not exceed safety thresholds (i.e., wind velocity, humidity and temperature). More specifically, wind velocity should be below specified values during all the duration of the trial. The conditions should not be such that the fire will be uncontrollable. Safety conditions for people, houses, animals and the vegetation itself must be assured. In addition, drone flights may be performed only if wind velocity is not too high.

- The trial will be performed during the summer in Sardinia, in this period temperatures are very high, so it is necessary that people keep appropriately hydrated and protect themselves from the sun (e.g., use of cap, sunscreen).

- A detailed risk analysis plan should be developed in order to assess the risks that could be present while conducting the trial. The safety plan has the aim of reducing potential

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risk and giving all people that are involved in the trial some safety and behavioral guidelines.

10.2 Other Trainings

10.3 Technical Helpdesk

The integration team (ENG) coordinates component-specific support across the TEMA ecosystem, ensuring all technological elements remain operational and properly integrated, while managing technical team interventions.

The KAMK team delivers dedicated support for the Smartdesk, the primary operational interface for end-users, providing technical assistance and training to maximize utilization of its mapping, prediction, and visualization capabilities.

For the trial, at least one representative for each edge technology will be present on-site, along with representatives for most of TEMA cloud components, ensuring full technical coverage during the trial.

10.4 Research Ethics and Informed Consent Forms

10.4.1 Identification and Recruitment of Pilot Participants

Participation in the TEMA Pilot Trials is strictly on a voluntary basis and involves no form of coercion or obligation. All individuals invited to participate are informed of their rights, including the right to decline participation or withdraw their consent at any point during the activity, without any adverse consequences.

In line with ethical standards and applicable legal requirements, no vulnerable individuals or minors will take part in the Pilot Trials. Participation is limited to competent adults (18 years and older), and no children or persons incapable of providing informed consent will be recruited or involved in the trials.

Recruitment of participants is carried out based on their relevance to the trial's objectives and may include individuals internal or external to the TEMA Consortium. These individuals may be selected due to their professional expertise, operational role, or affiliation with the entities involved in the design, evaluation, or operational validation of the TEMA technologies.

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Participants may include first responders, technology operators, or other relevant stakeholders with an interest in disaster response innovation.

All personal data processing associated with the identification, recruitment, and participation of individuals is conducted in strict compliance with the General Data Protection Regulation (GDPR). This includes ensuring that participants are fully informed—via the Information Sheet and Informed Consent Form—about the types of personal data collected, the purposes of processing, legal bases, data retention periods, data sharing practices, and their rights as data subjects.

The recruitment process is thus designed to ensure ethical integrity, legal compliance, and full transparency for all participants.

10.4.2 TEMA Informed Consent Procedures

In the context of the TEMA project's Pilot Trials, robust procedures have been established to ensure the informed consent of all participants, in line with ethical, legal, and data protection requirements.

10.4.2.1 Description and Analysis of the Information Sheet:

Participants are provided with a comprehensive Information Sheet that covers two distinct areas: (a) research participation and (b) the processing of personal data.

Research Participation:

- ❖ The Information Sheet clearly outlines the objectives and scope of the TEMA project, which seeks to improve Natural Disaster Management (NDM) through the integration of real-time semantic 3D mapping and AI-enabled disaster prediction tools.
- ❖ It explains the structure and purpose of the Pilot Trial, including participants' roles (e.g., operators, evaluators), the nature and duration of the trial, and the use of innovative technologies such as unmanned aerial vehicles (UAVs) and AI systems.
- ❖ Participants are explicitly informed that their involvement is voluntary and that they may withdraw consent at any stage without any consequence.
- ❖ The document highlights any potential health and safety risks, particularly related to UAV operations, and specifies that relevant safety protocols and regulatory compliance measures will be in place.

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Processing of Personal Data:

- The Information Sheet details the types of personal data to be collected and processed before, during, and after the Pilot Trial. These include names, identity/passport numbers, images and voice recordings, and signatures.
- It specifies the **purposes of data processing**, including secure site access, trial execution, dissemination and communication activities, and GDPR compliance.
- The **legal basis for processing** is clearly identified, primarily relying on the participants' consent (pursuant to Article 6(1)(a) GDPR), with specific exemptions relying on Article 6(1)(e) for certain access control measures.
- Information regarding **data controllers, storage periods**, data sharing with the TEMA Consortium, and participants' **rights** under the GDPR (e.g., access, rectification, erasure, restriction, portability, objection, and complaint) is transparently provided.
- It is explicitly stated that some visual and audio material may be disseminated via the project's website and social media platforms for communication purposes.

10.4.2.2 Consent Process and Timing

The **Information Sheet** and accompanying **Informed Consent Form** are provided to each participant in advance of the trial. Participants are given adequate time to carefully review the documents, raise any questions, and make an informed decision regarding their participation and the processing of their personal data. A representative of the Pilot Trial organiser is made available to respond to queries and provide clarifications.

Only participants who voluntarily sign the Informed Consent Form will be allowed to participate in the trial. Consent includes both participation in the research activities and agreement to the specified personal data processing operations.

10.4.2.3 Annexes

The full **Information Sheet** and **Informed Consent Form** may be appended to this document as annexes for reference and verification of compliance with ethical and data protection standards.

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10.5 Public Relations Plan

The aim of this public relations (PR) plan is to raise awareness and engagement around the trial exercise by showcasing how innovative technology enhances natural disaster response. It seeks to inform key stakeholders about project results, attract media attention and position the TEMA project as a leader in crisis management innovation.

10.5.1 PR plan objectives

- Raise Awareness: Inform stakeholders and the public about the trial exercise and its role in improving disaster response.
- Showcase Innovation: Highlight the cutting-edge technology being tested, the importance of this experimentation using an integrated and innovative NDM platform for natural disaster response and its potential impact.
- Engage Key Stakeholders: Ensure participation and support from policymakers, emergency responders, researchers, and the public.
- Reinforce Project Credibility: Position TEMA as a leader in crisis management innovation under Horizon Europe and communicate the participation of the Sardinia Region – Directorate General of Civil Protection, as an end user, in the TEMA Trial phase.
- Promote transparency: Showcase disaster response practices, particularly regarding active wildfire fighting operations, and strengthen public trust.
- Generate Media Coverage: Secure coverage in relevant publications, news outlets, and online platforms.

10.5.2 Target Audiences

Primary Audiences

- Government agencies (European Union bodies and agencies, national and local disaster management authorities)
- Emergency responders (firefighters, paramedics, civil protection units)
- Scientific Community (researchers, scholars, civil protection and AI experts)
- Technology providers and researchers
- Media (mainly local outlets and those focusing on science, tech, European Union policy, emergency response)

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Secondary Audiences

- The general public (especially in the Sardinia region)
- Volunteer Organizations (Civil Protection volunteer organizations, even those not directly involved in wildfire response)
- NGOs and international organisations in disaster relief and environmental protection

10.5.3 Key messages

Key message 1: “Technology for Saving Lives”

- The advanced digital tools offered by TEMA are transforming disaster response.
- This trial exercise demonstrates how cutting-edge technology can improve decision-making, reduce response times and ultimately save lives in crisis situations.

Key message 2: “EU Leadership in Crisis Management”

- As part of Horizon Europe, TEMA reflects the European Union’s commitment to enhancing disaster preparedness through research and innovation.
- By funding and supporting breakthrough technologies, the European Union strengthens its role as a global leader in climate resilience and emergency response solutions.

Key message 3: “Real-World Testing for Real-World Impact”

- To ensure that innovative tools can be effectively deployed in real crises, this trial tests them under realistic emergency conditions using historical data.
- By simulating natural disasters using historical data, the exercise helps identify strengths, limitations and areas for improvement before full-scale adoption.

Key message 4: “Collaboration is Key”

- Effective disaster response requires a multi-stakeholder approach, bringing together emergency responders, scientists and technology providers.
- This trial is an example of cross-sector and cross-country cooperation, ensuring that the solutions being developed are practical, scalable and aligned with real-world needs.

10.5.4 Key PR Activities and Timeline

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Phase 1: Pre-trial (Three months to one week before the trial)

- Preparation of a folder with pictures and videos of RAS in action to be used in the promotional material of the trial.
- Collection of a list of local and national media contacts.
- LC to prepare the first press release in English, which will be translated in Italian by RAS.
- Creation of the graphic templates that will be used on social media and other digital communication.
- Update and translation of the project powerpoint in Italian.
- Publish informative web articles with specific content on the Trial, planning moments, site visits, etc., referencing the TEMA project's goals, to be published on the regional civil protection website and shared with the Institutional Communication Service for publication on the regional (RAS) and TEMA websites.
- Social media posts presenting the up-coming trial on DGPC, RAS and TEMA social media accounts.

Phase 2: Trial execution (one week before till the completion of the trial)

The week before the trial:

- Press conference to present the Trial for Italian audiences (possible date: 16 June)
- Potential interviews with the Regional Minister, DG, project lead, and European partners during the press conference
- Press release following the press conference (both in English and Italian)

During the trial:

- Real-time updates on DGPC, RAS and TEMA social media accounts.
- Capture of high-quality visuals (photos and video) for post-event storytelling.
- RAS to offer interview opportunities for journalists.

Phase 3: Post-trial (the weeks following the trial)

- Circulation of the second press release, which will be written with the assistance of LC, in local and national media by RAS.
- Website and social media recap of the trial, sharing videos, key takeaways and testimonials.
- Further sharing of the trial results with key target audiences, such as policymakers and first responders, via the TEMA newsletter and TEMA's page in the Union Civil Protection Knowledge Network (UCPKN).

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10.6 Authorization, Registration and Permits for Trial

10.6.1 Trial Authorization

10.6.2 Trial Registration

10.6.3 Permits for the Trial

11 Annexes

Annex A - Informed Consent Forms

Annex B - Dissemination & Communication Audit Questionnaire

Annex xy TEMA Observers Questions

Annex xy TEMA Guided Discussion Questions

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MAPPING AND PREDICTION
FOR EMERGENCY
MANAGEMENT

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End of Document

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Annex 2

Trial Action Plan (TAP)

KAHY Trial-1

Project Information

Project acronym:	TEMA
Project full title:	Trusted Extremely Precise Mapping and Prediction for Emergency Management
Call identifier:	HORIZON-CL4-2022-DATA-01
Type of action:	HORIZON Research and Innovation Actions
Start date:	1 December 2022
End date:	30 November 2026
Grant agreement no:	101093003

Trial Action Plan:	BRK Trial-1		
WP:	**6**	**T6.3.**	
Author(s):	**Henrik Ilvesluoto**		
Editor:	**Henrik Ilvesluoto**		
Leading Partner:	**KAHY**		
Participating Partners:	**BRK, LC, KEMEA,KAMK**		

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Disclaimer

The TEMA consortium consists of the following partners:

No.	Partner Organisation Name	Partner Organisation Short Name	Country
1	ARISTOTELIO PANEPISTIMIO THESSALONIKIS	AUTH	EL
2	DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV	DLR	DE
3	ENGINEERING - INGEGNERIA INFORMATICA SPA	ENG	IT
4	ATOS IT SOLUTIONS AND SERVICES IBERIA SL	ATOS	ES
5	UNIVERSIDAD DE SEVILLA	USE	ES
6	TECNOSYLVA SL	TS	ES
7	NORTHDOCKS GMBH	ND	DE
9	THE LISBON COUNCIL FOR ECONOMIC COMPETITIVENESS ASBL	LC	BE

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10	LATITUDO 40 SRL	L40	IT
11	NELEN & SCHUURMANS TECHNOLOGY BV	NS	NE
12	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV	FHHI	DE
13	UNIVERSITA DEGLI STUDI DI MESSINA	UNIME	IT
14	KAJAANIN AMMATTIKORKEAKOULU OY	KAMK	FI
16	KENTRO MELETON ASFALEIAS	KEMEA	EL
17	DIMOS MANTOUDIOU - LIMNIS - AGIAS ANNAS	D.MALIAN	EL
18	REGIONE AUTONOMA DELLA SARDEGNA*RAS	RAS	IT
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21	INTERDISCIPLINARY TRANSFORMATION UNIVERSITY	I:TU	AU

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0.1	TEMA TAP Template	Margareta Mihalic Dogan
0.2	TEMA KAHY Trial 1	HenrikIlvesluoto, Jaakko Schroderus
0.3	Contributions to C4, 7, 9, and 10.	Paraskevi Petsioti, Aikaterini Beli, Maria Chiara Zaccaria, Filip Sever, Henrik Ilvesluoto
0.4	Completion of C3,4,5,8	HenrikIlvesluoto, Viktor Bezsmertyi
0.5	Completion of C1,2,6,7,10.	Margareta Mihalic Dogan, Henrik Ilvesluoto

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List of Terms and Abbreviations

Abbreviation	Description
EU	European Union
TAP	Trial Action Plan
TEMA	Trusted extremely precise mapping and prediction for emergency management
TGM	Trial Guidance Methodology
DoA	Description of the Action
AI	Artificial intelligence
NDM	Natural disaster management
PC	Personal computer
PPDR	Public Protection and Disaster Relief
TV	television
RGB	Red green blue
PR	Public relations
NGO	Non-governmental organization
UAV	Unmanned Aerial Vehicle
FOV	Filed of view

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Executive Summary

This report presents the necessary knowledge for the KAHY pilot. The pilot will be held in Finland, but participants from various European countries will take part, both remotely and in person. The document and its annexes describe the preparation and execution of the first iteration of the Finnish use case. The Finnish use case is the first instance where the TEMA platform and various technical components will be tested through authentic disaster response procedures.

The below sections describe in detail the background and need for the TEMA system. Through the description of the real-world event that occurred in Finland, the pilot actors, the narrative scenario, and preparatory actions to facilitate, execute and evaluate the TEMA solution and further improve it. The chapters describe the trial background and preparation; the methodology used to define the gaps, the scenario and assessment, the trial plan and agenda; the organization of the testing activities; the participants and their responsibilities; and other aspects such as ethics and safety of the participants and observers.

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1. Introduction

Climate change is leading countries in Europe to experience increasingly frequent and damaging adverse climatic events, such as large fires and flooding. The impact of severe weather events is expected to make Europe increasingly vulnerable due to the magnitude and frequency with which they will occur in the coming years.

According to the Emergency Events Database (EM-DAT), natural hazards have cost about **3 trillion dollars** of economic destruction and **1.3 million casualties** with more than **4.4 billion people** injured between 1998 and 2017 [5]. In Europe, between 1980 and 2020, disasters affected nearly 50 million people and caused economic losses of roughly **€12 billion per year.**

Natural Disaster Management (NDM) is crucial to prevent these events from becoming life-threatening. In light of such urgency, and under the advancements in science and technology that have been achieved in recent years, the TEMA research project will develop beyond-state-of-the-art methods and technologies to facilitate disaster management procedures, in particular by developing automated means for precise semantic area mapping and phenomenon evolution predictions for Natural Disaster Management in (near-)real-time. This will be achieved by AI systems that receive multiple heterogeneous data modalities, like geosocial media, topographical, or official meteorological data as input. Using AI technologies and multiple data sources, TEMA will provide a map-based emergency decision support system able to make an accurate assessment of an evolving crisis situation while also giving automated response recommendations.

TEMA has 3 main goals:

1. Improve Natural Disaster Management using **new digital technologies and extreme data analytics.**
2. Improve and accelerate extreme data analytics, by increasing **trustworthiness**, **accuracy** and **responsiveness** of extreme data analysis algorithms.
3. Improve and accelerate emergency phenomenon **modelling**, evolution **predictions**, simulation and **interactive visualization**.

The solution provided by TEMA project, both technological and methodological ones, will be experimented for the first time in Finnish wildfires in Kainuu area:

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The pilot will provide a study case on forest fire management operations through the aggregation of environmental data sources, both existing and collected during the project. These datasets will be enriched with earlier reports on prevention strategies. It will be possible to examine and improve procedures for managing disasters and for decision making.

TEMA aims to have a significant impact on a) scaling-up European capacity for extreme data analytics, b) producing explainable, robust and humanly verifiable analytics, c) providing fast and precise phenomenon prediction and response planning, d) reducing the emergency response times during Natural Disaster Management, e) improving the decision making during Natural Disaster Management, f) boosting the EU policy agenda in the Data Spaces domain, as well as in the adoption of Decision Support Systems for emergency management, g) opening up a new market segment via the envisioned Extreme-Analytics-as-a-Service, which makes select TEMA methods available to external users via the cloud and standardized interfaces.

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2. Purpose and Scope

The purpose of the Trial Action Plan (TAP) is to provide detailed plans of Trial organization and to facilitate the monitoring of Trial preparation activities as well as an evaluation plan for TEMA project.

The completion of the TAP chapters serves as an indicator of the Trial preparation progress.

2.1. Trial Stages

The Trial event stages, which reflect the stages of Trial preparation, include 5 steps:

1. Stage A – The initial stage, which ends with Deliverable D2.1.
2. Stage B – The main preparation stage which ends with Dry Run 1.
3. Stage C – The maturation stage which ends with Dry Run 2.
4. Stage D – The final preparation stage which ends with the Trial itself.
5. Stage E – The recapitulation stage which ends with the Trial evaluation report.

The preparation stages and the activities undertaken during each stage are presented in the table below (Table 1 in chapter 2.2.).

Stage A started in WP2 T2.1. of the TEMA project. Results of the work done in T2.1. are in deliverable D2.1. Stages B to E will be covered by work in WP6, more specifically: stages B and C will be covered within T6.3 and Stages D and E within 6.4 and reported in respective deliverables D6.1. and D6.2.

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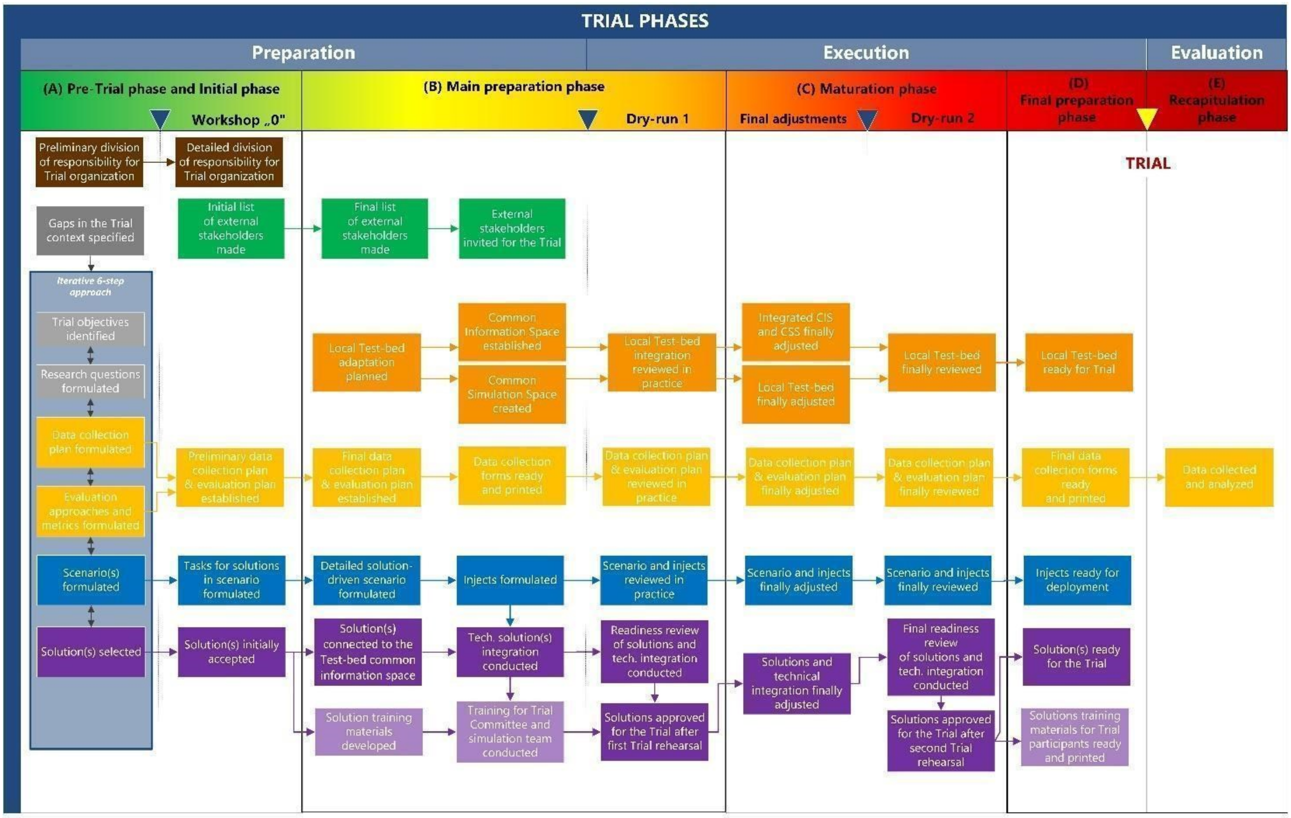

Figure 1. Trial phases

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2.2. TAP completing schedule

Table 1. TAP review schedule and monitoring

No	Deadline	Description	Contributor
1	16.5.2025	Chapter 1	KAHY
2	21.2.2025	Chapter 2	KAHY, BRK
3	6.3.2025	Chapter 3	KAHY
4	19.3.2025	Chapter 4	KAHY, BRK, KEMEA
5	22.4.2025	Chapter 5	KAHY
6	30.4.2025	Chapter 6	KAHY
7	30.4.2025	Chapter 7	BRK
8	30.4.2025	Chapter 8	KAHY
9	5.5.2025	Chapter 9	KAHY, KAMK
10	5.5.2025	Chapter 10	KAHY, LC
11	16.5.2025	Chapter 11	KAHY

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Table 2. General information on the trial

Location (Test bed)	Kidekuja 2, 88610 Vuokatti
Date	19.-23. May 2025
Organizer	KAHY, Kainuun hyvinvointialue
Trial type	Historical, wildfire

3. General Information on the Trial

The common challenge of TEMA project is the improvement of natural disaster management (NDM) by providing a state-of-the-art disaster management support system, dynamically exploiting multiple data sources and AI technologies for providing an accurate assessment of an evolving crisis situation.

Finland has seen few and minor fires in the past decades and lacks practical experience in managing forest fires on the scale seen in Southern Europe. With climate change the severity and frequency of incidents is set to increase in the future, particularly in Northern Europe. The TEMA project will be used to improve operations in forest fire management and trial new technologies.

The purpose of the KAHY trial 1 is to evaluate the TEMA solutions in several aspects:

- Understand current gaps and weaknesses in procedures and test new technologies to help improve current forest fire management practices (and closing the gaps) through 1) involvement of staff to train and learn, and 2) demonstration of technologies to assess them for Finnish forest fire management.
- Review the improvements using the TEMA solutions and the gaps identified

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- Disseminate the project regionally and nationally to drive forest fire management policy

3.1. Outline of the Trial Scenario

The pilot trial will use real event data from a prescribed burn that occurred near Kuhmo town on 27.05.2024. This data was collected for the specific purpose of pilot testing and represents a relevant trial case for the end users to both familiarize themselves with the TEMA technologies and evaluate them in their own context. In addition, the pilot scenario is inspired by the real wildfire that occurred in Kalajoki. Kalajoki 2021 wildfire was one of the worst wildfires in Finland of the last several decades.

3.2. The Scenario

Long dry periods in the Kainuu region have increased the wildfire index to the highest level. The local authorities are concerned about a wildfire outbreak and engage in established risk mitigation procedures. In 2021 Finland had one of the worst wildfires in the last decades, and the TEMA pilot will be based on that narrative and scale. The fire burned a forest area of 227 hectares, involving 1500 persons working on extinguishing and support work. This will provide a study case on forest fire management operations through the aggregation of rich environmental data sources, both existing (currently available to KAHY) and additional data collected during the project. For example, the first round of additional data was collected on 27.5.2024 from a prescribed burn in the Kuhmo municipality.

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The datasets will be enriched with earlier reports on prevention strategies, mapping of environment and infrastructure, as well as strategies and guidelines of the Finnish authorities for the boreal vegetation environment. By using the TEMA solution, it will be possible to examine and improve procedures for managing disasters and for decision making support. The source data for the trial is based on the Kuhmo prescribed burn location to provide accurate location referencing and a

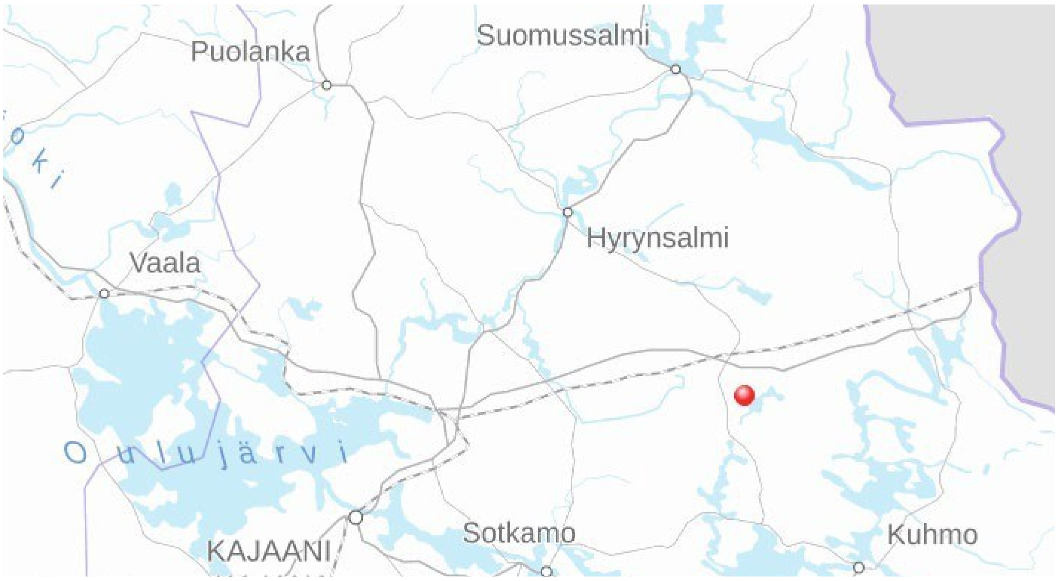

Figure 2. Pilot Location

realistic working environment for the technical and end-user teams. The ignition point is near Kotalammentie 558, 88740, Kuhmo, Approx. 64°22'57.7"N 29°07'30.4"E.

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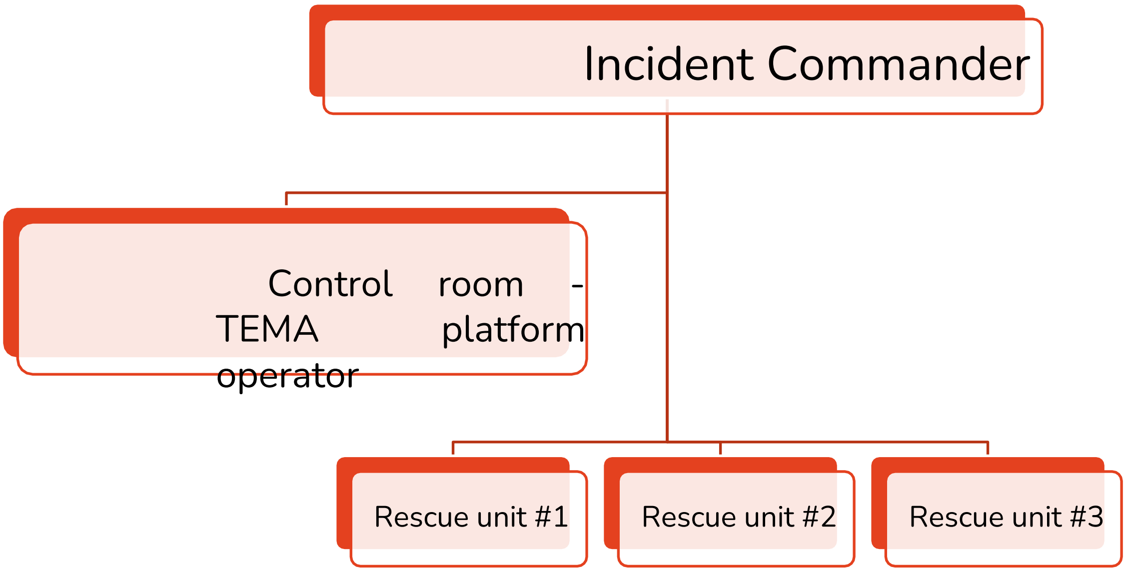

Figure 3. Command structure in scenario

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4. Trial Guidance Methodology Application

The identification of gaps when facing natural disasters like fire, flood, and relative to the purpose of TEMA project and pilots, should take into consideration the gaps from academic **literature** as well as the gaps stemming from the **Grant Agreement** and the **Storytelling.**

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4.1. Brief description of chosen gap assessment method

In TEMA project, gaps have been identified and assessed in the context of D2.1 as part of the storytelling procedure. In general, there is also a distinction between qualitative and quantitative gaps in a natural disaster.

- A qualitative gap is for example the political profile of a disaster, or the availability and the time to deploy resources for the disaster. There is also the need for improved management and coherent coordination to provide an overview of the situation and act fast.
- Quantitative gaps for floods or fires can be summarized to the lack of resources for the repression and interception of the natural disaster, the lack of sufficient quantities regarding shelter capacity, hospital modules, mobile units of equipment, lack of capacity for rescue and research, limited aerial fire-fighting capacity, as well as the lack of organization and preparedness of the resources that are engaged in the response mechanism, therefore a gap in the quantities of aerial and terrestrial resources deployed in the fight against the natural disaster.

Grant agreement:

- Information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.
- Low visibility and health hazards due to smoke. Scarcity of accurate information regarding the wider area, leading to suboptimal response strategies.
- Accurate information is crucial in planning, prioritizing and managing response actions.
- Access to trustworthy information is crucial for PPDR (Public Protection and Disaster Relief) organizations.

Gaps from Storytelling:

KAHY (Forest Fire): Situational awareness can always be better. Location of the first responders, how the fire acts, how the environment affects the fire, how fast the fire spreads, planning the use of resources, gathering resources to the scene.

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What the command on site needs most urgently is, listed by priority: There is a lack of means to directly communicate between the operatives in the field and control room beyond audio calling. Content sharing from drone and van camera are sources of information that are identified as valuable and would enhance situational awareness to control room staff. In addition, quick access to the newest satellite images and GIS layers (infrastructure, access routes, bridges, and their state; critical infrastructure, settlements, type of terrain) is important to plan response and warn citizens in case of danger. Having accurate information on how the fire will propagate would help in planning evacuation actions and response actions at a suitable scale. The detailed description of the gaps assessment method and results is to be found in TEMA Deliverable 2.1.1

4.2. Selected and Validated Gaps

A complete and detailed gap analysis was conducted as part of the analysis in WP2 and is described in Deliverable D2.1. For the needs of KAHY Trial 1, wildfire use case, the gaps most relevant to this specific use case, which will be validated in the same pilot trials, have been selected. The selected gaps are described in the table below. The selected gaps have a high priority for the end users of the Finnish use case.

Table 3. Selected gaps

Gap description	Interdependencies with other gaps	Method of verification
1. Lack of communication among the first responders and command control	Gap 2 and 6	The end user arriving in the field can directly chat with the Smartdesk operator in the control room and provide information. The two users can exchange text and images/screenshots to provide contextual information and enhance the quality of information.

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Gap description	Interdependencies with other gaps	Method of verification
2. The ability to collect and share crucial information.	Gap 1 and 6	The information collected and displayed through TEMA outputs can be shared through the end users' own systems or collaboration tools. For example, the Smartdesk runs on a Windows PC. Users in the control room can share data with different tools.
6. Information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.	Gaps 1,2, 8, 10 and 12	The end user has access to multiple map layers (including satellite, terrain, and access to Finnish National Geoportal Paikkatietoikkuna) which can be toggled to present different types of information.

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Gap description	Interdependencies with other gaps	Method of verification
7. Low visibility and health hazards due to smoke. Scarcity of accurate information regarding the wider area, leading to suboptimal response strategies.	Gap 8	Using detection and segmentation tools the end user gains more information of the scene and can also compare it against maps and 3D images. In addition, access to the wider area requires knowledge of the surrounding infrastructure and settlements.
8. Accurate information is crucial in planning, prioritizing and managing response actions	Gaps 1, 2, 6, 12 and 13	This accurate information includes forest fire propagation, weather data, location data, consistent updates from the field (communication with operatives, images, videos) and requires that operatives in the field and control room can communicate and share information.

4.3. Trial Specific Objectives

Objectives:

Enhance Situational Awareness for Response Actions: Deliver accurate and up-to-date information to facilitate better planning, prioritization, and management of response efforts.

Determine the Scope of the Affected Area: Establish a reliable method for assessing the size and boundaries of the affected area (epicenter) to allocate resources efficiently.

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Clarify Mission Needs and Objectives: Improve information gathering on mission requirements to ensure that response teams have clear, detailed objectives aligned with actual needs.

Optimize Assessment for Effective Rescue and Assistance: Develop an effective system to assess the urgency and priority of affected areas, enabling first responders to focus on the most critical locations.

Improved Decision Support: Solutions should enhance the ability of emergency management teams to make informed, data-driven decisions.

Enhanced Data Integration: Provide seamless access to various data sources (e.g., satellite imagery, UAV reconnaissance) to improve the accuracy of situational assessments.

4.4. Research questions

Based on the objectives (defined in DOA), research questions are focused on understanding the end-user experience and the perceived value of the TEMA system for disaster response, especially in comparison to their current tools and methods:

Usability and User-Friendliness: How do end-users perceive the usability and user-friendliness of the TEMA system compared to their current tools? This includes the ease of understanding information and labels, the intuitiveness of the tools, and the ease of customization.

Information Quality and Trustworthiness: How do end-users rate the clarity, detail, accuracy, and reliability of the information provided by the TEMA system in comparison to their current systems?

Efficiency and Speed: Does the TEMA system improve the efficiency and speed of disaster response tasks, such as accessing comprehensive maps, receiving updated information, gathering data, and displaying information?

Automation and Workload: How does the level of automation in the TEMA system compare to the end-users' current systems, and does it reduce the amount of manual work required?

Situational Awareness: How does the TEMA system affect end-users' ability to establish situational awareness during a disaster, including the ability to work with different map views and combine intel from multiple sources?

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Decision-Making Support: How does the TEMA system support and enhance decision-making during disaster response compared to current tools, including the speed and effectiveness of decisions?

Perceived Benefits and Limitations: What are the main perceived benefits and limitations of the TEMA system compared to current systems for Natural Disaster Management (NDM) from the end-users' perspective? What specific aspects of the TEMA platform are considered most beneficial?

Areas for Improvement: What improvements or additional functions do end-users suggest for the TEMA system?

These research questions are the basis for the evaluation questions.

4.5. Data collection method and outline

A **mixed-method approach** was adopted, combining both qualitative and quantitative data sources to ensure a comprehensive understanding and evaluation of the TEMA system. This approach enabled the integration of numerical data with context-rich insights from end-users and field observations, offering a more holistic view of the system's functionality and effectiveness.

Data collection was carried out in collaboration with KAHY and technology partners involved in disaster response. The dataset included:

- **User-generated content**: Photos, videos, and social media data collected by the PLUS company, providing real-time, ground-level insights into disaster scenarios.
- **Internet-sourced information**: Data collected by KAHY from online platforms, which included public reports, news feeds, and community updates related to ongoing or recent disasters.
- **Weather and environmental data**: Historical and real-time weather data were integrated to enhance situational awareness and support predictive modeling.
- **Institutional and local sources**: Additional data were obtained from the KAHY' own internal resources, including logs, reports, and previous disaster records.

This multi-source data strategy enabled the system to process diverse and often unstructured data in a unified manner, enhancing the responsiveness and accuracy of disaster assessment models.

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4.6. Initial Scenario

Table 4. Scenario

Timestamp	Narrative	Activity	Functions used
10:00	A local resident sees smoke coming from a nearby forest and calls the emergency center.	The emergency center operator alerts the local rescue department. KAHY fire commander verifies the incident information. If needed, additional units are assigned.	An alarm is sent to the rescue department. (SV-tech-02)
10:03	The fire commander starts collecting information relevant to the disaster scene. This helps to plan an extinguishing approach.	The fire commander opens the Smartdesk and examines the incident location. He is interested in: 1. roads (for access routes and firebreaks) 2. terrain types 3. topography 4. water sources (for firebreaks and extinguishing) 5. Residences	• Open street Map • Satellite – world imagery • Open topo map • Visual analytics • ''Maps'' button • Satellite based forest fire detection and assessment (PDM-tech-05) (TFA-tech-09)

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		6. Weather forecast, wind direction, wind speed 7. Satellite decision support	(SV-tech-03) (SV-tech-04) (SV-tech-06) (SV-tech-07)
10:40	The first unit arrives and starts collecting intel and reports it to the fire commander.	The fire commander checks the Fire simulation and reviews the available predictions. Drone is used to analyse fire and persons in the field.	• Fire simulation • Drone footage to detect people/vehicl es • Review of 3D model (PDM-tech-01) (TFA-tech-05) (TFA-tech-06)
11:00	Based on the information from the field and the Smartdesk, the fire commander starts planning the approach. - If the fire is near a settlement, citizens are warned, and extinguishing is focused on that area - If the fire is away from settlements, the field operatives prepare firebreaks on the areas where the fire is spreading	Fire commander uses annotation tool to mark: - Water sources - Field operations center - Unit priorities Firebreak line	Annotation tools

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	the fastest - Depending on fire behavior, units can be assigned to different priorities		
11:20	According to TEMA software's prediction, it is possible that the fire may threaten nearby buildings. As a result, the fire commander alerts a fourth rescue formation and the police, who begin planning the evacuation of the affected area.	Fire commander uses annotations tool to: - Add more units towards the village to extinguish the fire Fire commander designates evacuation place	Annotation tools
11:40	While the hazard is ongoing, the fire commander uses drones to stay updated and uses person and vehicle recognition technology to identify whether anyone is in danger.	Drone images with person and vehicle detection are reviewed.	Fire/smoke/person detection. (TFA-tech-07) (SV-tech-01)
11:50	The rescue formation manages to bring the fire under control.	The fire commander gathers data from	

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	However, weather conditions and terrain indicate that the fire could escape. But for now, the situation remains under control."	TEMA systems and makes conclusions. -Weather forecast, wind direction and wind speed -Satellite decision support -3D Map	

4.7. Technical components in TEMA Solution

Technical components of the TEMA-System that will be included in KAHY-Trial 1 wildfire use case were selected based on the selection of gaps, from which functionalities were described as well as the initial scenario. Agreed list comprises of the following 11 components in the table below.

Table 5. Technical components for KAHY Trial-1

Technologies / TEMA Components
TFA-tech-05 (AUTH) - Fire/smoke/person detection
TFA-tech-06 (AUTH) - Fire/flood/background segmentation
TFA-tech-07 (ATOS) - Person re-identification
TFA-tech-09 (DLR-DFD) - Satellite-based Forest fire detection and assessment
TFA-tech-15 (ATOS) - Data scarcity, synthetic data generation pipeline
PDM-tech-05 (USE) - Information fusion

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SV-tech-02 (ENG) - Digital Enabler
SV-tech-03 (ND) - 3D computer vision (SfM)/ Photogrammetry
SV-tech-04 (LAT40) - Geovisual analytics
SV-tech-06 (ND) - Extended Reality-based interactive visualisation system
SV-tech-07 (KAMK) - Smartdesk Application

4.8. Training plan on TEMA Solution

To ensure that the end users can use the TEMA Solution effectively and can evaluate its performance in the context of their trial scenarios, they require training on how to the TEMA solution.

Due to shift work of KAHY staff, multiple training sessions are organized. Each session will include 2-3 participants on the day, and 10 participants in total. The training days are: 12.05.2025, 13.05.2025, 14.05.2025 and 15.05.2025.

The training is organized at the Kainuu Rescue Department's (KAHY) premises in Kajaani. The participants are provided with learning materials and complete the assignments at their own pace. KAMK's staff participate as facilitators and support learners as needed during the training. To support the training process, a training handbook is provided. The three main sections of the handbook are:

1) Technology descriptions – plain language descriptions of each TEMA component and their functionalities

2) A learning manual – a step-by-step guide on how to use each TEMA component that has been implemented within the SmartDesk.

3) Learning tasks – several exercises to complete using the SmartDesk, which ensures that participants train with all TEMA functionalities.

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Table 6. Training Agenda

Duration	Activity
30min	Introduction to the TEMA system, distribution of learning documentation, installation of SmartDesk application.
2 hours	Hands-on training, provision of support in learning.
1 hour	Completion of training activities, collection of feedback for further development.

The training will use a sandbox version of the Smartdesk that contains sample data with relevant disaster scenarios. This is the fourth sandbox version, released on 09.05.2025. The Smartdesk will be prepared and installed on devices prepared by KAMK.

The training documentation will be updated in the future to ensure that all the developed features and functionalities are explained and practiced.

5. Trial Planning

This section describes the roles and responsibilities of the KAHY trial and confirmed participants of the trial.

5.1. Responsibilities

To succeed in the pilot, the pilot has been divided into areas of responsibility, and each area has been assigned a dedicated person. The areas of responsibility can be found in the tables below.

Table 7. Trial committee

Role	Name	Scope of responsibility

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Trial Owner	KAHY	Is the main contact person for the organization of the Finnish pilot.
Technical coordinator / Solution Coordinator	Antonio Filograna	The main contact person is overseeing the technical preparation and performance of the TEMA solution during pilot testing.
User coordinator (Platform)	Henrik Ilvesluoto	Plans and facilitates the pilot trials and coordinates the pilot participants.
Technical coordinator (Testbed) Testbed Infrastructure support	Francesco Arigliano	Oversees the individual components in the pilot trial and provides technical support if needed.

Table 8. Trial organizer support

Function	Name	Scope of responsibility
Main organizer (Trial Owner)	Jaakko Schroderus	Is the main contact person for the organization of the Finnish pilot.
Stakeholder coordinator	Jaakko Schroderus	Coordinates the participation and involvement of participants from within the project as well as external stakeholders.
Scenario coordinator	Henrik Ilvesluoto	Designs, plans and leads the scenario narrative.
Technical Coordinator (Local platform)	Viktor Bezsmertnyi	Provides front-end support for the TEMA platform and graphical user interface.

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Training coordinator	Filip Sever	Prepares learning material and training tasks. Participates online during the independent learning session to provide support.
Logistic coordinator	Henrik Ilvesluoto	Organizes venue, catering and facilities for the pilot trial.
Trial Director	Jaakko Schroderus	Plan and oversee the scenario and trial activities.
Deputy Trial Director	Henrik Ilvesluoto	Plan and oversee the scenario and trial activities.
Safety officer	Jaakko Schroderus	Responsible for safety during the pilot trial.
Evaluation and review coordinator	Henrik Ilvesluoto	Facilitates feedback and evaluation sessions.
Media Officer	Laura Leinonen	Captures content on the pilot activities and communicates with media

Table 9. Support Group

Support group	Name/Company and contact details	Scope of responsibility
Security team	Sokos Break Hotel, venue staff	Ensures the safety of staff and infrastructure.

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Medical team	Kainuun hyvinvointialue	Provides medical aid.
Catering crew	Sokos Break Hotel	Prepare meals and refreshments.
Cleaning crew	Sokos Break Hotel	Cleans the venue.
PR team	Laura Leinonen	Communicates with media and publishes pilot content.
VIP host	Petri Vehniäinen	Hosts end user partners and external stakeholders.

5.1.1. Trial participants

The table below lists participants who are physically present in the pilot.

Table 10. Trial Participants

Participating group	Confirmation of participation[2]	Number of anticipated participants
KAHY	Confirmed	10
KAMK	Confirmed	2
ENG	Confirmed	2
TSYL	Confirmed	1
AUTH	Confirmed	1

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5.2. Command structure during Trial

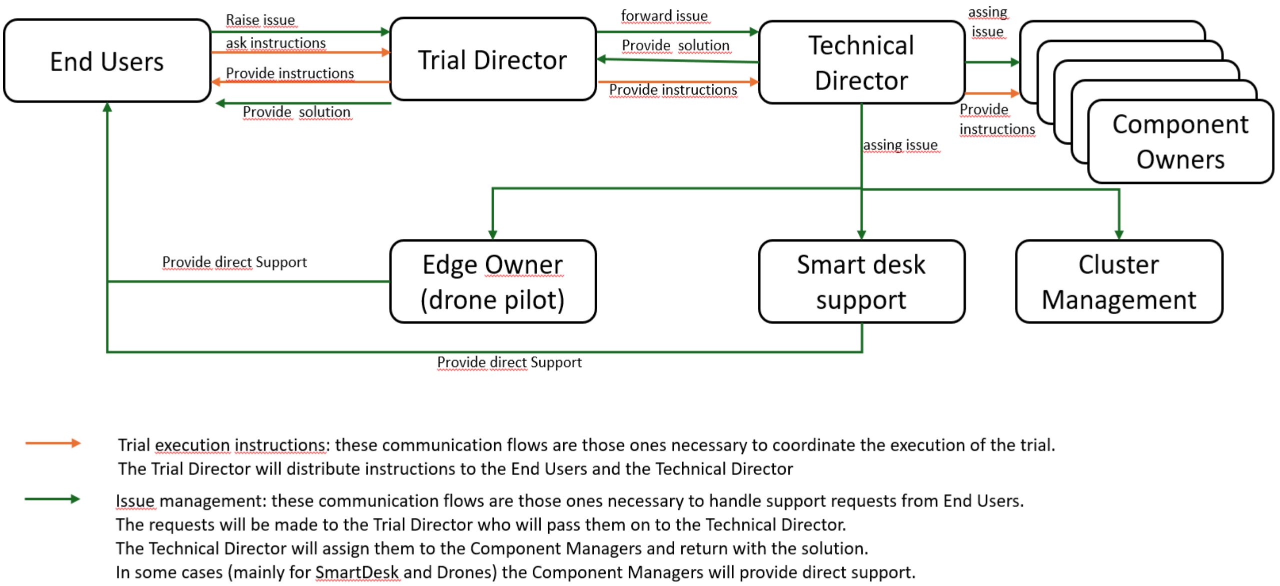

Figure 4. Incident command structure

All participants are in the same room, so communication happens in real time and face-to-face.

5.3. Timeline of Preparatory Activities

Table 11. Timeline of preparatory process

DATES	ACTIVITIES
24.3.2025	Confirm the Booking of meeting room
24.3.2025	Confirm catering and any other services needed for the meeting
13.5.2025	Confirm transportation arrangements

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1.4.2025	Confirm responsibilities
24.3.2025	Confirm the communication plan
13.5.2025	Confirm required equipment
20.5.2025	Confirm necessary permits

5.4. Risk analysis and contingency planning

Risk 1: Overlaps in pilot trial schedules
Contingency planning: It was agreed among the partners that there should be a minimum gap of two weeks between individual pilot trials. This allows partners who need to be physically present to plan their travel more reasonably and ensures there is sufficient time to transport equipment between locations. A table outlining the schedule for all pilot trials has been created, maintaining at least a two-week interval between each and avoiding months when most partners are typically on vacation.
Identified: 16.05.2024

Risk 2: Overlap in the schedule for fire use case, hybrid pilot trials
Contingency planning: Both KAHY and RAS identified June as the month for conducting prescribed burning to generate new data for the hybrid pilot trials. However, this posed a risk of scheduling overlap, which could create significant challenges for technical partners who need to be physically present at both trials and whose equipment must be transported to the trial locations. To avoid these conflicts, it was agreed that the RAS fire use-case hybrid pilot trial will take place in June 2025, and the KAHY trial in June 2026.
Identified: 16.05.2024

Risk 3: Available bandwidth not sufficient to conduct the pilot trial
Contingency planning: Trial owners were tasked with conducting bandwidth measurements at their respective pilot locations and submitting the results to the technical partners. These measurements will be evaluated to determine whether the available connection is sufficient to support the requirements of the hybrid pilot trials. If the bandwidth is found to be inadequate,

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additional technical support or alternative connectivity solutions will need to be discussed and arranged in coordination with the relevant partners.
Identified: 20.06.2025

Risk 4: Medical emergency.
Contingency planning: Have staff in place to provide first aid. Emergency services are called if required.
Identified: 22.4.2025.

Risk 5: Fire outbreak.
Contingency planning: Begin first aid extinguishing and call emergency services.
Identified: 22.4.2025

Risk 6: Loss of electricity.
Contingency planning: Use backup generators.
Identified: 22.4.2025.

Risk 7: Interference by citizens and local activities in the pilot area.
Contingency planning: Inform venue staff and security, call police if needed.
Identified: 22.4.2025.

6. Local Platform facilities

The Sokos Hotel venue provides the pilot with sufficient space to host a large group of internal and external participants. The venue includes sufficient capacity to support a large number of hardware and internet traffic as required by the TEMA platform as well as for hosting the observer and TEMA partners that will participate remotely. Moreover, the venue includes the amenities required to host larger groups, including catering, air conditioning and restrooms.

Control room

The pilot will be organized in the "Tykky" meeting room, with a capacity of 30 people and surface area of 47 m². The room includes:

- Data projector and TV screen

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- High-speed wireless broadband for all meeting guests
- Flip chart and note-taking supplies

As the first trial will be based on historical data, no external facilities are required.

Figure 5 Location of the control room

7. Solutions Utilization and Assessment

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The TEMA system will undergo evaluation through a structured pilot trial. The process will consist of several key stages to ensure comprehensive feedback from both end-users and observers. See attached annexes.

1. **Scenario-Based Evaluation**

End-user evaluators will first engage with a predefined scenario using the TEMA system.

2. **Observers Feedback**

Throughout the scenario session, designated observers will be present to monitor interactions and record detailed notes. These observers will follow a predefined set of reflective questions to guide their reporting and ensure consistent observation across sessions.

3. **Online Evaluation Questionnaire**

Immediately following the scenario session, evaluators will complete an online evaluation questionnaire hosted on the EU Survey platform. This questionnaire is standardized across all pilot trials to enable consistent data collection and comparison. For KAHY Trial 1, the original English questionnaire will be professionally translated into Finish to minimize language barriers and encourage more thorough and insightful responses from participants.

4. **Guided Discussion Session**

Once the online questionnaires are submitted, a facilitated discussion will be held, involving both the evaluators and the end-user observers. This session will follow a set of pre-prepared discussion questions to elicit deeper qualitative insights and clarify any observations or questionnaire responses.

5. **Final Evaluation Report**

The comprehensive evaluation report will include an integrated analysis of all three evaluation components:

- Observer reports
- Quantitative and qualitative analysis of the online evaluation questionnaire
- Summary and key insights from the guided discussion session

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This multi-layered evaluation approach is designed to provide a robust and holistic assessment of the TEMA system, ensuring that both quantitative metrics and qualitative insights inform the final outcomes.

8. Trial Scenario Building

The following chapter describes the scope, location information, story and key elements of the first pilot iteration

8.1. Scope

The pilot will be performed using historical data. The pilot will take place in the Kainuu region. It will be conducted in two locations: a forest area in Kuhmo, where a fictitious fire occurs, and a control room in Kainuu, where most of the work is done since it is mainly technical.

- To test how certain technologies provided by TEMA will help first responders on their work
- Participants: Rescue department personnel, photographers, control room operators and technical personnel, observers, media, guests.
- Duration: 2 trial days (including hardware and software setup, and dry run) and 2 travel days.
- Measurements: End users and technical partners review about pilot and technologies.

Trial location: The historical case is based on the location of sample data collected during the prescribed burn in 2024. The location of the data collection site is Kotalammentie 558, 88749, Kuhmo: 64°22'57.7"N 29°07'30.4"E.

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Trial venue: Sokos Hotel Break, Kidekuja 2, Vuokatti, 88610, Finland..

8.2. Story

In Kuhmo, a forest fire has spread over a large area. The fire is difficult to control, and first responders need to start mapping the nearby residential areas that may need to be evacuated if necessary. At the moment, practitioners start collecting data from the field using separate services to manually collate the data from the field and the control room. Once collected, a response is planned to extinguish the fire. If needed, protection of citizens is prioritized. TEMA technologies provide accurate spread forecasts, transmits situational awareness data, and suggests which residential areas should be evacuated first. The pilot will explore how the addition of such data can enhance the operational procedures of the firefighters.

8.3. Trial Scenario Elements

The trial scenario follows KAHY operational procedures and utilizes the TEMA solution to enhance situational awareness, improves the speed of information received and decisions made.

9. Organization and Logistics

9.1. Dry Run 1

Dry Run 1 is the first test to ensure that everything works properly on the TEMA platform. It provides insight into what needs improvement and what is already working well. Notes will be collected during Dry Run 1 for further development of the application. Dry Run 1 will be conducted remotely and will include TEMA's technical partners as well as staff from the Kainuu wellbeing services county who are familiar with TEMA application.

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9.1.1. Dry Run 1 review checklist

Table 12. Dry Run 1 review checklist

Review name	✓
Distaff training on Trial realization conducted	✓
Data collection plan & evaluation plan reviewed in practice	✓
Scenario and injects reviewed in practice	✓
Training on solutions for Trial simulation team conducted	✓
Readiness review of solutions and technical integration conducted	✓
Local Testbed adaptation reviewed in practice	✓
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	✓
Number of external stakeholders and their role reviewed in practice	✓

9.1.2. Conclusion and Lessons Learned

TFA-05 and TFA-06: Due to intense smoke, it was found it is extremely difficult to segment fires in the visual spectrum (RGB) and conceal the fire zones. To address this, we used infrared (IR) imaging to find smoke-hidden fire areas. However, crucial metadata like a field of view (FOV) was absent from IR data, necessitating afterward estimation for successful data fusion. Furthermore, the lack of objects (vehicles and people) in the data and their low visibility from vegetation and smoke made it difficult to recognize people and cars. To further mitigate this issue, additional training on similar scenarios is necessary.

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TFA-11: Due to the remoteness of the location, practically no directly associated social media data were available for this trial. We therefore prepared an artificial dataset based on historic tweets in Finland. With this dataset, TFA-11 worked reliably. Single post and Hotspot results were produced as expected. The output was still sparse, as only 77 posts occurred within 50km of the AOI. Because of the remoteness of the area, this behavior is also expected in the case of a real- world event.

9.2. Dry Run 2

Dry Run 2 will take place one day before the pilot and will be held at Sokos Hotel Vuokatti. It will involve the same people who will be using the TEMA platform on the pilot day. A remote connection will also be arranged for Dry Run 2. This dry run ensures that the application functions as expected during the pilot.

9.2.1. Dry Run 2 review checklist

Table 13. dry run 2 checklist

Review name	✓
Staff training on Trial realization conducted	✓
Data collection plan & evaluation plan reviewed in practice	✓
Scenario and data injects reviewed in practice	✓
Training on solutions for Trial simulation team conducted	✓

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Readiness review of solutions and technical integration conducted	✓
Local Testbed adaptation reviewed in practice	✓
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	✓
Number of external stakeholders and their role reviewed in practice	✓

9.2.2. Conclusion and Lessons Learned

Dry Run 2 was successfully performed. The test confirmed that while there is still room for improvement in the TEMA system, it is sufficiently functional for the pilot. Most of the feedback from DRY Run 2 focused on usability, which will be a key area for further development. Dry run 2 was also the final rehearsal where KAHY had the opportunity to test the system prior to the pilot day.

9.3. Trial Actions and Timeline

Table 14. Schedule for Finnish pilot

Day 1: Tuesday 20.05.2025. Sokos hotel, Vuokatti		
From – To	**TOPIC**	**LEADER**
09.00 – 09.20 20 min	Welcome - Start of Day 1	
09.20-10.00	Pilot preparations and local testing	KAHY

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10.00-11.15	Coffee break	
11.15-12.00	Training and rehearsal	KAHY
12.00-13.00	Lunch	
13.00-15.00	Debriefing and feedback session	KAHY
15.00	End of day 1	

Day 2: Wednesday 21.05.2025. Sokos hotel, Vuokatti		
From – To	**TOPIC**	**LEADER**
09.00 – 09.20 20 min	Welcome - Start of Day 2	
09:20 - 10.00 40 min	<u>Hardware and software setup</u>	ENG
10.00 – 11.15 15 min	Coffee break	
10.15 – 12:00 1.45 h	Hardware and software setup	ENG
12.00 – 13.00 1 h	Lunch break	

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13.00 – 13.10 10 min	Additional KAHY staff join, introduction	KAHY
13.10 – 15.00 1.50 h	Dry run 2	ENG **(Online meeting begins)**
15.00 – 15.20 20min	Group photo and coffee break	**(Online meeting begins)**
15.20 – 16.30 1.10 h	Debriefing and feedback session	KAHY
16.30	End of day 2	
19.00	Social dinner, Kippo restaurant, Vuokatti	

Day 3: Thursday 22.05.2025. Fire station, Kajaani		
From – To	**TOPIC**	**LEADER**
09.00 – 09.45 45 min	Hardware and software test	ENG

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09:45 – 10:00 15 min	Coffee break	**(Online meeting begins)**
10.00 – 12:00 2 h	Pilot	KAHY
12:00 – 13:00 1 h	Lunch break	
13.00 – 14.45 1.45 h	Evaluation and discussion	KAHY (End-user discussion in Finnish)
14.45 – 15.00 15 min	Coffee break	
15:00 – 17:30 2.30 h	Brief report on end user discussion, debriefing and feedback session, wrap-up session	KAHY
17:30	End of day 3	**(Online meeting ends)**

9.4. Communication plan

During the pilot, all participants will be in the same room, so communication will take place in real time and face-to-face. Before and after the pilot, communication will be done via email or phone.

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The Trial Action Plan outlines each person's area of responsibility, so you know who to contact regarding specific matters.

9.5. Auxiliary activities

The pilot will take place at a hotel, where basic auxiliary services will be available. These include, for instance, cleaning, venue facilities, internet access, first aid- and security services.

9.6. Assets for the Trial

KAHY will provide a control room for use during the pilot. The control room is equipped to broadcast remotely to other participants. It includes basic technology, internet access, and electricity.

10. Other Organizational Aspects

The following chapter describes another important consideration for planning and running the pilot trial.

10.1. Safety Plan

KAHY team will check that all equipment and facilities are safe. First aid kit and first aid medical support will be available. In hazardous situations participants must call 112 for emergency support.

10.2. Other Training

No other training.

10.3. Technical Helpdesk

The integration team (ENG) coordinates component-specific support across the TEMA ecosystem, ensuring all technological elements remain operational and properly integrated, while managing technical team interventions.

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The KAMK team delivers dedicated support for the SmartDesk, the primary operational interface for end-users, providing technical assistance and training to maximize utilization of its mapping, prediction, and visualization capabilities.

For the trial, both mentioned teams will ensure on-site presence alongside fire simulation specialists (TSYL) to provide comprehensive technical support..

10.4. Research Ethics and Informed Consent Forms

10.4.1. Identification and Recruitment of Pilot Participants

The KAHY pilot will consider its own staff working in control room as the primary end users of the TEMA solutions. In addition, external stakeholders such as Pelastusopisto (Emergency services academy) will be considered as they conduct teaching and research for Finnish rescue services..

10.4.2. TEMA Informed Consent Procedures

Staff KAHY will choose has expertise on procedures and mission management on wildfires. 10.4.3. TEMA Informed Consent Procedures

In the context of the TEMA project's Pilot Trials, robust procedures have been established to ensure the informed consent of all participants, in line with ethical, legal, and data protection requirements.

10.4.3. Description and Analysis of the Information Sheet

Participants are provided with a comprehensive Information Sheet that covers two distinct areas:

(a) research participation and (b) the processing of personal data.

1. **Research Participation**:

○ The Information Sheet clearly outlines the objectives and scope of the TEMA project, which seeks to improve Natural Disaster Management (NDM) through the integration of real-time semantic 3D mapping and AI-enabled disaster prediction tools.

○ It explains the structure and purpose of the Pilot Trial, including participants' roles (e.g., operators, evaluators), the nature and duration of the trial, and the use of innovative technologies such as unmanned aerial vehicles (UAVs) and AI systems.

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○ Participants are explicitly informed that their involvement is voluntary and that they may withdraw consent at any stage without any consequence.

○ The document highlights any potential health and safety risks, particularly related to UAV operations, and specifies that relevant safety protocols and regulatory compliance measures will be in place.

2. **Processing of Personal Data**:

○ The Information Sheet details the types of personal data to be collected and processed before, during, and after the Pilot Trial. These include names, identity/passport numbers, images and voice recordings, and signatures.

○ It specifies the **purposes of data processing**, including secure site access, trial execution, dissemination and communication activities, and GDPR compliance.

○ The **legal basis for processing** is clearly identified, primarily relying on the participants' consent (pursuant to Article 6(1)(a) GDPR), with specific exemptions relying on Article 6(1)(e) for certain access control measures.

○ Information regarding **data controllers, storage periods**, data sharing with the TEMA Consortium, and participants' rights under the GDPR (e.g., access, rectification, erasure, restriction, portability, objection, and complaint) is transparently provided.

○ It is explicitly stated that some visual and audio material may be disseminated via the project's website and social media platforms for communication purposes.

10.4.4. Consent Process and Timing

The **Information Sheet** and accompanying **Informed Consent Form** are provided to each participant in advance of the trial. Participants are given adequate time to carefully review the documents, raise any questions, and make an informed decision regarding their participation and the processing of their personal data. A representative of the Pilot Trial organizer is made available to respond to queries and provide clarifications.

Only participants who voluntarily sign the Informed Consent Form will be allowed to participate in the trial. Consent includes both participation in the research activities and agreement to the specified personal data processing operations.

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10.4.5. Annexes

The full Information Sheet and Informed Consent Form may be appended to this document as annexes for reference and verification of compliance with ethical and data protection standards

10.5. Public Relations Plan

The aim of this public relations (PR) plan is to raise awareness and engagement around the trial exercise by showcasing how innovative technology enhances natural disaster response. It seeks to inform key stakeholders about project results, attract media attention and position the TEMA project as a leader in crisis management innovation.

10.5.1. PR plan objectives

- Raise Awareness: Inform stakeholders and the public about the pilot exercise and its role in improving disaster response.
- Showcase Innovation: Highlight the cutting-edge technology being tested and its potential impact.
- Engage Key Stakeholders: Ensure participation and support from policymakers, emergency responders, researchers, and the public.
- Reinforce Project Credibility: Position TEMA as a leader in crisis management innovation under Horizon Europe.
- Generate Media Coverage: Secure coverage in relevant publications, news outlets, and online platforms.

10.5.2. Target Audiences

Primary Audiences

- Government agencies (European Union bodies and agencies, national and local disaster management authorities)
- Emergency responders (firefighters, paramedics, civil protection units)
- Technology providers and researchers
- Media (mainly local outlets and those focusing on science, tech, European Union policy, emergency response)

Secondary Audiences

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- The general public (especially in the Kajaani region)
- NGOs and international organizations (local organizations, Finnish Red Cross, United Nation agencies)

10.5.3. Key messages

Key message 1: "Technology for Saving Lives"

● The advanced digital tools offered by TEMA are transforming disaster response.

● This trial exercise demonstrates how cutting-edge technology can improve decision-making, reduce response times and ultimately save lives in crisis situations.

Key message 2: "EU Leadership in Crisis Management"

● As part of Horizon Europe, TEMA reflects the European Union's commitment to enhancing disaster preparedness through research and innovation.

● By funding and supporting breakthrough technologies, the European Union strengthens its role as a global leader in climate resilience and emergency response solutions.

Key message 3: "Real-World Testing for Real-World Impact"

● To ensure that innovative tools can be effectively deployed in real crises, this trial tests them under realistic emergency conditions using historical data.

● By simulating natural disasters using historical data, the exercise helps identify strengths, limitations and areas for improvement before full-scale adoption.

Key message 4: "Collaboration is Key"

● Effective disaster response requires a multi-stakeholder approach, bringing together emergency responders, scientists and technology providers.

● This trial is an example of cross-sector and cross-country cooperation, ensuring that the solutions being developed are practical, scalable and aligned with real-world needs.

10.5.4. Key PR Activities and Timeline

Phase 1: Pre-trial (Three months to one week before the trial)

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- Preparation of a folder with pictures and videos of KAHY in action to be used in the promotional material of the trial.
- Collection of a list of local and national media contacts.
- LC to prepare the first press release in English, which will be translated in Finnish by KAHY.
- Creation of the graphic templates that will be used on social media and other digital communication.
- Update and translation of the project presentation in Finnish.

Phase 2: Trial execution (one week before the completion of the trial)

The week before the trial:

- Circulation of the first press release in local and national media by KAHY, alongside the project presentation.
- Announcement of the trial on KAHY and TEMA social media.
- KAHY to offer interview opportunities for journalists.

During the trial:

- Real-time updates on KAHY and TEMA social media.
- Capture of high-quality visuals (photos and video) for post-event storytelling.
- KAHY to offer interview opportunities for journalists.

Phase 3: Post-trial (the weeks following the trial)

- Circulation of the second press release, which will be written with the assistance of LC, in local and national media by KAHY.
- Website and social media recap of the trial, sharing videos, key takeaways and testimonials.
- Further sharing of the trial results with key target audiences, such as policymakers and first responders, via the TEMA newsletter and TEMA's page in the Union Civil Protection Knowledge Network (UCPKN).

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10.6. Authorization, Registration and Permits for Trial

Participants must accept the event's terms before taking part.

10.6.1. Trial Authorization

KAHY approves its staff to participate in pilot preparations, pilot activities, discussing and evaluating.

10.6.2. Trial Registration

Document will be shared to partners to confirm participation.

11. Annexes

Annex 1 Informed Consent Forms

Annex 2 Dissemination & Communication Audit Questionnaire

Annex 3 TEMA Observers Questions

Annex 4 TEMA Guided Discussion Questions

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INFORMATION SHEET

FOR RESEARCH PARTICIPATION & DATA PROCESSING

Dear participant,

You are invited to take part in the TEMA **Pilot Trial 1** carried out as part of the TEMA project (Grant Agreement 101093003).

In the context of **WP6 Integration and Validation (pilot trials)**:
(a) A Pilot Trial will be organised and hosted by **KAHY on: 19.5-22.5 2025** where the technologies of TEMA will be tested, validated and evaluated**.**

Before you decide to participate, please, be informed of the following details and, if you wish, consent (a) to your participation and (b) to the processing of your personal data by signing the relevant **Informed Consent Form**.

ABOUT YOUR PARTICIPATION:

What is the TEMA project about?
TEMA will greatly improve Natural Disaster Management (NDM, e.g., for wildfires, floods) by automating precise semantic 3D mapping and disaster evolution prediction to achieve NDM goals in near-real-time. It will analyze and fuse many heterogeneous extreme data sources: smart drone and in-situ sensors, remote sensing data, topographical data, meteorological data/predictions and geosocial media data (text, image and videos). TEMA will focus on the extreme nature of the data, due to their varying resolution and quality, very large volume and update rate, different spatiotemporal resolutions and acquisition frequencies, real-time needs and multilingualism. It will develop an integrated, ground breaking NDM platform, focusing on real-time semantic extraction from multiple heterogeneous data modalities and sources, on-the-fly construction of a meaningful semantically annotated 3D disaster area map, prediction of disaster evolution and improved communication between service providers and end-users, through automated process triggering and response recommendations. Semantic analysis computations will be distributed across the edge-to-cloud continuum, in a federated manner, to minimize latency. Extreme data analytics will be performed in a trustworthy and transparent way, by greatly advancing state-of-the-art AI and XAI approaches. The constantly updated 3D map and the disaster evolution predictions will form the basis for an advanced, interactive, Extended Reality (XR) interface, where the current situation will be visualized and different

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response strategies will be dynamically evaluated through simulation by NDM personnel. The innovative, scalable and efficient TEMA platform will provide precise NDM support, based on extreme data analytics. It will be validated on two critical disaster use-cases (wildfires and floods), in four EU countries, and will form the basis for the TEMA NDM-Analytics-as-a Service (NDM-AaaS) model.

How long is the TEMA research project likely to last?
The duration of the project is 48 months as of 1 December 2022 until 30 November 2026.

Why have you been asked to take part?
You were asked to take part due to your knowledge, expertise and active involvement in the TEMA project or due to your relation to the Pilot Trial organisers KAHY and your interest in the TEMA project.

What will you need to do?
You will participate in the TEMA KAHY Pilot Trial of WP6 (Integration and Validation). The trial is led by Jaakko Schroderus and will last 3 days You will take part once and you will contribute to the evaluation of the TEMA technologies/ the prototype TEMA platform (as a tool operator or participant…) in accordance with the scenarios. The duration of the TEMA Pilot Trial is expected to be 2 hours.

In addition, the TEMA project includes AI systems and the participants may interact with the AI systems. Participants shall use the AI systems during the TEMA Pilot Trial in accordance with the instructions of use presented by the providers. Please be informed that these AI tools will not process any personal data of the participants, and there will be no negative impact, nor any risk for the participants during the Pilot Trial.

——

Where will this take place?
The activities related to Trial will be carried out at Kuntokatu 7, Kajaani

How can you find out about the results of the activity?

Are there any foreseeable risks, discomfort or disadvantages that might ensue?
A health and safety risk that has been identified is related to the potential collision or fall of a drone over humans during the Pilot Trial. The necessary health and safety procedures will be followed in accordance with the applicable legal framework and with the user manual issued for the drones. Competent authority designated with the necessary powers and allocated responsibilities for the authorisation and compliance of organisations and persons involved in Unmanned Aircraft operations and related training in the airspace of Jaakko Schroderus is Fire chief and Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft.

When will you have the opportunity to discuss your participation?

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The present Information Sheet and the relevant Informed Consent Form will be provided to you **prior to** your participation, and you will have time to carefully read them before deciding. A representative from KAHY will respond to any of your questions (see contact details below). If you decide to take part, you shall first sign the Informed Consent Form.

What if you do not wish to take part?
Your participation is **totally voluntary**. You have the right to entirely or partially refuse to participate and your refusal will not disadvantage you in any way.

What if you change your mind during the study?
In that case, you are **free to withdraw your consent** to your participation from any part of the present activity at any time, without consequences by contacting a representative from Jaakko Schroderus see the contact details below).

ABOUT THE PROCESSING OF YOUR PERSONAL DATA:

Data controllers:

Jaakko Schroderus

Data Protection Officers:

tietosuojavastaava@kainuu.fi

Types of personal data:

Regarding the Trial, the following personal data will be processed by the data controllers for the purposes mentioned below, provided that you have consented to each processing operation:
1. Prior to the Trial, Jaakko Schroderus will process:

- Names of the participants on the entrance list

2. During the Trial, Jaakko Schroderus will process:

- Images that may identify a participant *potentially* collected through cameras or other types of sensors
- Images and voice that can identify a participant collected through photos and video recordings
- Names of the participants on the Informed Consent Form and the attendance list
- Signatures of the participants on the Informed Consent Form and the attendance list

Purposes of the processing:

1. Personal data (names, passport numbers/identity card numbers) will be processed by the data controllers to ensure secure access of the participants to the Kuntokatu 7

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2. Personal data (images) *may* be processed by Jaakko Schroderus through cameras (onboard UAVs) for the execution of the trial.
3. Personal data (images, voice) will be processed by KAHY for the dissemination and communication of the project's results related to the Trial.
4. Personal data on the attendance list and the Informed Consent Form (names, signatures) will be processed by Jaakko Schroderus for compliance with the relevant GDPR provisions (Article 6 par.1 a GDPR) and for accountability reasons towards the Funding Authority (European Commission).

We will not use personal data for any other purpose, unless a new legal basis exists, in which case you will be notified accordingly or asked for renewed consent.

Legal basis for the processing:

Personal data are processed by the controllers **based on your consent** (see the Informed Consent Form to be signed) according to **Article 6 par.1 (a) GDPR** *with the following exemptions:*

[*Your name on the entrance list are processed by **** according to **Article 6 par.1 (e) GDPR** since the processing is carried out in the exercise of official authority vested in the controller (prerequisite for secure access to the Field Trial site).*

*Your name and signature on the attendance list and the Informed Consent Form are processed as part of the informed consent procedure **for the processing to be lawful and compliant to the GDPR** and for accountability reasons in case the Funding Authority (European Commission) carries out any ethics checks or reviews*.]

Recipients:

1. Personal data (names) collected through the entrance list to ensure secure access to will be retained solely by Jaakko Schroderus.
2. Personal data (images that could identify an individual) *potentially* collected for the execution of the TEMA Pilot Trial will be shared with the TEMA Consortium. (TEMA Consortium partners https://tema-project.eu/partners).
3. Personal data (images and voice that could identify an individual) collected for dissemination and communication purposes will be shared with the TEMA Consortium and some of them will be uploaded on the official TEMA website and the TEMA social media accounts.
4. Personal data on the attendance list and Informed Consent Form will be retained solely by Jaakko Schroderus.

Storage period:

1. Personal data collected through the entrance list will be retained until the end of the TEMA Pilot Trial (22.5).

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2. Personal data *potentially* collected through cameras for the execution of the Pilot Trial will be retained by the end of the TEMA project (30 November 2026 or later if the project is officially extended).
3. Personal data collected through photographs and video recordings for dissemination and communication purposes will be retained until the end of the TEMA project (30 November 2026 or later if the project is officially extended). However, some photos or videos will be uploaded on the official TEMA website and on the TEMA social media accounts.
4. Personal data on attendance list and the Informed Consent Form will be retained for a period of 5 years after the end of the TEMA project (30 November 2031 or later if the project is officially extended) according to Articles 18.1 and 20 of the TEMA Grant Agreement.

After the aforementioned periods the personal data will be permanently deleted without keeping any copy.

Right of the data subject:

You have the right to:

- Request information about whether we hold personal information about you, and, if so, what that information is and why we are holding it (Art.15 GDPR).
- Request access to your personal information. This enables you to receive a copy of the personal information we hold about you and to check that we are lawfully processing it (Art.15 GDPR).
- Request rectification of the personal information that we hold about you. This enables you to have any incomplete or inaccurate information we hold about you corrected (Art.16 GDPR).
- Request erasure of your personal information. This enables you to ask us to delete or remove personal information where there is no good reason for us continuing to process it (Art.17 GDPR).
- Request the restriction of processing of your personal information. This enables you to ask us to suspend the processing of personal information about you (Art.18 GDPR).
- Request transfer of your personal information in an electronic and structured form to you or to another party (right to “data portability”). This enables you to take your data from us in an electronically usable format and to be able to transfer your data to another party in an electronically usable format (Art.20 GDPR).
- Object to the processing of passport numbers/identity card numbers through the entrance list (Art.21 GDPR).
- Lodge a complaint to the competent supervisory authority (Art.77 GDPR).
- Withdraw your consent at any time. Please note that the withdrawal does not affect the processing of your data which is based on the consent you have given before the withdrawal. Once we have received notification that you have withdrawn your consent, we will no longer process your personal information for the purpose/purposes you originally agreed to.

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Contact persons:

In case you have any questions and concerns about the **TEMA Pilot Trial**, you can contact Jaakko Schroderus.

For the exercise of your rights related to **data protection**, you may contact the Data Protection Officer of by sending an email to tietosuojavastaava@kainuu.fi

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INFORMED CONSENT FORM

FOR RESEARCH PARTICIPATION & DATA PROCESSING

Hereby I, ...(name, surname)

	YES	NO
I have carefully read the Information Sheet for the **Finnish Pilot Trial 1** that will be carried out on 20.5.2025 – 21.05.2025 as part of the WP6 "Integration and validation" of the TEMA research project (Grant Agreement 101093003). I **have been informed of my data protection rights** and I have been given the contact details of the contact persons. I understand that **I am free to withdraw my consent** at any time without giving a reason for my withdrawal and without any consequences.		
I confirm that **I am over 18 years old.**		
I wish to participate in the **Finnish Pilot Trial 1** in Vuokatti under the conditions set out in the Information Sheet.		
I consent to the processing of **images, audio and video or any other means** where I may be identified.		
I consent to the processing of **my image and voice** for **research purposes, dissemination and communication purposes via the official TEMA website and the official TEMA social media accounts** (Finnish pilot trial 1)**.**		

I wish to receive a copy of the Information Sheet. Yes ☐ No☐

Date: ….../ …. /2025

Location: Vuokatti

Participant's Signature

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Questions for the Observers during the trials

- How user-friendly did the end-users find the TEMA platform during the operation?
- Were there any features of the TEMA tools that the end-users found particularly helpful or challenging?
- Did the end-users encounter any technical issues or downtime with the TEMA tools? If so, please describe.
- What improvements or additional features did the end-users suggest for the TEMA tools?
- Do you have any other observation that you would like to share with technical partners?

Guided discussion questions for the pilot trials

1. Can you recall a moment when TEMA helped you respond faster than you would have in your usual process? What made the difference?
2. Were there any steps or information in TEMA that slowed you down or introduced unnecessary delay?
3. Did TEMA help you notice or understand aspects of the emergency you would otherwise have missed? Can you give an example?
4. Was there any information you felt was missing or unclear? How would you prefer to have that information delivered?
5. Would you prefer to integrate selected individual TEMA functionalities into your existing systems, or would you rather adopt the full TEMA platform as an additional or extended system alongside your current setup? Why?
    a. Which specific functionalities would you prioritize for integration?
    b. What advantages or challenges do you see with either approach?
6. Did TEMA reduce the amount of manual tasks or decisions you normally have to handle? Which tasks specifically?
7. Were there points where you still felt overloaded or stressed despite using TEMA? What contributed to that?
8. How intuitive did you find the system to use under time pressure? Were there any confusing parts that added to your workload?
9. If you could change one thing about TEMA to make it more useful in an emergency, what would it be?
10. Did you trust the outputs and recommendations of TEMA? Why or why not?
11. Did you experience any technical or organizational barriers when using TEMA (e.g., connectivity)?

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End of Document

TEMA

TRUSTED
EXTREMELY PRECISE
MAPPING AND PREDICTION
FOR EMERGENCY
MANAGEMENT

Annex 3

Trial Action Plan (TAP)

BRK Trial-1

TEMA
TRUSTED
EXTREMELY PRECISE
MAPPING AND PREDICTION
FOR EMERGENCY
MANAGEMENT

Project Information

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Executive Summary:			
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Participating Partners:	**All**		

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Document Revision History

Version	Description	Contributions
0.1	TEMA TAP Template	Margareta Mihalic Dogan
0.2.	Added chapters 3.2., 4.1., 8.1, 8.2.	KEMEA, BRK
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0.4.	Added chapters 4.3., 4.6., 8.1., 10.3, 10.3.4., 10.3.5.	BRK, KAMK, LC
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List of Terms and Abbreviations

Abbreviation	Description
ND	Natural Disaster
NDM	Natural disaster management
TAP	Trial Action Plan
TEMA	Trusted extremely precise mapping and prediction for emergency management
TGM	Trial Guidance Methodology

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Executive Summary

This project has received funding from the European Union's HE research and innovation programme under the grant agreement No. 101093003

1. Introduction

This project has received funding from the European Union's HE research and innovation programme under the grant agreement No. 101093003

2. Purpose and Scope

The purpose of the Trial Action Plan (TAP) is to provide the detailed plan of Trial organization and to facilitate the monitoring of Trial preparation activities as well as an evaluation plan for TEMA project.

The completion of the TAP chapters serves as an indicator of the Trial preparation progress.

2.1. Trial Stages

The Trial event stages, which reflect the stages of Trial preparation, include 5 steps:

1. Stage A – The initial stage, which ends with Deliverable D2.1.
2. Stage B – The main preparation stage which ends with Dry Run 1.
3. Stage C – The maturation stage which ends with Dry Run 2.
4. Stage D – The final preparation stage which ends with the Trial itself.
5. Stage E – The recapitulation stage which ends with the Trial evaluation report.

The preparation stages and the activities undertaken during each stage are presented in the table below (Table 1 in chapter 2.2.).

Stage A was started in WP2 T2.1. of the TEMA project. Results of the work done in T2.1. are in deliverable D2.1. Stages B to E will be covered by work in WP6, more specifically: stages B and C will be covered within T6.3 and Stages D and E within 6.4 and reported in respective deliverables D6.1. and D6.2.

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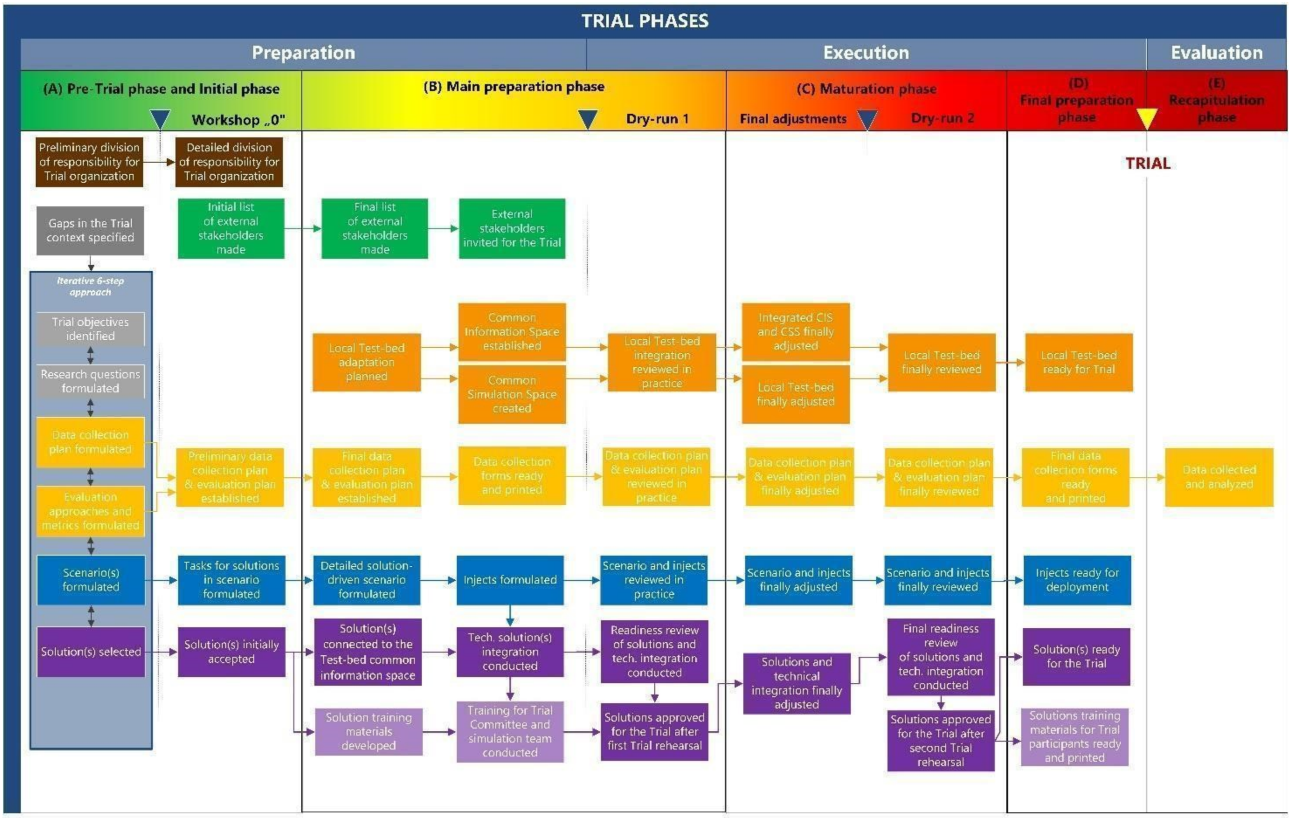

Figure 1. Trial phases

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2.2. TAP completing schedule

Table 1. TAP review schedule and monitoring

No	Deadline	Description	Contributor	Needed for
1	August 2024	2, 2.1, 2.2, 3, 3.1, 3.2, 4.1	BRK, KEMEA	
2	November 2024	4.2.	BRK	
3	January 2025	4.7.	BRK, all	
4	February 2025	4.3., 4.6. 8.1.	BRK	
5	March 2025	10.3., 10.3.4., 10.3.5.	LC	
6	April 2024	4.4., 4.8., 10.4	BRK, KAMK	
7	May 2025	7., 9.2., 10.2.	BRK, ENG	
8	June 2025	5.3.	BRK	
9	July 2025	5, 5.1., 5.1.2, 6, 8.2, 8.3, 8.4., 10.3.2, 10.3.3.	BRK	
10	September 2025	4.5, 4.8 (revision) 5.1.1, 5.13, 5.4, 8, 9.1, 9.1.1, 9.1.2, 9.3, 9.4, 10.1, 10.3.1, 10.4. (revision), 10.5	BRK, KAMK, KEMEA, LC	
11	October 2025	5.2, 9, 9.4, 9.3, 10	BRK	

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3. General Information on the Trial

Location (Control room)	
Date	10.-14. November 2025
Organizer	Bavarian Red Cross
Trial type	Historical, Flash flood- Ahrtal use case

3.1. Trial Purpose and Goals

The common challenge of TEMA project is the improvement of the natural disaster management (NDM) by providing a state-of-the-art disaster management support system, dynamically exploiting multiple data sources and AI technologies for providing an accurate assessment of an evolving crisis situation.

The purpose of the BRK´s Pilot Trial 1 is to evaluate the solution in several aspects:

- to assess whether natural disaster management capability gaps are closed.
- to evaluate the performance of the TEMA solution in flash flood scenario while using the historical data
- to evaluate if improvement in NDM using new digital technologies and extreme data analytics has been achieved.

End-users from different PPDRs involved in the pilot trial will evaluate operational effectiveness by trialing the technology in simulated response to natural disaster caused by the flash flood and missions under conditions as real as possible by using the historic data from the flood in July 2021. For the purpose of the trial new data might be produced if the available historic data is lacking.

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The objective of the BRK´s Pilot Trial 1 is to conduct a practitioner evaluation of TEMA-Solution, based on a large-scale Flash Flood scenario.

3.2. Outline of the Trial Scenario

The pilot trial will use the real event, Ahrtal 2021 Flood, as a base for creating a trial scenario. As for the sources of data used for the BRK Pilot-1, the majority of the data will be real historic data gathered during and after the Ahrtal flood. This data will be completed with new and simulated data to compensate for all the historic data that has not been able to gather.

The Scenario:

As a result of the heavy and long-lasting rain in July 2021, there were heavy floods in Germany. Up to 200 liters of rain per square meter fell in some areas. Due to the special geographic location and the nature of the soil in the Ahr valley, the absorption capacity in some parts was quickly exceeded resulting in major flash floods. Despite the measures taken to avert danger, there was considerable damage. The number of dead has risen to a total of 183; rescue workers are also among the dead. Over 800 people were injured, some seriously. Before and during the flood events (between July 10th and 20th), 256 event-related warning messages were issued in four countries via the modular warning system (MoWaS), which the Federal Office for Civil Protection and Disaster Assistance (BBK) the States and municipalities makes available. In 10 Local authorities were identified as having a catastrophe. The floods officially started on 15/07/2021, and in official documents stated the end of the catastrophe was declared 28/08/2021.

The natural disaster (ND) area of interest for this purpose is located in Germany, between the cities: Kreuzberg, Altenburg, Altenahr, Mayschoß, Dernau, Bad Neuenahr - Ahrweiler.

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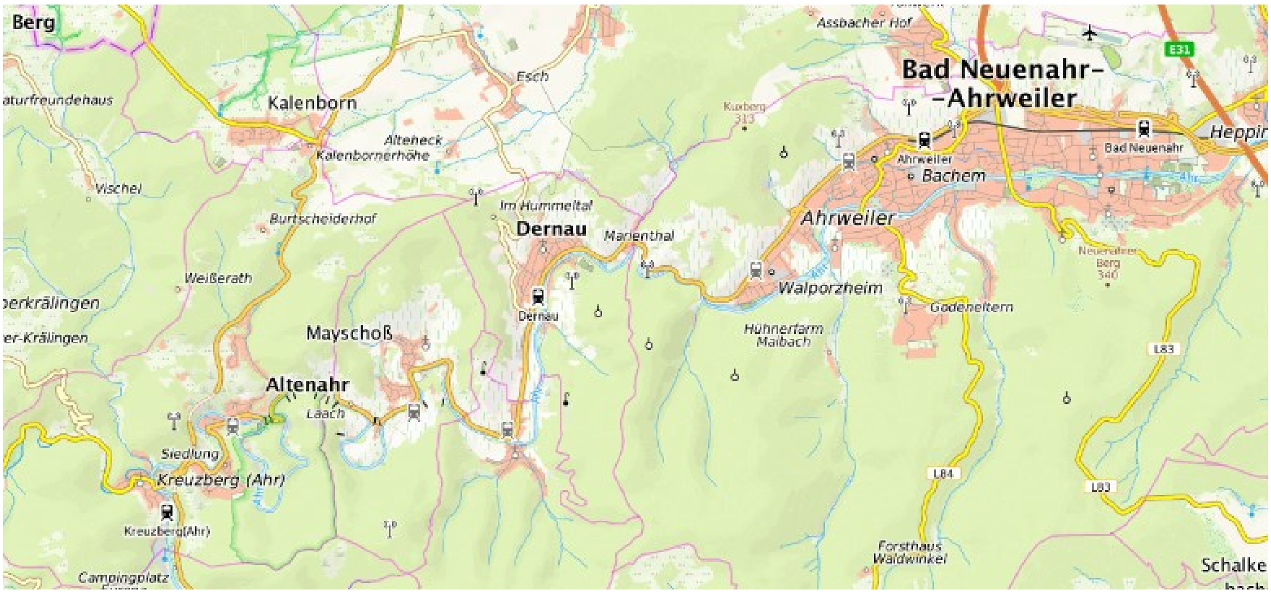

Figure 2. Trial Area

For the trial purposes the 4 km2 that will be used for the pilot is Altenburg, Altenahr und Mayschoß.

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4. Trial Guidance Methodology Application

4.1. Brief description of chosen gap assessment method

The identification of gaps when facing natural disasters like fire, flood, and relative to the purpose of TEMA project and pilots, should take into consideration the gaps from the **academic literature** as well as the gaps stemming from the **Grant Agreement** and the **Storytelling**.

In TEMA project, gaps have been identified and assessed in the context of D2.1 as part of the storytelling procedure. There the vulnerabilities of the response mechanism as well as proposed solutions offered by TEMA technologies have been stressed out.

In general, there is also a distinction between qualitative and quantitative gaps in a natural disaster.

- A qualitative gap is for example the political profile of a disaster, or the availability and the time to deploy resources for the disaster. There is also the need for improved management and coherent coordination in order to provide an overview of the situation and act fast.
- Quantitative gaps for floods or fires can be summarized to the lack of resources for the repression and interception of the natural disaster, the lack of sufficient quantities regarding shelter capacity, hospital modules, mobile units of equipment, lack of capacity for rescue and research, limited aerial fire-fighting capacity, as well as the lack of organization and preparedness of the resources that are engaged in the response mechanism, therefore a gap in the quantities of aerial and terrestrial resources deployed in the fight against the natural disaster.

Grant agreement:

- Information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.
- Low visibility and health hazards due to smoke. Scarcity of accurate information regarding the wider area, leading to suboptimal response strategies.
- Accurate information is crucial in planning, prioritizing and managing response actions.
- Access to trustworthy information is crucial for FRs/PPDR (Public Protection and Disaster Relief) organizations.

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Gaps from Storytelling:

BRK (flood): What was the status of the international cooperation during the ND: were the operators able to reach everybody? How long did it take for Copernicus to provide the information?

What the command on site needs most urgently is, listed by priority: A map even in printed form, Evaluated map, What is the area of interest (epicenter), What infrastructure is available (example is there still a bridge and is it safe to use it). One of the most important things for the rescue units and their command is to get any kind of information as soon as possible, which in time needs to be more and more accurate so that the strategy can be planned. The technology used in cases of ND needs to be something that is used every day and simple. When the disaster strikes, and the situation is dangerous and full of adrenaline, a person who is in rescue hasn't got the time to learn about the new technology or to try what are the options that this (new) warning system provides. It needs to be clean and simple to use. Orientation in unfamiliar terrain is extremely difficult because of the massive destruction. "Mapping" of destroyed buildings is also very difficult. Drone images are only suitable to a limited extent for local/small site use only. High cost of post-processing. Local radio stations played an important role: can place fast information and warnings; are automatically turned on in local crises; can warn precisely – for individual districts or even for certain streets.

The detailed description of the gaps assessment method and results is to be found in TEMA Deliverable 2.1..

Link: https://drive.google.com/file/d/1OWm1eCl6tDl3jv6cnBDTWsAOnkdvkAWN/view

4.2. Selected and Validated Gaps

A complete and detailed gap analysis was conducted as part of the analysis in WP2 and is described in Deliverable D2.1. For the needs of BRK Trial 1, Ahrtal Flood use case, the gaps most relevant to this specific use case, which will be validated in the same pilot trials, have been selected. The selected gaps are described in Table 2. To this selected list of gaps, given priority is high.

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Table 2. Selected gaps

Gap description	Interdependencies with other gaps	Method of verification
6. Lack of information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.	Gaps, 8, 10 and 12	TEMA components:
8. Accurate information is crucial in planning, prioritizing and managing response actions	Gaps 6, 12 and 13	TEMA-System in total
10. Lack of information on size the affected area / area of interest (epicenter)	Gaps 6 and 8	
12. Lack of detailed information of the needs and objectives of the mission	Gaps 6, 8 and 13	TEMA-System in total
13. Lack of information needed to perform a assessment (which area is the most pressing for rescue mission or assistance)	Gaps 6, 8 and 12	

4.3. Trial Specific Objectives

Objectives:

Ensure Accessibility Information for Mission Planning: Provide real-time and reliable data (for the purpose of BRK Trial1 historical data the historical data will be used to simulate “real time data”) on road and bridge conditions in affected areas to support first responders in planning and executing missions effectively.

Enhance Situational Awareness for Response Actions: Deliver accurate and up-to-date information to facilitate better planning, prioritization, and management of response efforts.

Determine the Scope of the Affected Area: Establish a reliable method for assessing the size and boundaries of the affected area (epicenter) to allocate resources efficiently.

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Clarify Mission Needs and Objectives: Improve information gathering on mission requirements to ensure that response teams have clear, detailed objectives aligned with actual needs.

Optimize Assessment for Effective Rescue and Assistance: Develop an effective system to assess the urgency and priority of affected areas, enabling first responders to focus on the most critical locations.

Improved Decision Support: Solutions should enhance the ability of emergency management teams to make informed, data-driven decisions.

Enhanced Data Integration: Provide seamless access to various data sources (e.g., satellite imagery, UAV reconnaissance) to improve the accuracy of situational assessments.

4.4. Research questions

Based on the objectives (defined in DOA) research questions are focused on understanding the end-user experience and the perceived value of the TEMA system for disaster response, especially in comparison to their current tools and methods:

Usability and User-Friendliness: How do end-users perceive the usability and user-friendliness of the TEMA system compared to their current tools? This includes the ease of understanding information and labels, the intuitiveness of the tools, and the ease of customization.

Information Quality and Trustworthiness: How do end-users rate the clarity, detail, accuracy, and reliability of the information provided by the TEMA system in comparison to their current systems?

Efficiency and Speed: Does the TEMA system improve the efficiency and speed of disaster response tasks, such as accessing comprehensive maps, receiving updated information, gathering data, and displaying information?

Automation and Workload: How does the level of automation in the TEMA system compare to the end-users' current systems, and does it reduce the amount of manual work required?

Situational Awareness: How does the TEMA system affect end-users' ability to establish situational awareness during a disaster, including the ability to work with different map views and combine intel from multiple sources?

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Decision-Making Support: How does the TEMA system support and enhance decision-making during disaster response compared to current tools, including the speed and effectiveness of decisions?

Perceived Benefits and Limitations: What are the main perceived benefits and limitations of the TEMA system compared to current systems for Natural Disaster Management (NDM) from the end-users' perspective? What specific aspects of the TEMA platform are considered most beneficial?

Areas for Improvement: What improvements or additional functions do end-users suggest for the TEMA system?

These research questions are the basis for the evaluation questions.

4.5. Data collection method and outline

[In this step for each of the research questions that has been formulated in step 2, is determined by which key performance indicators the requested impact can be measured. A data collection plan has to be developed that describes in which way all required kinds of data will be collected (measured), by whom or by which means, during the Trial. This should be done in a clear and consistent way to avoid unambiguousness and to get data of good quality. This plan should enable answering the research questions.

Detailed Solution Dimension KPI selection is further explained in chapter 5.2.]

4.6. Initial Scenario

4.7. Technical components in TEMA Solution

Technical components of the TEMA-System that will be included in BRK-Trial 1 Ahrtal flood use case were selected based on the selection of gaps, from which functionalities were described as well as the initial scenario. Agreed list comprises of the following 15 components:

Table 3: Technical components for BRK Trial-1

Technologies / TEMA Components

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TFA-tech-02 (FHHI) **Human-comprehensible presentation of concept-based explanations**
TFA-tech-05 (AUTH) Fire/smoke/person detection
TFA-tech-06 (AUTH) Fire/flood/background segmentation
TFA-tech-07 (ATOS) Person re-identification
TFA-tech-08 (DLR-DFD) Satellite-based flood detection and assessment
TFA-tech-11 (IT:U) Geo-social media analysis
TFA-tech-13 (ATOS) Contrastive image-language models
TFA-tech-15 (ATOS) Data scarcity, synthetic data generation pipeline
PDM-tech-02 (NS) 3Di Hydrodynamic simulation
PDM-tech-05 (USE) Information fusion
PDM-tech-06 (DLR-DFD) Data-fusion-based decision support and process triggering
SV-tech-02 (ENG) Digital Enabler
SV-tech-03 (ND) 3D computer vision (SfM)/ Photogrammetry
SV-tech-06 (ND) Extended Reality-based interactive visualisation system
SV-tech-07 (KAMK) Smartdesk Application

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4.8. Training plan on TEMA Solution

To ensure that the end users can use the TEMA Solution effectively and can evaluate its performance in the context of their trial scenarios, they require training on how to use the TEMA solution.

Training with experts tat will be part of the BRK Trial 1 will be planned after summer 2025 aiming for approximately two weeks before the trial.

The training will be organised on-line. The participants are provided with learning materials and complete the assignments at their own pace. KAMK staff participate online to aid learners as needed during the training. To support the learning process, a training handbook is provided. The three main sections of the handbook are:

1) Technology descriptions – plain language descriptions of each TEMA component and their functionalities.
2) A learning manual – a step-by-step guide on how to use each TEMA component that has been implemented within the SmartDesk.
3) Learning tasks – several exercises to complete using the SmartDesk, which ensures that participants train with all TEMA functionalities.

Table 4. Training agenda

Duration	Activity
30min	Introduction to the TEMA system, distribution of learning documentation, installation of SmartDesk application.
2 hours	Hands-on training, provision of support in learning.
1 hour	Completion of training activities, collection of feedback for further development.

The training will use a sandbox version of the Smartdesk that contains sample data with relevant disaster scenarios.

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5. Trial Planning

5.1. Responsibilities

This section should identify key persons responsible for different aspects of the preparation process and the conduct of the Trial. Typical functions are identified in the table.

5.1.1. Trial committee

Table 5. Trial committee

Role	Name	Scope of responsibility
Trial Owner	BRK	
Technical coordinator (Solutions) Solution Coordinator		
User coordinator (Platform)		
Technical coordinator (Test-bed) Testbed Infrastructure support		

5.1.2. Trial organizer support

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Function	Name	Scope of responsibility
Main organizer (Trial Owner)	BRK	
Event coordinator	Margareta Mihalic Dogan	
End users coordinator	Uwe Kippnich	
Scenario coordinator	Uwe Kippnich	
Technical Coordinator (Local platform)		
Training coordinator	Filip Sever	Prepares learning material and training tasks. Participates online during the independent learning session to provide support.
Logistic coordinator		
Trial supervisor (Director)		
Safety officer		
Evaluation coordinator	Michaela Selzer	
Review leader		
Media Officer		
External Cooperation Manager (ECM)		

Support group	Name/Company and contact details	Scope of responsibility
Security team		
Medical team		
Catering crew		

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Cleaning crew		
PR team		
VIP host		

5.1.3. Trial participants

Table 6. Trial participants

Participating group	Confirmation of participation[1]	Number of anticipated participants	Comments (e.g. limitations - conditions of availability)

5.2. Command structure during Trial

[1] Status: initially informed / invited / confirmed / to be confirmed later (date) / conditional availability (explain) / other (with suggested action)

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5.3. Timeline of Preparatory Activities

Table 7. Timeline of preparatory process

DATES	ACTIVITIES
Stage A	

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DATES	ACTIVITIES
Stage D – Recapitulation stage	

5.4. Risk analysis and contingency planning

Risk 1: Overlaps in pilot trail schedules
Contingency planning: It was agreed among the partners that there should be a minimum gap of two weeks between individual pilot trials. This allows partners who need to be physically present to plan their travel more reasonably and ensures there is sufficient time to transport equipment between locations. A table outlining the schedule for all pilot trials has been created, maintaining

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at least a two-week interval between each and avoiding months when most partners are typically on vacation.
Identified: 16.05.2024

Risk 2: Overlap in the schedule for fire use case, hybrid pilot trials
Contingency planning: Both KAHY and RAS identified June as the month for conducting prescribed burning to generate new data for the hybrid pilot trials. However, this posed a risk of scheduling overlap, which could create significant challenges for technical partners who need to be physically present at both trials and whose equipment must be transported to the trial locations. To avoid these conflicts, it was agreed that the RAS fire use-case hybrid pilot trial will take place in June 2025, and the KAHY trial in June 2026.
Identified: 16.05.2024

Risk 3: Available bandwidth not sufficient to conduct the pilot trial
Contingency planning: Trial owners were tasked with conducting bandwidth measurements at their respective pilot locations and submitting the results to the technical partners. These measurements will be evaluated to determine whether the available connection is sufficient to support the requirements of the hybrid pilot trials. If the bandwidth is found to be inadequate, additional technical support or alternative connectivity solutions will need to be discussed and arranged in coordination with the relevant partners.
Identified: 20.06.2025

Risk 4:
Contingency planning:
Identified: (date)

Risk 5:
Contingency planning:
Identified: (date)

6. Local Platform facilities

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7. Solutions Utilization and Assessment

The TEMA system will undergo evaluation through a structured pilot trial. The process will consist of several key stages to ensure comprehensive feedback from both end-users and observers.

1. **Scenario-Based Evaluation**
End-user evaluators will first engage with a predefined scenario using the TEMA system.

2. **Observers Feedback**

Throughout the scenario session, designated observers will be present to monitor interactions and record detailed notes. These observers will follow a predefined set of reflective questions (see Annex xy TEMA Observers Questions)) to guide their reporting and ensure consistent observation across sessions.

3. **Online Evaluation Questionnaire**
Immediately following the scenario session, evaluators will complete an online evaluation questionnaire hosted on the EU Survey platform. This questionnaire is standardized across all pilot trials to enable consistent data collection and comparison. For BRK Trial 1, the original English questionnaire will be professionally translated into German to minimize language barriers and encourage more thorough and insightful responses from participants.

4. **Guided Discussion Session**
Once the online questionnaires are submitted, a facilitated discussion will be held, involving both the evaluators and the end-user observers. This session will follow a set of pre-prepared discussion questions (see Annex xy TEMA Guided Discussion Questions) designed to elicit deeper qualitative insights and clarify any observations or questionnaire responses.

5. **Final Evaluation Report**
The comprehensive evaluation report will include an integrated analysis of all three evaluation components:

   - Observer reports

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- ○ Quantitative and qualitative analysis of the online evaluation questionnaire
- ○ Summary and key insights from the guided discussion session

This multi-layered evaluation approach is designed to provide a robust and holistic assessment of the TEMA system, ensuring that both quantitative metrics and qualitative insights inform the final outcomes.

8. Trial Scenario Building

8.1. Scope

Objective: The main goal of this pilot trial is to evaluate the performance, usability, and effectiveness of TEMA-System in supporting natural disaster management efforts. This includes its ability to improve response time and information sharing, increase the level of accuracy of situation reports, offer event development prediction, and reduce the manual workload during disaster events caused by flash flood.

The pilot will be performed as real as possible by using actual historical data from the actual geographical area of the ND, Ahrtal flood from 2021.

Scope:

- **Participants:** X number of the control room operators, commanders and first responders
- **Duration:** total duration of the pilot trial is 2 days, that includes preparatory activities (setting up the equipment, dry run 2, trail run, evaluation, social event and the auxiliary activities)
- **Measurements:** TEMA-System will be evaluated using real historical data (if data is missing it will be complemented by new data or augmented data)
- **Technologies from the TEMA tool box:** 15 components of the TEMA-System will be put to trial during BRK-Trial 1. Full list of technical components is available in chapter 4.7. Technical components in TEMA Solution, table XY of this document

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- **Functionalities:**

Selected functionalities that will be put to BRK Trial-1 are:

· Use different sources of information to form an overall image

· Use different sources of information to cross-verify the findings to increase the level of information accuracy

· Integrate big data analytics with social media analysis to provide a holistic view of the disaster

· Provide a layered visualization, allowing users to toggle between different data sources (e.g., satellite, drone, social media) and time periods to understand how the disaster is evolving

· Provide prediction of the disaster development (flood propagation, possible expectancy of the second wave)

· Provide analysis of geographic data, allowing for the prediction of the spread of disaster impacts (flooding progression), based on real-time environmental conditions

· Aggregate and analyze social media posts from people in the affected area to gain a granular understanding of the situation on the ground. (This can provide immediate insights into conditions that may not be visible through other data sources, such as blocked roads, areas without power, or locations with significant injury or damage.)

· Provide as quick as possible information about the affected area (even with low accuracy), after which provide more and more reliable information on the affected area

· Include confidence levels for the information presented, allowing users to weigh the accuracy and reliability of the data when making decisions

· Send automated alerts as new data comes in, updating users on changes in the situation.

· Integrate satellite and drone imagery with social media data to provide a comprehensive view of the disaster.

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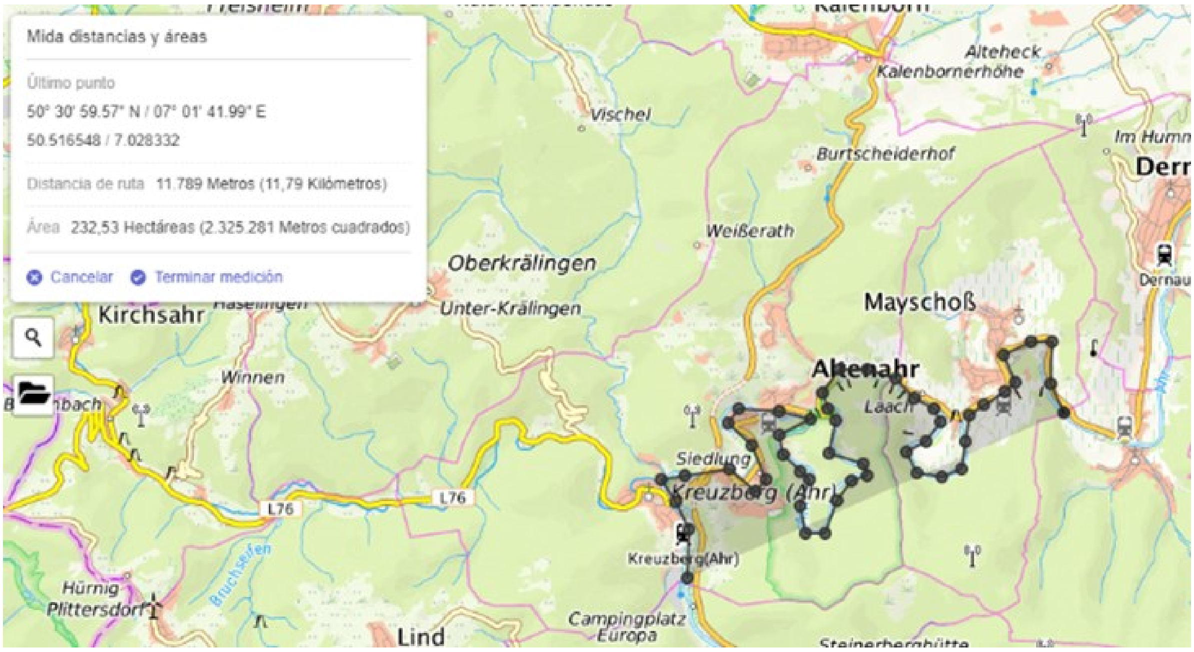
- **Trial Locations:**

The location of the historical trial that will serve as a **primary trial location** is in Germany, around the cities Altenburg, Altenahr und Mayschoß. The span of this area is around 12 km2. Historical event that is serving as use case is West Germay (Ahrtal) flood from 2021. This event is providing historical data for the pilot trial.

Figure xy: Map of primary location of BRK Trial-1



The secondary location of the pilot trial is the location of the control room. For trial purposes the control room will be built at XY (update needed).

- **Trial Duration:**

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The historical event that serves as an inspiration for the trail scenario build, and collection of data started approximately on 12/07/2021 (approximate time of the severe weather warnings), with flood that started on 14/07/2021 and response to natural disaster that spread over next several months. The historical data used was also collected during that time span.

For the BRK Trial-1 purpose, the historical timeframe selected is 12/07/2021-21/07/2021.

8.2. Story

[Initial situation and the whole storyline (plot) of the scenario.]

[How that scenario is being solved by practitioners now, including list of tools and systems that are used in interesting areas of response (e.g. COP tools that are currently being used).]

[How that scenario would be solved using the TEMA solutions.]

8.3. Trial Scenario Elements

8.4. Control of the Trial flow

9. Organization and Logistics

9.1. Dry Run 1

[Dry Run is meant to be a rehearsal before the Trial. The goal is to find potential issues and check processes for optimization.

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1st Dry Run is conducted to realistically check assumptions and arrangements for the Trial. Therefore, it should be conducted with an "as-realistic-as-feasible" approach. This means – organizer should try to act as he plans to during upcoming Trial, however re-does and time-brakes are allowed if productive.

It is advised to merge Dry Run with technical component test deployment and integration. However, that might also be held as a separate face to face meeting.]

9.1.1. Dry Run 1 review checklist

Review name	Responsible person (name, e-mail, mobile)
Distaff training on Trial realization conduced	
Data collection plan & evaluation plan reviewed in practice	
Scenario and injects reviewed in practice	
Training on solutions for Trial simulation team conducted	
Readiness review of solutions and technical integration conducted	
Local Testbed adaptation reviewed in practice	
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	
Number of external stakeholders and their role reviewed in practice	

9.1.2. Conclusion and Lessons Learned

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[The list of conclusions and most important notes extracted from the review sessions. This subchapter should be filled as a list of short points.

The broader list (with a complete explanation contacting: description (what happened), results (why it is important) and the lesson) may be provided in the documentation of Reviews as an Annex]

9.2. Dry Run 2

9.2.1. Dry Run 2 review checklist

Review name	Responsible person (name, e-mail, mobile)
Distaff training on Trial realization conduced	
Data collection plan & evaluation plan reviewed in practice	
Scenario and injects reviewed in practice	
Training on solutions for Trial simulation team conducted	
Readiness review of solutions and technical integration conducted	
Local Testbed adaptation reviewed in practice	
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	
Number of external stakeholders and their role reviewed in practice	

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9.2.2. Conclusion and Lessons Learned

[The list of conclusions and most important notes extracted from the review sessions. This subchapter should be filled as a list of short points.

The broader list (with a complete explanation contacting: description (what happened), results (why it is important) and the lesson) may be provided in the documentation of Reviews as an Annex]

9.3. Training Agenda

The training session will take place online, with individual session for each end-user partner. The training sessions will be organized approximately 2 weeks before each of the pilot trials.

Duration	Activity
30min	Introduction to the TEMA system, distribution of learning documentation, installation of SmartDesk application.
2 hours	Hands-on training, provision of support in learning.
1 hour	Completion of training activities, collection of feedback for further development.

9.4. Trial Actions and Timeline

Table 8. x-day schedule

Day, date	Activity	Location

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9.5. Communication plan

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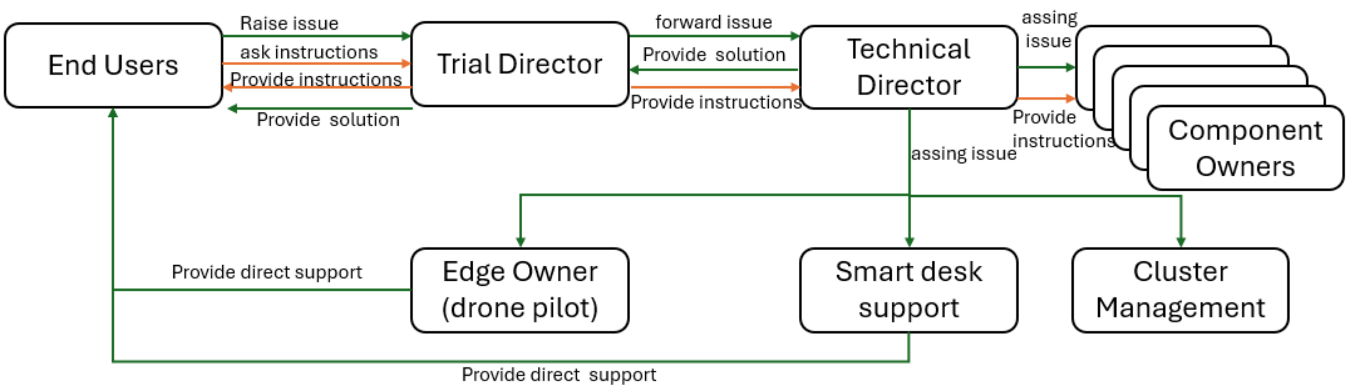

Trial execution instructions: these communication flows are those ones necessary to coordinate the execution of the trial. The Trial Director will distribute instructions to the End Users and the Technical Director

Issue management: these communication flows are those ones necessary to handle support requests from End Users. The requests will be made to the Trial Director who will pass them on to the Technical Director. The Technical Director will assign them to the Component Managers and return with the solution. In some cases (mainly for SmartDesk and Drones) the Component Managers will provide direct support.

9.6. Auxiliary activities

9.7. Assets for the Trial

10. Other Organizational Aspects

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10.1. Safety Plan

10.2. Technical Helpdesk

The integration team (ENG) coordinates component-specific support across the TEMA ecosystem, ensuring all technological elements remain operational and properly integrated, while managing technical team interventions.

The KAMK team delivers dedicated support for the Smartdesk, the primary operational interface for end-users, providing technical assistance and training to maximize utilization of its mapping, prediction, and visualization capabilities.

For the trial, both mentioned teams will ensure on-site presence alongside fire simulation specialists (TSYL) to provide comprehensive technical support.

10.3. Research Ethics and Informed Consent Forms

10.3.1. Identification and Recruitment of Pilot Participants

Participation in the TEMA Pilot Trials is strictly on a voluntary basis and involves no form of coercion or obligation. All individuals invited to participate are informed of their rights, including the right to decline participation or withdraw their consent at any point during the activity, without any adverse consequences.

In line with ethical standards and applicable legal requirements, no vulnerable individuals or minors will take part in the Pilot Trials. Participation is limited to competent adults (18 years and older), and no children or persons incapable of providing informed consent will be recruited or involved in the trials.

Recruitment of participants is carried out based on their relevance to the trial's objectives and may include individuals internal or external to the TEMA Consortium. These individuals may be selected due to their professional expertise, operational role, or affiliation with the entities involved in the design, evaluation, or operational validation of the TEMA technologies. Participants may include

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first responders, technology operators, or other relevant stakeholders with an interest in disaster response innovation.

All personal data processing associated with the identification, recruitment, and participation of individuals is conducted in strict compliance with the General Data Protection Regulation (GDPR). This includes ensuring that participants are fully informed—via the Information Sheet and Informed Consent Form—about the types of personal data collected, the purposes of processing, legal bases, data retention periods, data sharing practices, and their rights as data subjects.

The recruitment process is thus designed to ensure ethical integrity, legal compliance, and full transparency for all participants.

10.3.2. TEMA Informed Consent Procedures

In the context of the TEMA project's Pilot Trials, robust procedures have been established to ensure the informed consent of all participants, in line with ethical, legal, and data protection requirements.

Description and Analysis of the Information Sheet:

Participants are provided with a comprehensive Information Sheet that covers two distinct areas: (a) research participation and (b) the processing of personal data.

1. **Research Participation:**

    - The Information Sheet clearly outlines the objectives and scope of the TEMA project, which seeks to improve Natural Disaster Management (NDM) through the integration of real-time semantic 3D mapping and AI-enabled disaster prediction tools.
    - It explains the structure and purpose of the Pilot Trial, including participants' roles (e.g., operators, evaluators), the nature and duration of the trial, and the use of innovative technologies such as unmanned aerial vehicles (UAVs) and AI systems.
    - Participants are explicitly informed that their involvement is voluntary and that they may withdraw consent at any stage without any consequence.

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- The document highlights any potential health and safety risks, particularly related to UAV operations, and specifies that relevant safety protocols and regulatory compliance measures will be in place.

2. **Processing of Personal Data:**
   - The Information Sheet details the types of personal data to be collected and processed before, during, and after the Pilot Trial. These include names, identity/passport numbers, images and voice recordings, and signatures.
   - It specifies the **purposes of data processing**, including secure site access, trial execution, dissemination and communication activities, and GDPR compliance.
   - The **legal basis for processing** is clearly identified, primarily relying on the participants' consent (pursuant to Article 6(1)(a) GDPR), with specific exemptions relying on Article 6(1)(e) for certain access control measures.
   - Information regarding **data controllers, storage periods**, data sharing with the TEMA Consortium, and participants' **rights** under the GDPR (e.g., access, rectification, erasure, restriction, portability, objection, and complaint) is transparently provided.
   - It is explicitly stated that some visual and audio material may be disseminated via the project's website and social media platforms for communication purposes.

Consent Process and Timing

The **Information Sheet** and accompanying **Informed Consent Form** are provided to each participant in advance of the trial. Participants are given adequate time to carefully review the documents, raise any questions, and make an informed decision regarding their participation and the processing of their personal data. A representative of the Pilot Trial organiser is made available to respond to queries and provide clarifications.

Only participants who voluntarily sign the Informed Consent Form will be allowed to participate in the trial. Consent includes both participation in the research activities and agreement to the specified personal data processing operations.

Annexes

The full **Information Sheet** and **Informed Consent Form** may be appended to this document as annexes for reference and verification of compliance with ethical and data protection standards.

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10.4. Public Relations Plan

The aim of this public relations (PR) plan is to raise awareness and engagement around the pilot exercise by showcasing how innovative technology enhances natural disaster response. It seeks to inform key stakeholders about project results, attract media attention and position the TEMA project as a leader in crisis management innovation.

10.4.1. PR plan objectives

- Raise Awareness: Inform stakeholders and the public about the pilot exercise and its role in improving disaster response.
- Showcase Innovation: Highlight the cutting-edge technology being tested and its potential impact.
- Engage Key Stakeholders: Ensure participation and support from policymakers, emergency responders, researchers, and the public.
- Reinforce Project Credibility: Position TEMA as a leader in crisis management innovation under Horizon Europe.
- Generate Media Coverage: Secure coverage in relevant publications, news outlets, and online platforms.

10.4.2. Target Audiences

Primary Audiences

- Government agencies (European Union bodies and agencies, national and local disaster management authorities)
- Emergency responders (firefighters, paramedics, civil protection units)
- Technology providers and researchers
- Media (mainly local outlets and those focusing on science, tech, European Union policy, emergency response)

Secondary Audiences

- The general public (especially in the Bavarian region)
- NGOs and international organisations (local organisations, German Red Cross, United Nation agencies)

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10.4.3. Key messages

Key message 1: “Technology for Saving Lives”

- The advanced digital tools offered by TEMA are transforming disaster response.
- This pilot exercise demonstrates how cutting-edge technology can improve decision-making, reduce response times and ultimately save lives in crisis situations.

Key message 2: “EU Leadership in Crisis Management”

- As part of Horizon Europe, TEMA reflects the European Union’s commitment to enhancing disaster preparedness through research and innovation.
- By funding and supporting breakthrough technologies, the European Union strengthens its role as a global leader in climate resilience and emergency response solutions.

Key message 3: “Real-World Testing for Real-World Impact”

- To ensure that innovative tools can be effectively deployed in real crises, this pilot tests them under realistic emergency conditions using historical data.
- By simulating natural disasters using historical data, the exercise helps identify strengths, limitations and areas for improvement before full-scale adoption.

Key message 4: “Collaboration is Key”

- Effective disaster response requires a multi-stakeholder approach, bringing together emergency responders, scientists and technology providers.
- This pilot is an example of cross-sector and cross-country cooperation, ensuring that the solutions being developed are practical, scalable and aligned with real-world needs.

10.4.4. Key PR Activities and Timeline

Phase 1: Pre-pilot (Three months to one week before the pilot)

- Preparation of a folder with pictures and videos of BRK in action to be used in the promotional material of the pilot.
- Collection of a list of local and national media contacts.
- LC to prepare the first press release in English, which will be translated into German by BRK.
- Creation of the graphic templates that will be used on social media and other digital communication.
- Update and translation of the project powerpoint in German.

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Phase 2: Pilot execution (one week before till the completion of the pilot)

The week before the pilot:

- Circulation of the first press release in local and national media by BRK, alongside the project powerpoint.
- Announcement of the pilot on BRK and TEMA social media.
- BRK to offer interview opportunities for journalists.

During the pilot:

- Real-time updates on BRK and TEMA social media.
- Capture of high-quality visuals (photos and video) for post-event storytelling.
- BRK to offer interview opportunities for journalists.

Phase 3: Post-pilot (the weeks following the pilot)

- Circulation of the second press release, which will be written with the assistance of LC, in local and national media by BRK.
- Website and social media recap of the pilot, sharing videos, key takeaways and testimonials.
- Further sharing of the pilot results with key target audiences, such as policymakers and first responders, via the TEMA newsletter and TEMA's page in the Union Civil Protection Knowledge Network (UCPKN).

10.5. Authorization, Registration and Permits for Trial

10.5.1. Trial Authorization

10.5.2. Trial Registration

10.5.3. Permits for the Trial

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11. Annexes

Annex A - Informed Consent Forms

Annex B - Dissemination & Communication Audit Questionnaire

Annex xy TEMA Observers Questions

Annex xy TEMA Guided Discussion Questions

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End of Document

TEMA

TRUSTED
EXTREMELY PRECISE
MAPPING AND PREDICTION
FOR EMERGENCY
MANAGEMENT

Annex 4

Trial Action Plan (TAP)

D.MALIAN Trial-1

TEMA
TRUSTED
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FOR EMERGENCY
MANAGEMENT

Project Information

Project acronym:	TEMA
Project full title:	Trusted Extremely Precise Mapping and Prediction for Emergency Management
Call identifier:	HORIZON-CL4-2022-DATA-01
Type of action:	HORIZON Research and Innovation Actions
Start date:	1 December 2022
End date:	30 November 2026
Grant agreement no:	101093003

Trial Action Plan:	D.MALIAN Trial-1		
Executive Summary:			
WP:	**6**	**T6.3.**	
Author(s):	Aikaterini Kommata, Georgios Mourgias-Alexandris, Georgios Tsapourniotis, Nikolaos Skoumpris		
Editor:			
Leading Partner:	D.MALIAN		
Participating Partners:	BRK, LC, KEMEA, KAMK		
Version:		Status:	
Document Type:		Dissemination Level:	
Official Submission Date:		Actual Submission Date:	

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Disclaimer

The TEMA consortium consists of the following partners:

No.	Partner Organisation Name	Partner Organisation Short Name	Country
1	ARISTOTELIO PANEPISTIMIO THESSALONIKIS	AUTH	GR
2	DEUTSCHES ZENTRUM FUR LUFT – UND RAUMFAHRT EV	DLR	DE
3	ENGINEERING - INGEGNERIA INFORMATICA SPA	ENG	IT
4	ATOS IT SOLUTIONS AND SERVICES IBERIA SL	ATOS IT	ES
4.1	ATOS SPAIN SA	ATOS SP	ES
5	UNIVERSIDAD DE SEVILLA	USE	ES
6	TECNOSYLVA SL	TSYL	ES
7	NORTHDOCKS GMBH	ND	DE
8	PARIS-LODRON-UNIVERSITAT SALZBURG	PLUS	AT

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9	THE LISBON COUNCIL FOR ECONOMIC COMPETITIVENESS ASBL	LC	BE
10	LATITUDO 40 SRL	LAT40	IT
11	NELEN & SCHUURMANS TECHNOLOGY BV	NS	NL
12	FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV	FHHI	DE
13	UNIVERSITÀ DEGLI STUDI DI MESSINA	UNIME	IT
14	KAJAANIN AMMATTIKORKEAKOULU OY	KAMK	FI
16	KENTRO MELETON ASFALEIAS	KEMEA	GR
17	DIMOS MANTOUDIOU - LIMNIS - AGIAS ANNAS	D.MALIAN	GR
18	REGIONE AUTONOMA DELLA SARDEGNA*RAS	RAS	IT
19	BAYERISCHES ROTES KREUZ	BRK	DE
20	KAINUUN HYVINVOINTIALUE	KAHY	FI
21	INTERDISCIPLINARY TRANSFORMATION UNIVERSITY	I:TU	AU

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Document Revision History

Version	Description	Contributions
0.1	TEMA TAP Template	Margareta Mihalic Dogan
0.2	D.MALIAN Trial 1	Aikaterini Kommata

Authors

Author	Partner
Margareta Mihalic Dogan	BRK
Aikaterini Kommata	D.MALIAN

Reviewers

Name	Organisation

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List of Tables

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List of Terms and Abbreviations

Abbreviation	Description
TAP	Trial Action Plan
TEMA	Trusted extremely precise mapping and prediction for emergency management
TGM	Trial Guidance Methodology
D.MALIAN	Municipality Mantoudiou -Limnis-Agias Annas
NDM	Natural Disaster Management
GDPR	General Data Protection Regulation

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Executive Summary

The Trial Action Plan that is presented throughout the next chapters outlines the phases of the first pilot trial of D.MALIAN's participation in the TEMA project, as an end user partner. The project as a whole aims to evaluate the effectiveness of a platform that provides visualized information containing geomorphological data, weather data, drone images and social media posts, through various sources, that is available during a natural disaster event in a more effective way in terms of civilian safety improvement and mitigation of the negative impacts to the environment and the society. Furthermore the fusion of the information that varies in format and type and their presentation through a platform with an AI base, leads to a new era in the NDM protocols that the European countries engage when a natural disaster occurs. The high flood preparedness, effective response, and mitigation efforts within a targeted region or community, are improved within the augmented reality that TEMA platform transfers to the user. The TAP serves as a framework for testing the TEMA platform that focuses on integrated flood and other natural disasters management responses in real-world scenarios, aiming to reduce disaster risk and improve resilience.

1.1.1.1 Objective

To test the use of the TEMA platform through a real case scenario. The evaluation will be performed by specialized evaluators in the NDM field. Furthermore it is going to be evaluated as a coordinated response mechanism by the municipality that will combine the information fusion technology, early warning mechanisms, depiction of the upcoming situation during a natural disaster incident, first-responders collaboration, stakeholders engagement, and data-driven decision-making to effectively manage flood risks and impacts, coordinate the field teams and succeed in terms of life saving and negative impact mitigation.

1.1.1.2 Scope

The trial focuses on simulation exercises, deployment of real-time monitoring tools, geographical maps, water surface information maps, land use cover maps, weather forecasts, meteorological data and social media messages. It involves collaboration among local authorities, emergency services, stakeholders, first responders and community representatives.

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1.1.1.3 Key Components

- **Risk Assessment & Mapping:** Identification of flood-prone areas using historical data and geospatial analysis.
- **Early Warning Systems:** Deployment of drone images, meteorological data, geomorphological data and the position of critical infrastructure to provide timely alerts.
- **Response Protocols:** Testing the response mechanism, the preparedness of the first responders, the collaboration percentage between different authorities, the outcome of the evacuation plans and the protection of civilians.
- **Stakeholder Coordination:** Establishing roles and responsibilities across various authorities and evaluating the way that each one uses the information to organize its actions.
- **Data Collection & Evaluation:** Monitoring the performance of the tools that the platform provides and collecting feedback from the evaluators and the observers.

1.1.1.4 Expected Outcomes

- The use of state of the art AI technology improves the NDM mechanism.
- Improved risk assessment, coordination between first responders and improved civil protection plans.
- Actionable insights for scaling the flood response model to other regions.

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1 Introduction

In the next chapters it is presented in a detailed way the planning of the 1st historical trial of Mantoudi -Limni - Agia Anna municipality.

In the trial area there have been 2 significant flood incidents. The first occurred in late September of 2018. During that time two people lost their lives and two others were injured. Many public infrastructures such as schools, training areas, and football venues were flooded. Main roads were not accessible and people were trapped in their houses.

The same situation happened in late September 2023. Many of the areas that were flooded in 2018, flooded again. Apart from the infrastructure that was damaged, many corps were under water leading to a shortage in the food chain in the area. Drinkable water was not available for many days as the damage in the water supply system was major. In the trial area there was also a megafire during August 2021 that affected the land cover vegetation leading to more expressed flash floods.

The 1st historical trial uses the 2023 flood as a use case to study the TEMA platform. Through the chapters it is referred to the method used to define the gaps when facing natural disasters like fire, flood, and relative to the purpose of TEMA project and pilots, from the academic literature , the Grant Agreement and the Storytelling. It also presented the trial scenario in a detailed way and the technical components that will be used in the platform. The chapters also describe the communication plans to deliver in the best possible way the outcomes of the trial to the public and the scientific community, the data that will be implemented, the possible hazards during the trial and the plan to address them successively and the GDPR forms that were developed for the participants during the trial.

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2 Purpose and Scope

The purpose of the Trial Action Plan (TAP) is to provide the detailed plan of the Trial organization and to facilitate the monitoring of Trial preparation activities as well as an evaluation plan for the TEMA project.

The completion of the TAP chapters serves as an indicator of the Trial preparation progress.

2.1 Trial Stages

The Trial event stages, which reflect the stages of Trial preparation, include 5 steps:

1. Stage A – The initial stage, which ends with Workshop "0"
2. Stage B – The main preparation stage which ends with Dry Run 1.
3. Stage C – The maturation stage which ends with Dry Run 2.
4. Stage D – The final preparation stage which ends with the Trial itself.
5. Stage E – The recapitulation stage which ends with the Trial evaluation report.

The preparation stages and the activities undertaken during each stage are presented in the table below *(Table 1 in chapter 2.2.)*.

Stage A was started in WP2 T2.1. of the TEMA project. Results of the work done in T2.1. are in deliverable D2.1. Stages B to E will be covered by work in WP6, more specifically: stages B and C will be covered within T6.3 and Stages D and E within 6.4 and reported in respective deliverable D6.1. and D6.2.

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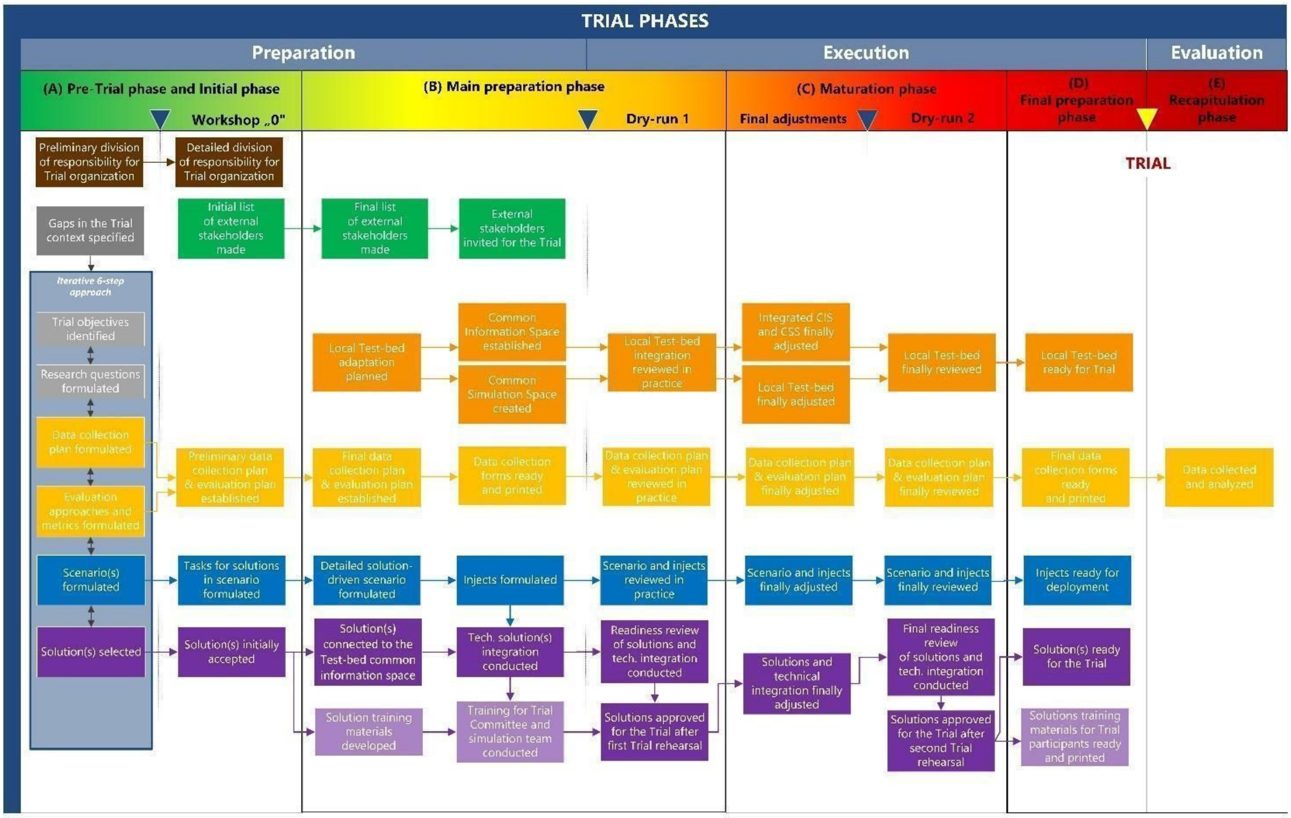

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2.2 TAP completing schedule

Table 1. TAP review schedule and monitoring

No	Deadline	Description	Contributor
1	29.05.2025	Chapter 1	D.MALIAN
2	29.05.2025	Chapter 2	D.MALIAN, BRK
3	29.05.2025	Chapter 3	D.MALIAN
4	29.05.2025	Chapter 4	D.MALIAN, BRK, KEMEA
5	29.05.2025	Chapter 5	D.MALIAN
6	29.05.2025	Chapter 6	D.MALIAN
7	29.05.2025	Chapter 7	BRK
8	29.05.2025	Chapter 8	D.MALIAN
9	29.05.2025	Chapter 9	D.MALIAN, KAMK
10	29.05.2025	Chapter 10	D.MALIAN, LC

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3 General Information on the Trial

Location (Test bed)	Operation room of D.MALIAN municipality	Mantoudi Evia Greece
Date	6-10 October 2025	Start and End dates of Trial, not preparatory activities.
Organizer	Municipality of Mantoudi -Limni- Agia Anna (D.MALIAN)	The authority responsible for the Trial organisation.
Trial type	Historical. It will be visualised the 2023 flood that occurred in multiple places within the area of D.MALIAN municipality, focused on the Mantoudi residential area	It should also describe the scale and type of the planned Trial: e.g. workshop, field, command post, table-top, map study (sand table), simulator based VR, etc. If Trial combines characteristics of multiple types, please describe it further.

3.1 Trial Purpose and Goals

As the climate changes lead to extreme weather conditions, that many times is expressed as flash floods, the need for the use of innovative technologies to assist the NDM practices, becomes mandatory. TEMA system offers a state of the art technology, AI based, that combines different types of information such as weather conditions, geomorphological characteristics, social media context, population density, etc, to assist the decision making process, which is the most crucial stage when a natural disaster is in progress.

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In Greece generally the challenges that authorities face when a natural disaster occurs rapidly, is the capability to address the negative impacts of it that may cost human lives. The fast response, the amount and objectivity of the information on the event and the synchronization of means to address the hazard is the main concern of the municipality's department of civil protection.

The main goal of the D.Malian's 1st historical trial is to assess the objectivity, quality and speed of the information provided through TEMA platform on the areas where the flood that occurred in the area of interest put at real risk the population. The specific objectives that will be tested are summarized shortly:

(a) The speed (or time frame) at which the rise of the flow of the main rivers occurs.

(b) The proximity of infrastructure such as the hospital, fire departments, schools, police station, public services to the most prone to immediate flooding areas.

(c) Points between the main roads that connect the municipality's cities and villages prone to unexpected flooding.

(d) The visualisation of the place where rescue teams are involved in the event in real time.

(e) The evaluation of the real hazard to human lives during the event in accordance with the social media data that are sent from the area that is affected.

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3.2 Outline of the Trial Scenario

The 1st Historical Trial will demonstrate the flood that occurred in September 2023 in the municipality of Mantoudi - Limni - Agia Anna, during the “Daniel" and “Elias” storms.

The affected area has been defined within a distance of 15 Km around the epicenter of the flood which is Mantoudi. For the trial the area will be limited within a distance of 2km away from the epicenter and an area of 4 km^2 totally.

The scenario:

There was an alarm on the 27th of September 2023, in the Ministry of Civil Protection, because of a weather forecast that predicted high levels of rainfall in the area of municipality Malian, during the “Elias” storm. The Ministry of civil protection gathers the public authorities involved in the protection of civilians, to inform them on the upcoming event and define the roles that each one

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will have during the storm. The authorities are the Region of Central Greece, the Euboea Fire Department, The Mantoudi Police Station and the Municipality of Mantoudi - Limni - Agia Anna.

Early in the morning, heavy rainfall starts in Mantoudi, gradually intensifying throughout the day. Local authorities, anticipating potential flooding, activate the TEMA system for a trial demonstration. As rain continues and water levels rise, the trial aims to showcase how TEMA can fill critical gaps in emergency response, data integration, and communication.

The flood is caused as the biggest rivers that pass through residential areas, “Kireas” and “Nileas” exceed their level of capacity to contain water. As a result the drainage basins of them which contain residential and agriculture areas, as well as infrastructures like main roads, are covered with water, which level keeps rising.

During the 1st historical trial, the real data will be used in the TEMA system, that were obtained during previous flash floods, to demonstrate the situation that occurred during the 2023 flood in D.Malian.

4 4 Trial Guidance Methodology Application

4.1 Brief description of chosen gap assessment method

The identification of gaps when facing natural disasters like fire, flood, and relative to the purpose of TEMA project and pilots, should take into consideration the gaps from the **academic literature** as well as the gaps stemming from the **Grant Agreement** and the **Storytelling**.

In the TEMA project, gaps have been identified and assessed in the context of D2.1 as part of the storytelling procedure. There the vulnerabilities of the response mechanism as well as proposed solutions offered by TEMA technologies have been stressed out.

In general, there is also a distinction between qualitative and quantitative gaps in a natural disaster.

- A qualitative gap is for example the political profile of a disaster, or the availability and the time to deploy resources for the disaster. There is also the need for improved management and coherent coordination in order to provide an overview of the situation and act fast.

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- Quantitative gaps for floods or fires can be summarized to the lack of resources for the repression and interception of the natural disaster, the lack of sufficient quantities regarding shelter capacity, hospital modules, mobile units of equipment, lack of capacity for rescue and research, limited aerial fire-fighting capacity, as well as the lack of organization and preparedness of the resources that are engaged in the response mechanism, therefore a gap in the quantities of aerial and terrestrial resources deployed in the fight against the natural disaster.

Grant agreement:

- Information about the accessibility to settlements (roads, bridges, etc.) in an affected area which is crucial for the mission planning and FR (first respondents) reaction.
- Low visibility and health hazards due to smoke. Scarcity of accurate information regarding the wider area, leading to suboptimal response strategies.
- Accurate information is crucial in planning, prioritizing and managing response actions.
- Access to trustworthy information is crucial for FRs/PPDR (Public Protection and Disaster Relief) organizations.

Gaps from Storytelling:

D. Mallian (Flood): Weather data and data from sensors could be used to provide timelier (even half an hour earlier) and valid warning about the magnitude of the upcoming disaster. After the event it would be nice to use a mapping of the area before and after the flood to estimate the extent of the damage and provide an estimation of what is needed for the rehabilitation.

The detailed description of the gaps assessment method and results is to be found in TEMA Deliverable 2.1.

Link: https://drive.google.com/file/d/1OWm1eCl6tDl3jv6cnBDTWsAOnkdvkAWN/view

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4.2 Selected and Validated Gaps

The gaps were identified in Deliverable 2.1, through Grant Agreement, Storytelling and Literature Review. The selection for D.Malian's 1st historical trial, was made on the basis of the technology that is necessary to be integrated into NDM practises, in the scope of the improvement and completion of those practises, leading to effective and successful operations on the field, the mitigation of the negative impacts of a natural disaster and the relief of the civilians.

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Table XY: Selected gaps

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Gap description	Interdependencies with other gaps	Method of verification
1.Non-existent coordination management centers for natural disasters	Gap 3	The TEMA communication platform is used by first responders, including police, fire departments, and rescue teams, to maintain constant communication. Through voice, text, and video channels, responders can share live updates and coordinate rescue efforts efficiently. The system's centralized dashboard dynamically adjusts as new data comes in, suggesting optimal routes and response strategies based on the evolving situation. Local authorities, anticipating potential flooding, activate the TEMA system for a trial demonstration. As rain continues and water levels rise, the trial aims to showcase how TEMA can fill critical gaps in emergency response, data integration, and communication.

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Gap description	Interdependencies with other gaps	Method of verification
2. The absence of comprehensive maps or data sources is an issue (e.g topographic maps, geologic maps, hydrological data, etc.)	Gap 4	Maps are demonstrated showing critical points within the boundaries of the endangered area where the first responders should be alert. The system as the phenomenon occurs provides immediate updates on road conditions, bridges, and potential evacuation routes. Meteorological data and hydrological characteristics of the rivers in the area supplement the system by transmitting data on rainfall, water levels, and other meteorological parameters. This real-time information is processed by the TEMA platform, which generates a comprehensive and up-to-date map of affected areas, identifying flooded zones, damaged infrastructure, and safe access routes

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Gap description	Interdependencies with other gaps	Method of verification
3. Access to trustworthy information is crucial for FRs/PPDR organizations	Gap 9	Local authorities utilize TEMA's integrated data sets, which include satellite imagery, social media reports, geographical information, and environmental data. The system's predictive analytics model forecasts flood propagation and potential hazards, enabling the prioritization of response actions. This allows for rapid decision-making on where to deploy resources and how to organize evacuations or provide assistance.

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Gap description	Interdependencies with other gaps	Method of verification
4. Lack of information on size the affected area / area of interest (epicenter)	Gap 10	TEMA's cross-referencing capabilities ensure that data from multiple sources is verified for accuracy, reducing the likelihood of misinformation. Responders receive confirmed updates, allowing for effective triage. The system identifies and prioritizes areas most in need of immediate rescue or medical assistance, directing efforts toward the most critical zones based on severity and resource needs.
5. Lack of detailed information of the needs and objectives of the mission	Gap 12	Using TEMA's broadcast system, timely alerts are sent to citizens via SMS, social media, and other communication channels. These messages provide real-time guidance on safe evacuation routes, shelter locations, and important safety information. A public-facing dashboard offers a transparent view of the flood's progression and the status of emergency services.

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Gap description	Interdependencies with other gaps	Method of verification
6. Lack of comprehensive picture of the situation	Gap 13	TEMA monitors environmental hazards such as contaminated water, downed power lines, or damaged infrastructure, issuing alerts to both responders and the public. This real-time health and safety monitoring minimizes risks to responders and citizens alike, ensuring informed and safe operations throughout the flood event.

4.3 Trial Specific Objectives

Centralized Communication and Coordination: First responders from various public authorities and/or volunteer organizations, use the TEMA platform and the information provided by its use to participate in an integrated plan of addressing natural disasters.

R**eal-Time Infrastructure and Access Monitoring:** The knowledge of the evolving situation during a natural disaster helps to better organize the efforts made from the first responders and focus on the most hazardous incidents.

Comprehensive Data Integration for Decision Making: Innovative technology will combine various information on the affected area, covering a diversity of aspects, delivering the outcome of their combination as an integrated visualized tool for decision making, which will be aligned to the real needs of the mission.

Accurate Information Verification and Triage Support: The rescue teams that are involved in dangerous incidents, prioritize their efforts, based on a system that provides accurate, up to date information. That way their intervention is more effective, faster and successful in terms of NDM planning.

Public Communication and Safety Alerts: Public authorities involved in the management of natural disasters and have the responsibility of managing the negative impacts of them, learn to interact with a system that provides real - time alerts and information on the upcoming situation.

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That way they can better organize their plan to address the potential hazards during an event, having informed the population in their area of possible dangerous situations.

Environmental Hazard and Health Monitoring: The TEMA system provides information on potential hazardous factors that the first responders may not have predicted, in order to protect the field teams and the people from dangerous situations.

In general: The trial evaluates how the TEMA system's real-time updates, integrated data view, and streamlined communication improve situational awareness, coordination, and response efficiency. Feedback from responders and authorities will refine the platform's capabilities, focusing on enhancing the accuracy of information, response speed, and the integration of multiple data sources for future disaster scenarios.

This trial aims to demonstrate the TEMA system's ability to support Mantoudi's emergency response efforts, providing a blueprint for enhancing disaster management through real-time data, predictive analytics, and coordinated communication.

4.4 Research questions

Based on the objectives (defined in DOA) research questions are focused on understanding the end-user experience and the perceived value of the TEMA system for disaster response, especially in comparison to their current tools and methods:

Usability and User-Friendliness: How do end-users perceive the usability and user-friendliness of the TEMA system compared to their current tools? This includes the ease of understanding information and labels, the intuitiveness of the tools, and the ease of customization.

Information Quality and Trustworthiness: How do end-users rate the clarity, detail, accuracy, and reliability of the information provided by the TEMA system in comparison to their current systems?

Efficiency and Speed: Does the TEMA system improve the efficiency and speed of disaster response tasks, such as accessing comprehensive maps, receiving updated information, gathering data, and displaying information?

Automation and Workload: How does the level of automation in the TEMA system compare to the end-users' current systems, and does it reduce the amount of manual work required?

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Situational Awareness: How does the TEMA system affect end-users' ability to establish situational awareness during a disaster, including the ability to work with different map views and combine intel from multiple sources?

Decision-Making Support: How does the TEMA system support and enhance decision-making during disaster response compared to current tools, including the speed and effectiveness of decisions?

Perceived Benefits and Limitations: What are the main perceived benefits and limitations of the TEMA system compared to current systems for Natural Disaster Management (NDM) from the end-users' perspective? What specific aspects of the TEMA platform are considered most beneficial?

Areas for Improvement: What improvements or additional functions do end-users suggest for the TEMA system?

These research questions are the basis for the evaluation questions.

4.5 Data collection method and outline

During the TEMA project various technologies and components were developed and have been integrated in the platform that is going to be evaluated. The visualization of the prone to flood areas, the proximity of these areas to public infrastructure and dense populated areas and the quantification and qualification of the danger that the municipality is prone to, during a natural disaster like flood is going to be evaluated. The 1st historical trial will evaluate the AI platform by the implementation of the information gathered during the 2023 flood incident in the pilot area. For that purpose various data were gathered from D.MALIAN to be used in the platform:

1. Photos from the flooded area. Main sources:
    a. Personal photos from civilians
    b. Photos from media news
2. Drone images
3. Videos: The main source were the youtube platform and some videos that were given to D.MALIAN from personal devices
4. Social media messages that pointed out the ongoing situation during the disaster. The main sources that the messages were collected from were:
    a. Facebook
    b. X platform

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For the completion of the digital twin the DTM was obtained from the Greek authority “ELLINIKO KTIMATOLOGIO”.

To implement the data analysis in the specific area, various information about the geomorphological characteristics of it were obtained, in GIS format:

1. Corine land cover shapefile
2. Hydrological network shapefile
3. The geographical area of towns and villages shapefile
4. The main roads shapefile

All the available weather data were also gathered from three meteorological stations that are in the specific area.

The available data considering the disasters that occured in the area and were depicted in the Copernicus system, were also obtained.

Given the fact that the TEMA platform's main characteristic is big data analytics, major efforts have been made to collect as much data as possible.

[In this step for each of the research questions that has been formulated in step 2, is determined by which key performance indicators the requested impact can be measured. A data collection plan has to be developed that describes in which way all required kinds of data will be collected (measured), by whom or by which means, during the Trial. This should be done in a clear and consistent way to avoid unambiguousness and to get data of good quality. This plan should enable answering the research questions.

Detailed Solution Dimension KPI selection is further explained in chapter 5.2.]

4.6 Initial Scenario

Timestamp	Narrative	Activity	Functions used
08.40	There is an alert from the Ministry of Civil Protection in Athens that “Elias” storm will hit Euboea island where the municipality MALIAN is expected to have heavy rainfall. A weather forecast predicting that the area of municipality Mantoudi -	The Ministry of Civil Protection gives specific commands and that all the local first responders authorities gather to assess the upcoming situation and act accordingly.	In the control center of municipality MALIAN where the TEMA system is set up, the personnel responsible for the maintenance of the

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	Limni -Agia Anna will experience extreme weather conditions sets an alarm in the Civil Protection Department of D.MALIAN		system controls the internet connection and power supply, as everything needs to be ready when the storm hits the municipality. The weather forecast sets the TEMA system on alert.
09.00	Heavy rainfall starts to hit the area with the epicenter being the Mantoudi town while strong wind increases and soon the level of water in the main river “Kireas” is rising.	The representative of each of the authorities that is present in the municipality sets the TEMA system, and . The update on the evaluates the first information given. The Ministry of Civil Protection gives the command that every first responder authority should assess the information that TEMA system will provide and give directions to the team on field. The information that TEMA provides are: • The level of the water in the river • The areas that are prone in flooding within the next 20 minutes • The population that will be affected firstly	• Geovisual analytics • 3D maps • Decision support

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		• The infrastructure that maybe infected, such as hospital and schools • Possibility that main roads are flooded	
09:15	15 minutes later the impacts of the continuous heavy rainfall starts to be visible. Some houses are already flooded, specific roads are on the critical point of maintaining the movement of vehicles, the water level on the main river has risen significantly. People share their thoughts and fears for the ongoing situation through social media platforms. The first photo of the disaster made an appearance on social media platforms.	The chief of police, chief of the fire department and the civil protection department, contact their teams on the field to receive information of the situation and assess the information given by TEMA in accordance to the real event. The teams ask their leaders to give them directions on the areas that should be evacuated, roads that no longer are accessible, public buildings that should be on alert and areas close to the main river or the drainage basin of it, that starts to flood.	• Geovisual analytics • 3D maps • Decision support • Images from drones • Detection of people/vehicles at need • Information fusion with the integration of social media reports

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09.35	As the natural disaster is progressing the authorities need confirmation from their teams that the critical areas have been evacuated and others are on alert. They also want to know whether the main roads that lead outside the areas at risk are safe and if civilians are trapped. They also need a weather update to organize the measures that need to be taken in order to protect the population.	TEMA system integrates multiple information such as weather conditions, social media texts, tools that focus on specific areas, etc. The purpose of the visualization is to gather information of the main roads that are not accessible and the expansion of the flood that may threaten the schools and the hospital.	• Geovisual analytics • 3D maps • Decision support • Images from drones • Detection of people/vehicles at need • Information fusion with the integration of social media reports • Annotation tools
10:00	As the phenomenon is at its most critical point, the authorities take advantage of the information that TEMA system provides to assess the current situation and the percentage of adaptivity of their actions to the real needs to be addressed.	As the initially recognized areas that were at risk are secured and evacuated, the system's operator focuses on other areas, using annotation tools to assess the situation, as the flooded areas are more now. It needs to be defined whether the phenomenon as it keeps evolving will affect other areas as well and how. In that case new strategic plans have to be implemented. Drone images,	• Geovisual analytics • 3D maps • Decision support • Images from drones • Detection of people/vehicles at need

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		social media texts, tools that TEMA provides, need to be fused. The main concern is to assess the level of water that is rising in the river and how this will affect nearby houses and if people are trapped in their cars somewhere in the affected area.	• Information fusion with the integration of social media reports • Annotation tools
10.50	As the phenomenon starts to decrease in the severity of the rainfall and wind speed, the authorities supervise the actions of their teams on the field and the outcome of their actions. They take feedback on their plans that were implemented during the disaster and how they succeed in addressing the negative impacts of the phenomenon.	TEMA system integrates all the available information to define whether all the areas in danger were secured/evacuated, the roads are safe, the water lever rose as it was calculated and covered specific areas and if people are safe.	• Geovisual analytics • 3D maps • Decision support • Images from drones • Detection of people/vehicles at need • Information fusion with the integration of social media reports • Annotation tools

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4.7 Technical components in TEMA Solution

Technology / TEMA components
TFA-tech-02 (FHHI) Human-comprehensible presentation of concept-based explanations
TFA-tech-05 (AUTH) Fire/smoke/person detection
TFA-tech-06 (AUTH) Fire/flood/background segmentation
TFA-tech-07 (ATOS) Person re-identification
TFA-tech-08 (DLR-DFD) Satellite-based flood detection and assessment
TFA-tech-11 (PLUS) Geo-social media analysis
TFA-tech-13 (ATOS) Contrastive image-language models
TFA-tech-15 (ATOS) Data scarcity, synthetic data generation pipeline
PDM-tech-02 (NS) 3Di Hydrodynamic simulation
PDM-tech-05 (USE) Information fusion
SV-tech-02 (ENG) Digital Enabler
SV-tech-03 (ND) 3D computer vision (SfM)/ Photogrammetry

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SV-tech-04 (LAT40) Geovisual Analytics
SV-tech-06 (ND) Extended Reality-based interactive visualisation system
SV-tech-07 (KAMK) Smartdesk Application

4.8 Training plan on TEMA Solution

The training plan on the TEMA solution consists of a minimum of two hands-on sessions organized by technical partners and delivered to end users. Hands on training encompasses a dedicated time slot where end users learn how to use the TEMA solution. The technical partners prepare the learning materials and organize the time slots.

The first round of training is delivered to all end users simultaneously in person to ensure that the end users can receive in person support and guidance, the technologies can be thoroughly demonstrated, and the end users learn.

To support the training process, three documents are prepared and shared with the end users:

1) Technology descriptions – plain language descriptions of each TEMA component and their functionalities
2) A learning manual – a step-by-step guide on how to use each TEMA technology that has been implemented within the SmartDesk.
3) Learning tasks – several exercises to complete using the SmartDesk, which ensures that participants train with all TEMA functionalities.

In addition to the documentation, a sandbox version of the SmartDesk is created specifically for training. The purpose of the Sandbox version is to ensure that each technical component includes sample data for learning and testing of the features. This ensures that prior to the pilot exercises and field use of the TEMA solution, the end users are able to navigate the SmartDesk and fully utilize the TEMA functionalities.

The training documentation will be updated in the future to ensure that all the developed features and functionalities are explained and practiced.

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5 Trial Planning

This section provides information on the number of people that will take part at the trial and the specific role and responsibility that each one will have.

5.1 Responsibilities

This section should identify key persons responsible for different aspects of the preparation process and the conduct of the Trial. Typical functions are identified in the table.

5.1.1 Trial committee

Table 2. Trial committee

Role	Name	Scope of responsibility
Trial Owner	Municipality of Mantoudi - Limni - Agia Anna Aikaterini Kommata - George Mourgias Alexandris	Responsible for the TAP writing, organizing and completing all the stages of the 1st Historical Trial
Technical coordinator (Solutions) Solution Coordinator	Antonio Filograna	The main contact person is overseeing the technical preparation and performance of the TEMA solution during pilot testing.

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Role	Name	Scope of responsibility
User coordinator (Platform)	Aikaterini Kommata George Mourgias Alexandris	Organize the trial, responsible for everything concerning the preparation of the venue, the evaluators presence, addressing possible dysfunctionalities during the trial.
Technical coordinator (Test-bed) Testbed Infrastructure support	Francesco Arigliano	Oversees the individual components in the pilot trial and provides technical support if needed.

5.1.2 Trial organizer support

Function	Name	Scope of responsibility
Main organizer (Trial Owner)	Aikaterini Kommata George Mourgias Alexandris	Responsible for the Greek pilot trial
Event coordinator	Aikaterini Kommata George Mourgias Alexandris	Organize the various details of the pilot trial
End users coordinator	Aikaterini Kommata George Mourgias Alexandris	Coordinates the participation of the evaluators, the members of the TEMA consortium that will attend the trial and the external stakeholders
Scenario coordinator	Aikaterini Kommata George Mourgias Alexandris	Organize all the details that the scenario will contain in order to lead to satisfactory results
Technical Coordinator (Local platform)	Francesco Arigliano	Oversees the individual components in the pilot trial and provides technical support if needed.

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Function	Name	Scope of responsibility
Training coordinator	Filip Sever	Prepares learning material and training tasks. Participates online during the independent learning session to provide support.
Logistic coordinator	Aikaterini Kommata	Organize the technical tools that will be used during the trial, the control room and the catering
Trial supervisor (Director)	Aikaterini Kommata George Mourgias Alexandris	Responsible for the successful outcome of the pilot trial, addressing any possible obstacle during the trial.
Safety officer	Nikos Skoumpris	Responsible for the safety of the venue place
Evaluation coordinator	George Mourgias Alexandris	Responsible for the detailed explanation of the questionnaire and the clarification of each answer that needs to be given by the participants
Review leader	Aikaterini Kommata	Responsible for the feedback
Media Officer	Nikos Skoumpris	Responsible for organizing the press release of the trial outcome

Support group	Name/Company and contact details	Scope of responsibility
Security team	Security employes at the main building of Municipality of Mantoudi - Limni - Agia Anna	Secure the safety of the control room where all the participants during the trial will attend, that is at the main building.
Medical team	Doctor at the regional hospital	Provides medical support
Catering crew	Bouras K.	Provides catering services

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Cleaning crew	Employes at the main building of Municipality of Mantoudi -Limni - Agia Anna that are responsible for cleaning	Clean the venue
PR team	Nikos Skoumpris, Head of the civil protection department at Municipality D.MALIAN	Responsible for providing information on TEMA project and pilot trial to the press
VIP host	Nikos Skoumpris, legal representative of Municipality Mantoudi - Limni - Agia Anna	Responsible for the evaluators and all the members of TEMA consortium that will attend the 1st Greek pilot trial.

5.1.3 Trial participants

Table 3. Trial participants

Participating group	Confirmation of participation[1]	Number of anticipated participants	Comments (e.g. limitations - conditions of availability)
D.MALIAN		8	

[1] Status: initially informed / invited / confirmed / to be confirmed later (date) / conditional availability (explain) / other (with suggested action)

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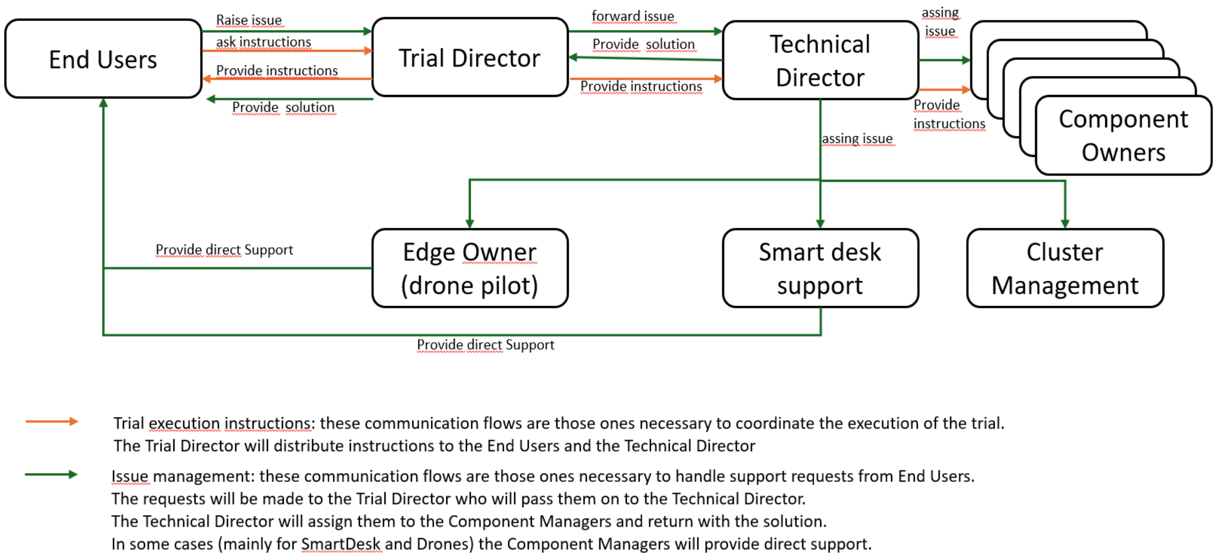
KEMEA		2-3	
AUTH		2-3	
D.MALIAN		3	Observers group

5.2 Command structure during Trial



5.3 Timeline of Preparatory Activities

Table 4. Timeline of preparatory process

DATES	ACTIVITIES
15.04.2025	Defining where the pilot will take place

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DATES	ACTIVITIES
02.05.2025	Confirm the technical means that will be needed
02.05.2025	Agree on the number and identities of the persons that will participate as evaluators
15.05.2025	Arrange the catering details
28.05.2025	Defining TAP details
02.06.2025	Schedule meetings with LC in order to define the pilot's publicity strategic

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DATES	ACTIVITIES

5.4 Risk analysis and contingency planning

Risk 1: Overlaps in pilot trail schedules
Contingency planning: It was agreed among the partners that there should be a minimum gap of two weeks between individual pilot trials. This allows partners who need to be physically present to plan their travel more reasonably and ensures there is sufficient time to transport equipment between locations. A table outlining the schedule for all pilot trials has been created, maintaining at least a two-week interval between each and avoiding months when most partners are typically on vacation.
Identified: 16.05.2024

Risk 2: Overlap in the schedule for fire use case, hybrid pilot trials
Contingency planning: Both KAHY and RAS identified June as the month for conducting prescribed burning to generate new data for the hybrid pilot trials. However, this posed a risk of scheduling overlap, which could create significant challenges for technical partners who need to be physically present at both trials and whose equipment must be transported to the trial locations. To avoid these conflicts, it was agreed that the RAS fire use-case hybrid pilot trial will take place in June 2025, and the KAHY trial in June 2026.
Identified: 16.05.2024

Risk 3: Available bandwidth not sufficient to conduct the pilot trial
Contingency planning: Trial owners were tasked with conducting bandwidth measurements at their respective pilot locations and submitting the results to the technical partners. These measurements will be evaluated to determine whether the available connection is sufficient to support the requirements of the hybrid pilot trials. If the bandwidth is found to be inadequate, additional technical support or alternative connectivity solutions will need to be discussed and arranged in coordination with the relevant partners.

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Identified: 20.06.2025

Risk 4: Medical emergency.
Contingency planning: Have staff in place to provide first aid. Emergency services are called if required.
Identified: 22.4.2025.

Risk 5: Fire outbreak.
Contingency planning: Begin first aid extinguishing and call emergency services.
Identified: 22.4.2025

Risk 6: Loss of electricity.
Contingency planning: Use backup generators.
Identified: 22.4.2025.

Risk 7: Interference by citizens and local activities in the pilot area.
Contingency planning: The historical trial will be organized inside the municipality's main building where there is a security service.
Identified: 01.6.2025.

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6 Local Platform facilities

The venue where the trial will take place is part of the Municipal building at Mantoudi. This is where the administrative functions of the local government are carried out. The control room that will be used during the trial is part of the municipality's operations and management systems, serving as a center for monitoring, decision making and emergency coordination. It has the capacity to host around 60 people. Its features are summarized next:

- High speed wireless connectivity to the internet
- Communication system including microphones on the desks
- Round connected desks
- Emergency exit
- Chairs and desks for the external observers
- Laptops for each of the evaluators
- Big screen that will be brought by KEMEA

7 Solutions Utilization and Assessment

The TEMA system will undergo evaluation through a structured pilot trial. The process will consist of several key stages to ensure comprehensive feedback from both end-users and observers.

1. **Scenario-Based Evaluation**

End-user evaluators will first engage with a predefined scenario using the TEMA system.

2. **Observers Feedback**

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Throughout the scenario session, designated observers will be present to monitor interactions and record detailed notes. These observers will follow a predefined set of reflective questions (see Annex xy TEMA Observers Questions) to guide their reporting and ensure consistent observation across sessions.

3. **Online Evaluation Questionnaire**

Immediately following the scenario session, evaluators will complete an online evaluation questionnaire hosted on the EU Survey platform (https://ec.europa.eu/eusurvey/runner/5d722fef-c3fc-3f85-ae81-b3998b8d7c63). This questionnaire is standardized across all pilot trials to enable consistent data collection and comparison.

4. **Guided Discussion Session**

Once the online questionnaires are submitted, a facilitated discussion will be held, involving both the evaluators and the end-user observers. This session will follow a set of pre-prepared discussion questions (*see Annex xy TEMA Guided Discussion Questions)* designed to elicit deeper qualitative insights and clarify any observations or questionnaire responses.

5. **Final Evaluation Report**

The comprehensive evaluation report will include an integrated analysis of all three evaluation components:

- Observer reports
- Quantitative and qualitative analysis of the online evaluation questionnaire
- Summary and key insights from the guided discussion session

This multi-layered evaluation approach is designed to provide a robust and holistic assessment of the TEMA system, ensuring that both quantitative metrics and qualitative insights inform the final outcomes.

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8 Trial Scenario Building

The following chapter presents the documentation and construction of the scenario concerning D.MALIAN's Trial-1 in the context of the TEMA project. After considering carefully the identified gaps in current emergency management practices, the technical capabilities of the TEMA platform, and the objectives set out for the trial this scenario has been designed in order to ensure a realistic and accurate test of the TEMA platform.

8.1 Scope

The chosen scope for the trial scenario is inspired by actual events that have affected the municipality of Mantoudi - Limni - Agia Anna (DMALIAN), focusing on the catastrophic flood of September 2023 during the "Elias" storm that has mainly affected the distincts of Thessaly and the North part of Euboea island. This focus enables the simulations of the complexities, uncertainties, and challenges associated with real disaster response, while leveraging historical data and observed community impacts.

A high level of realism will be achieved as the scenario utilizes authentic meteorological, hydrological, and geospatial data, as well as documented communications and field actions from the 2023 incident. By engaging actual first responders, local authorities, and stakeholders, the scenario environment mirrors operational conditions as closely as possible within a controlled exercise. The use of real maps, situational reports, and social media data contributes to a realistic environment, supporting credible and precise evaluation of the TEMA platform.

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8.2 Story

On the morning of 27 September 2023, local authorities suddenly received an official warning regarding severe rainfall in the DMALIAN region, issued by the Ministry of Civil Protection. With memories of the 2018 and 2021 disasters fresh in mind, the municipality moves quickly to activate the TEMA platform. All relevant agencies including fire department, police, municipal services, and regional authorities set up a meeting in the control room to coordinate and plan a proactive resonse.

Scenario Narrative:
As rainfall intensifies, river levels rise rapidly, threatening the city of Mantoudi, and critical road links including the road Prokopi-Mantoudi which is across the river. The TEMA platform is deployed, integrating multi-source data:

- Real-time meteorological feeds,
- Hydrological models and river level sensors,
- Geospatial mapping (including DTM and land use),
- Social media monitoring,
- Drone and satellite imagery.

Responders use TEMA to visualize at-risk zones, track the evolving situation, and share information instantly across agencies. Alerts are sent to the public via the 112 alert mechanism and social media, evacuation routes are visualized, and decisions are guided by predictive analytics though TEMA platform. The system's dashboards allow for rapid triage of priorities, directing field teams to areas of greatest need and adjusting tactics as new data flows in.

Current Practice vs. TEMA Approach:

Previously, such incidents relied on fragmented information channels—radio calls, manual mapping, and siloed data sources—often resulting in delays, missed information, and coordination gaps. The TEMA solution aims to bridge these gaps by providing a unified, real-time operational picture, supporting faster and more effective decision-making.

8.3 Trial Scenario Elements

Key elements of the scenario include:

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- **Dynamic Situation Evolution:** The scenario unfolds in real time, with simulated data injections reflecting worsening weather and cascading impacts (e.g., road blockages, rising floodwaters, etc).
- **Multi-Stakeholder Collaboration:** Coordination between fire, police, municipal civil protection, and external observers is central, testing both technological integration and human factors.
- **Information Fusion and Decision Support:** The trial emphasizes the TEMA platform's ability to combine dissimilar data sources, verify information, and support prioritization of resources.
- **Public Communication:** Realistic public alerting and communication challenges are integrated, including the dissemination of timely warnings and management of incoming citizen reports via social media.
- **Post-Action Feedback:** The scenario incorporates structured moments for observers to record notes, feedback from end-users, and automated system logging for later analysis.

8.4 Control of the Trial flow

The flow of the scenario is managed by a scenario coordinator in collaboration with the technical team, using a "white cell" approach to inject data and guide the progression of events. The following steps are implemented:

- **Pre-briefing:** All participants are briefed on roles, safety protocols, and scenario boundaries.

- **Inject Timeline:** Data and scenario injects (e.g., sudden infrastructure failure, new social media reports, or weather updates) are introduced at predefined intervals to simulate the unpredictable nature of disaster events.
- **Response Monitoring:** Actions taken by participants are logged, with observers noting both successes and points of confusion or delay.
- **Hot Wash / Immediate Feedback:** Upon conclusion, a debrief session is conducted to capture initial impressions, lessons learned, and suggested improvements.
- **Data Collection:** All interactions are captured for post-trial analysis, linking observed behaviors to TEMA system outputs and overall trial objectives.

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9 Organization and Logistics

9.1 Dry Run 1

The Dry Run 1 will be programmed 3 days before the trial. It will be the trial's first general rehearsal that will identify and resolve any technical, logistical or practical issues. During the dry run 1 all the trial's procedures will be tested, the instructions to the evaluators and the observers will be clarified, all the equipment needed will be tested for its usability, the internet connection will be tested and all the documents that will be fulfilled during the trial date will be reviewed and printed.

During Dry Run 1 the objectives are:

- To simulate the recruitment and consent of the all participants(evaluators and observers)
- To go through all the procedures that will be followed as soon as the trial starts
- To make sure that the participants have understood their role and value to the trial
- To test all the equipment that will be used and have a plan b if something isn't functionable
- To test the time schedule

9.1.1 Dry Run 1 review checklist

Review name	Responsible person (name, e-mail, mobile)
Distaff training on Trial realization conduced	
Data collection plan & evaluation plan reviewed in practice	
Scenario and injects reviewed in practice	
Training on solutions for Trial simulation team conducted	
Readiness review of solutions and technical integration conducted	

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Review name	Responsible person (name, e-mail, mobile)
Local Testbed adaptation reviewed in practice	
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	
Number of external stakeholders and their role reviewed in practice	

9.1.2 Conclusion and Lessons Learned

[The list of conclusions and most important notes extracted from the review sessions. This subchapter should be filled as a list of short points.

The broader list (with a complete explanation contacting: description (what happened), results (why it is important) and the lesson) may be provided in the documentation of Reviews as an Annex]

9.2 Dry Run 2

Dry Run 2 will take place 1 day before the trial in the same place where it will be held. It will be a final rehearsal before the trial. It will incorporate all the improvements that were decided after the dry run 1. It is expected that there will be no deviations from dry run 2 to the trial day. There will be a checkpoint where all the details have been identified and improved, so that everything is prepared properly. It will be used as a final step to validate readiness, to address any remaining issues and confirm that everything like technical equipment, communication systems, procedures and participants are all aligned.

9.2.1 Dry Run 2 review checklist

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Review name	Responsible person (name, e-mail, mobile)
Distaff training on Trial realization conduced	
Data collection plan & evaluation plan reviewed in practice	
Scenario and injects reviewed in practice	
Training on solutions for Trial simulation team conducted	
Readiness review of solutions and technical integration conducted	
Local Testbed adaptation reviewed in practice	
Solutions approved for the Trial after first Trial rehearsal (with GO/Conditional GO/NO-GO decision)	
Number of external stakeholders and their role reviewed in practice	

9.2.2 Conclusion and Lessons Learned

9.3 Training Agenda

The training session will take place online, with individual session for each end-user partner. The training sessions will be organized approximately 2 weeks before each of the pilot trials.

Duration	Activity
30min	Introduction to the TEMA system, distribution of learning documentation, installation of SmartDesk application.
2 hours	Hands-on training, provision of support in learning.
1 hour	Completion of training activities, collection of feedback for further development.

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9.4 Trial Actions and Timeline

Table 5. x-day schedule

Day, date	Activity	Location

9.5 Communication plan

The communication systems will be placed and set before the dry run 1 so to be tested. The participants (evaluators and observers) will all have a physical presence, so anything they need to ask or have help will be addressed face to face. For members of the consortium that will be participating online there will be an online meeting.

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9.6 Auxiliary activities

The auxiliary activities will be completed during dry run 1 and 2.

9.7 Assets for the Trial

The trial will take place at the municipality's main building, in the room that is used for general meetings. There will be laptops for all the evaluators and a big screen (some of the equipment will be brought by KEMEA). The communication system includes microphones and internet access.

10 Other Organizational Aspects

10.1 Safety Plan

Identification of possible hazards:

- Physical: There is no hazard as it is going to be a historical trial
- Operational: The trial coordinators will make sure that everything will be ready to work properly
- Environmental: There is not any environmental risk that will be taken

In case of an emergency situation will make sure that:

- There will be implemented the first aid protocol for health issues
- In case of fire or a natural disaster evacuation procedures are established and will be implemented
- Emergency contact numbers for key personnel and medical support will be available

10.2 Technical Helpdesk

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10.3 Research Ethics and Informed Consent Forms

10.3.1 Identification and Recruitment of Pilot Participants

Participation in the TEMA Pilot Trials is strictly on a voluntary basis and involves no form of coercion or obligation. All individuals invited to participate are informed of their rights, including the right to decline participation or withdraw their consent at any point during the activity, without any adverse consequences.

In line with ethical standards and applicable legal requirements, no vulnerable individuals or minors will take part in the Pilot Trials. Participation is limited to competent adults (18 years and older), and no children or persons incapable of providing informed consent will be recruited or involved in the trials.

Recruitment of participants is carried out based on their relevance to the trial's objectives and may include individuals internal or external to the TEMA Consortium. These individuals may be selected due to their professional expertise, operational role, or affiliation with the entities involved in the design, evaluation, or operational validation of the TEMA technologies. Participants may include first responders, technology operators, or other relevant stakeholders with an interest in disaster response innovation.

All personal data processing associated with the identification, recruitment, and participation of individuals is conducted in strict compliance with the General Data Protection Regulation (GDPR). This includes ensuring that participants are fully informed—via the Information Sheet and Informed Consent Form—about the types of personal data collected, the purposes of processing, legal bases, data retention periods, data sharing practices, and their rights as data subjects.

The recruitment process is thus designed to ensure ethical integrity, legal compliance, and full transparency for all participants.

10.3.2 TEMA Informed Consent Procedures

In the context of the TEMA project's Pilot Trials, robust procedures have been established to ensure the informed consent of all participants, in line with ethical, legal, and data protection requirements.

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10.3.2.1 Description and Analysis of the Information Sheet:

Participants are provided with a comprehensive Information Sheet that covers two distinct areas: (a) research participation and (b) the processing of personal data.

1. **Research Participation:**
    - The Information Sheet clearly outlines the objectives and scope of the TEMA project, which seeks to improve Natural Disaster Management (NDM) through the integration of real-time semantic 3D mapping and AI-enabled disaster prediction tools.
    - It explains the structure and purpose of the Pilot Trial, including participants' roles (e.g., operators, evaluators), the nature and duration of the trial, and the use of innovative technologies such as unmanned aerial vehicles (UAVs) and AI systems.
    - Participants are explicitly informed that their involvement is voluntary and that they may withdraw consent at any stage without any consequence.
    - The document highlights any potential health and safety risks, particularly related to UAV operations, and specifies that relevant safety protocols and regulatory compliance measures will be in place.

2. **Processing of Personal Data:**
    - The Information Sheet details the types of personal data to be collected and processed before, during, and after the Pilot Trial. These include names, identity/passport numbers, images and voice recordings, and signatures.
    - It specifies the **purposes of data processing**, including secure site access, trial execution, dissemination and communication activities, and GDPR compliance.
    - The **legal basis for processing** is clearly identified, primarily relying on the participants' consent (pursuant to Article 6(1)(a) GDPR), with specific exemptions relying on Article 6(1)(e) for certain access control measures.
    - Information regarding **data controllers, storage periods**, data sharing with the TEMA Consortium, and participants' **rights** under the GDPR (e.g., access, rectification, erasure, restriction, portability, objection, and complaint) is transparently provided.
    - It is explicitly stated that some visual and audio material may be disseminated via the project's website and social media platforms for communication purposes.

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10.3.2.2 Consent Process and Timing

The **Information Sheet** and accompanying **Informed Consent Form** are provided to each participant in advance of the trial. Participants are given adequate time to carefully review the documents, raise any questions, and make an informed decision regarding their participation and the processing of their personal data. A representative of the Pilot Trial organiser is made available to respond to queries and provide clarifications.

Only participants who voluntarily sign the Informed Consent Form will be allowed to participate in the trial. Consent includes both participation in the research activities and agreement to the specified personal data processing operations.

10.3.2.3 Annexes

The full **Information Sheet** and **Informed Consent Form** may be appended to this document as annexes for reference and verification of compliance with ethical and data protection standards.

10.4 Public Relations Plan

The aim of this public relations (PR) plan is to raise awareness and engagement around the pilot exercise by showcasing how innovative technology enhances natural disaster response. It seeks to inform key stakeholders about project results, attract media attention and position the TEMA project as a leader in crisis management innovation.

10.4.1 PR plan objectives

- Raise Awareness: Inform stakeholders and the public about the pilot exercise and its role in improving disaster response.
- Showcase Innovation: Highlight the cutting-edge technology being tested and its potential impact.
- Engage Key Stakeholders: Ensure participation and support from policymakers, emergency responders, researchers, and the public.

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- Reinforce Project Credibility: Position TEMA as a leader in crisis management innovation under Horizon Europe.
- Generate Media Coverage: Secure coverage in relevant publications, news outlets, and online platforms.

10.4.2 Target Audiences

Primary Audiences

- Government agencies (European Union bodies and agencies, national and local disaster management authorities)
- Emergency responders (firefighters, paramedics, civil protection units)
- Technology providers and researchers
- Media (mainly local outlets and those focusing on science, tech, European Union policy, emergency response)

Secondary Audiences

- The general public (especially in the Evoia region)
- NGOs and international organisations (local organisations, Greek Red Cross, United Nation agencies)

10.4.3 Key messages

Key message 1: "Technology for Saving Lives"

- The advanced digital tools offered by TEMA are transforming disaster response.
- This pilot exercise demonstrates how cutting-edge technology can improve decision-making, reduce response times and ultimately save lives in crisis situations.

Key message 2: "EU Leadership in Crisis Management"

- As part of Horizon Europe, TEMA reflects the European Union's commitment to enhancing disaster preparedness through research and innovation.
- By funding and supporting breakthrough technologies, the European Union strengthens its role as a global leader in climate resilience and emergency response solutions.

Key message 3: "Real-World Testing for Real-World Impact"

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- To ensure that innovative tools can be effectively deployed in real crises, this pilot tests them under realistic emergency conditions using historical data.
- By simulating natural disasters using historical data, the exercise helps identify strengths, limitations and areas for improvement before full-scale adoption.

Key message 4: “Collaboration is Key”

- Effective disaster response requires a multi-stakeholder approach, bringing together emergency responders, scientists and technology providers.
- This pilot is an example of cross-sector and cross-country cooperation, ensuring that the solutions being developed are practical, scalable and aligned with real-world needs.

10.4.4 Key PR Activities and Timeline

Phase 1: Pre-pilot (Three months to one week before the pilot)

- Preparation of a folder with pictures and videos of D.MALIAN in action to be used in the promotional material of the pilot.
- Collection of a list of local and national media contacts.
- LC to prepare the first press release in English, which will be translated in Greek by D.MALIAN.
- Creation of the graphic templates that will be used on social media and other digital communication.
- Update and translation of the project powerpoint in Greek.

Phase 2: Pilot execution (one week before till the completion of the pilot)

The week before the pilot:

- Circulation of the first press release in local and national media by D.MALIAN, alongside the project powerpoint.
- Announcement of the pilot on D.MALIAN and TEMA social media.
- D.MALIAN to offer interview opportunities for journalists.

During the pilot:

- Real-time updates on D.MALIAN and TEMA social media.

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- Capture of high-quality visuals (photos and video) for post-event storytelling.
- D.MALIAN to offer interview opportunities for journalists.

Phase 3: Post-pilot (the weeks following the pilot)

- Circulation of the second press release, which will be written with the assistance of LC, in local and national media by D.MALIAN.
- Website and social media recap of the pilot, sharing videos, key takeaways and testimonials.
- Further sharing of the pilot results with key target audiences, such as policymakers and first responders, via the TEMA newsletter and TEMA's page in the Union Civil Protection Knowledge Network (UCPKN).

10.5 Authorization, Registration and Permits for Trial

10.5.1 Trial Authorization

The evaluators and observers will have to sign a GDPR form and consent to trial terms, participate physically and fill the evaluation form.

10.5.2 Trial Registration

Formal invitations will be sent to participants to confirm their availability and participation.

10.5.3 Permits for the Trial

11 Annexes

Annex A - Informed Consent Forms

This project has received funding from the European Union's HE research and innovation programme under the grant agreement No. 101093003

Annex B - Dissemination & Communication Audit Questionnaire

Annex xy TEMA Observers Questions

Annex xy TEMA Guided Discussion Questions

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This project has received funding from the European Union's HORIZON Research and Innovation Actions program under grant agreement No 101093003.

End of Document

ANNEX 5

Evaluation Questionnaire

Evaluation Questionnaire for end-user evaluation of the TEMA-system:

Thank you for participating in this evaluation questionnaire. Please note that your responses will be collected and used solely for research purposes within the TEMA project. All data will be treated confidentially and analysed in aggregate form, ensuring that no individual can be identified. Your participation is voluntary, and you may choose to withdraw at any time without any negative consequences.

Personal Information

1. **The pilot trial you participated in was:**

◦ Finland, May 2025
◦ Italy, June 2025
◦ Greece, October 2025
◦ Germany, November 2025

2. **Gender**

◦ Male
◦ Female
◦ Diverse
◦ I prefer not to say

3. **Age**

◦ 18 years – 25 years
◦ 26 years – 35 years
◦ 36 years – 45 years
◦ 46 years – 55 years
◦ 56 years – 65 years
◦ 66 years and older

4. **Have you already had experience in disaster response and how long?**

◦ Yes, up to 1 year of experience
◦ Yes, approximately 1 to maximum 5 years of experience
◦ Yes, approximately 5 to maximum 10 years of experience
◦ Yes, 10 years of experience and longer
◦ No prior experience

5. **What is the average time spent per day that you use apps on (your own or business) smartphone, laptop, PC, and/or tablet?**

◦ 0 – max. 1 hour per day
◦ 1 – max. 4 hours per day
◦ 4 – max. 8 hours per day
◦ 8 – max. 10 hours per day
◦ 10 hours and more per day
◦ No use at all

Software Usability Evaluation

6. Have you received training on the TEMA system?

◦ Yes
◦ No

7. In addition to the training, have you already been able to work with the TEMA system and/or the information provided in it?

◦ Yes, for max. 1 hour
◦ Yes, for approx. 1 – max. 4 hours
◦ Yes, for approx. 4 – max. 8 hours
◦ Yes, for approx. 8 hours and longer
◦ No prior opportunity to work with the TEMA system

8. What methods, tools, or sources do you currently use in the control room to gather real-time information about the situation during a disaster response?

◦ (Open text - qualitative answer expected)

9. What similar technologies/software do you currently use for disaster response management? (Please provide a name or link if applicable.)

◦ (Open text - qualitative answer expected)

10. How long does it take for you to access a comprehensive map of the disaster area using your current disaster response system or methods? (e.g., within minutes, within hours, days, longer)

◦ (Open text - quantitative answer expected)

11. How would you describe the speed of providing updates of information in the TEMA system?

◦ very fast
◦ fast
◦ moderate
◦ slow
◦ very slow

12. How easy is it to understand the information and labels on the maps generated by your current system?

◦ very easy
◦ easy
◦ moderate
◦ difficult
◦ very difficult

13. **If you answered 'moderate,' 'difficult,' or 'very difficult' to the previous question, could you briefly explain why?**

◦ (Open text - qualitative answer expected)

14. **How would you rate the ease of understanding the information and labels on the maps provided by the TEMA system?**

◦ very easy
◦ easy
◦ moderate
◦ difficult
◦ very difficult

15. **If you answered 'moderate,' 'difficult,' or 'very difficult' to the previous question, could you briefly explain why?**

◦ (Open text - qualitative answer expected)

16. **Did the TEMA system's user interface help improve your understanding of the information needed for situational awareness?**

◦ Yes
◦ No
◦ Somewhat
◦ I cannot assess

17. **Did the TEMA system's detail improve your ability to understand the situation?**

◦ Yes
◦ No
◦ Somewhat
◦ I cannot assess

18. **How do you currently integrate information from heterogeneous sources like satellite imagery, social media reports, and sensor data for disaster response?**

◦ (Open text - qualitative answer expected)

19. **How much time and effort do you typically spend gathering satellite data or other related information with your current system or method?**

◦ > 50%
◦ 30-50%
◦ 15-30%
◦ 5-15 %
◦ <5 %
◦ None
◦ I cannot assess

20. How would you describe the effort required to gather satellite data or other related information using the TEMA system?

◦ a lot of effort
◦ moderate effort
◦ little effort
◦ no effort at all

21. Did the TEMA system reduce the time you would normally spend gathering data using your current system?

◦ No reduction at all
◦ Slight reduction
◦ Moderate reduction
◦ Significant reduction
◦ Very large reduction
◦ I cannot assess

22. With your current system, would you say that your workload is mostly manual, mostly automated, or a mix of both?

◦ mostly manual
◦ mostly automated
◦ a mix of both

23. How would you describe the level of automation in the TEMA system?

◦ mostly manual
◦ mostly automated
◦ a mix of both

24. Did the TEMA system reduce the amount of manual work you needed to do?

◦ Yes, significantly – It greatly reduced my manual workload
◦ Yes, moderately – It reduced a noticeable portion of manual work
◦ Yes, slightly – It reduced a small amount of manual work
◦ No change – The amount of manual work stayed the same
◦ No – It did not reduce manual work at all
◦ No – It increased the amount of manual work
◦ Not applicable – I did not perform manual tasks related to this system

25. With your current system, how quickly is information displayed?

◦ Within seconds
◦ Within minutes
◦ With up to 1 hour delay
◦ With up to 5 hours delay
◦ With up to 12 hours delay
◦ With more than 12 hours delay
◦ This is very dependent on the situation and the information type and I am not able to provide one specific answer

26. Did the TEMA system display information faster than your current tools?

◦ Yes
◦ No
◦ Somewhat

27. How interactive are your usual systems?

◦ very interactive
◦ interactive
◦ moderately interactive
◦ not very interactive
◦ not at all interactive

28. How would you rate the interactive features in the TEMA system?

◦ very interactive
◦ interactive
◦ moderately interactive
◦ not very interactive
◦ not at all interactive

29. Can you customize how you view the information in your current system?

◦ a lot
◦ some
◦ a little
◦ not at all

30. Were you able to easily customize how you viewed information with the TEMA system?

◦ Yes
◦ No
◦ Somewhat

31. How would you describe the user-friendliness of the tools you usually use?

◦ very user-friendly
◦ user-friendly
◦ moderately user-friendly
◦ not very user-friendly
◦ not at all user-friendly

32. How would you describe the user-friendliness of the TEMA system?

◦ very user-friendly
◦ user-friendly
◦ moderately user-friendly
◦ not very user-friendly
◦ not at all user-friendly

33. Was the TEMA system easier to use and understand than your current disaster response tools?

◦ Yes
◦ No
◦ Somewhat

34. If you answered 'No,' or 'Somewhat' to the previous question, could you briefly explain why?

◦ (Open text - qualitative answer expected)

35. Compared to the system you currently use; how would you rate the mental effort required to use the TEMA system?

◦ Much lower mental effort than my current system
◦ Somewhat lower mental effort than my current system
◦ About the same mental effort as my current system
◦ Somewhat higher mental effort than my current system
◦ Much higher mental effort than my current system

36. How confident are you in the accuracy and reliability of the information you currently use for decision-making?

◦ very confident
◦ confident
◦ moderately confident
◦ not very confident
◦ not at all confident

37. How would you describe your confidence in the accuracy and reliability of the information provided by the TEMA system?

◦ very confident
◦ confident
◦ moderately confident
◦ not very confident
◦ not at all confident
◦ I cannot assess

38. Did the TEMA system provide information that was more trustworthy and reliable than your current tools?

◦ Yes
◦ No
◦ Somewhat
◦ I cannot assess

39. How would you rate the decision-making support provided by the TEMA platform?

◦ greatly assists
◦ assists

◦ moderately assists
◦ does not assist
◦ no impact
◦ I cannot assess

40. Based on your experience during this trial, how do you believe the TEMA platform could improve your response during a real emergency?

◦ significantly improve
◦ improve
◦ moderately improve
◦ not improve
◦ worsen
◦ I cannot assess

41. If your answer was “significantly improve”, “improve” or “moderately improve” to the previous question, can you briefly describe how your disaster response improved (or changed) with the help of TEMA?

◦ (Open text)

42. Which specific features of the TEMA platform would be most beneficial in a real emergency, and why?

◦ (Open text - qualitative answer expected)

43. What are the main advantages of your current systems for Natural Disaster Management (NDM)?

◦ (Open text - qualitative answer expected)

44. What are the main limitations of your current systems for NDM?

◦ (Open text - qualitative answer expected)

45. Based on your experience, what limitations of your current systems do the TEMA system address?

◦ (Open text - qualitative answer expected)

46. Overall, how would you rate the TEMA system compared to your current tools?

◦ much better
◦ better
◦ similar
◦ worse
◦ much worse
◦ I cannot assess

47. Could you give some remarks about the improvement of the TEMA-System or additional functions that would be useful to include?

◦ (Open text - numerical or qualitative answer expected)

48. Could you describe functions that the system you are currently using is providing, and TEMA-system doesn't?

◦ (Open text - numerical or qualitative answer expected)

49. Does the TEMA system provide all the necessary information? If not, what more should it provide?

◦ (Open text - numerical or qualitative answer expected)

TEMA

TRUSTED
EXTREMELY PRECISE
MAPPING AND PREDICTION
FOR EMERGENCY
MANAGEMENT

ANNEX 6

TEMA Training Handbook

TABLE OF CONTENTS

1.TEMA technology descriptions

1.1. Smartdesk (SV-tech-07)

Use cases

RAS/KAHY wildfire and BRK/D.MALIAN flood use case scenarios.

Brief description

The Smartdesk is a mission management application that is installed on a computer in the control room. This software can be installed on most modern Windows computers.

What does the end user see?

The basic components of the Smartdesk application are maps, current weather, map measuring tools, map annotations. In addition to those basic tools, the Smartdesk visualises other data sources and technologies in the TEMA project. That information is visualised precisely on the map. For example, the map shows fires or floods, where photos were taken, drones are flying and their planned route, risk zones, and more.

Where does the end user see it?

The Smartdesk application is where most of the TEMA technologies are visualized

Image and description

The large table-size touchscreen PC with the Smartdesk application running.

Image and description

The Smartdesk application running on a laptop.

1.2. Human-comprehensible presentation of concept-based explanations (TFA-tech-02)

Use cases

BRK/D.MALIAN flood use case scenarios.

Brief description

TFA-tech-02 provides human-comprehensible concept-based explanations for the segmentation and object detection tasks implemented in TFA-tech-05, TFA-tech-06, TFA-tech-08, TFA-tech-09.

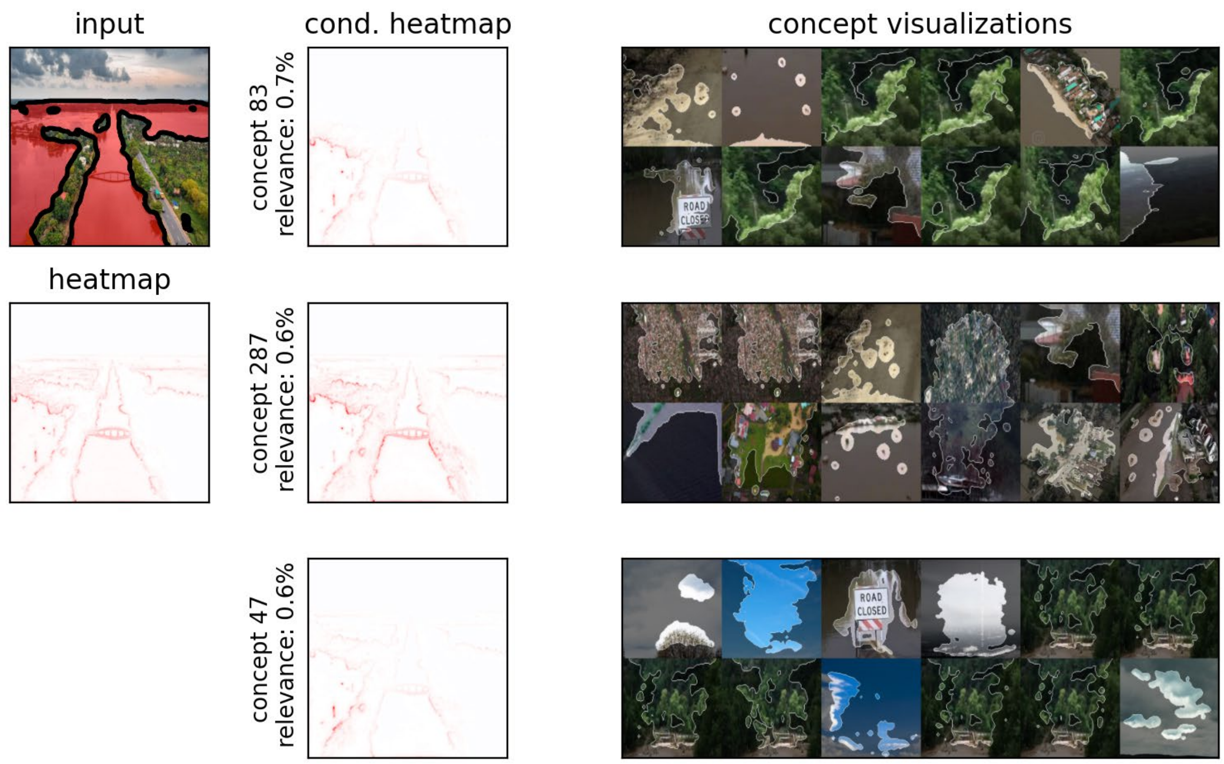
What does the end user see?

The end user sees an explanation heatmap together with the prediction result on the input image, as well as several most important concepts responsible for this result and their corresponding conditional heatmaps. The number of concepts can be adjusted (on request) according to the end-users' preferences.

Where does the end user see it?

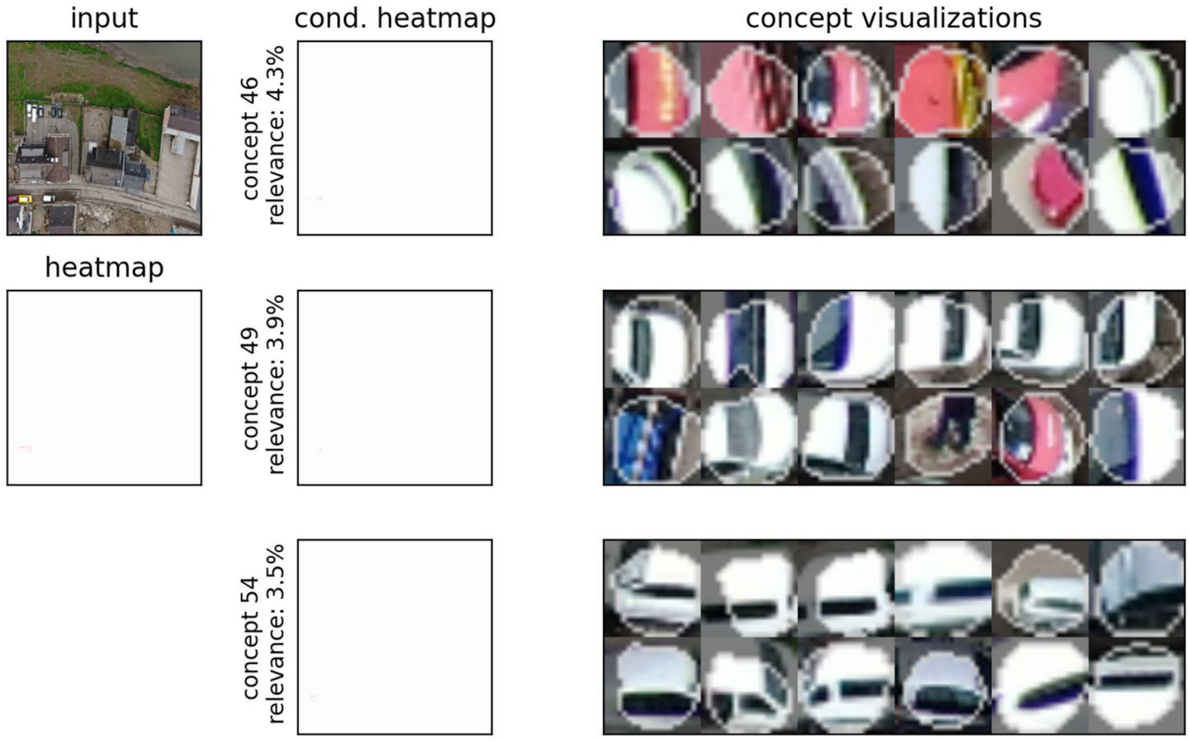
Explanation heatmaps are displayed on the SmartDesk provided by KAMK and can be retrieved on-demand via an explanation button on the UI that opens a pop-up window showing the explanation.

Image and description



Explanation for the flood segmentation result, displayed on the optional pop-up window. The top-left corner displays the segmentation result overlaid with the input image. Below that, a heatmap highlights the most influential areas of the input image that contributed to the model's segmentation decision. The center and right columns highlight conditional heatmaps for the top three concepts, along with example images that best represent each concept.

The first concept (83) corresponds to forest cover (vegetation region) and roadblock signs, the second concept (287) corresponds to land terrain surrounded by water, and the third concept (47) corresponds to blue and grey regions resembling water. Together these concepts help to identify the flood in the image. (By default, concepts are numbered according to their channel number inside a middle convolutional layer of the model).



Explanation for the vehicle detection result, displayed in the optional pop-up window. The top-left corner displays the object detection result as a yellow bounding box overlaid with the input image (here a white car is detected on the bottom-left of the image). Below that, a heatmap highlights the most influential regions of the input image that contributed to the model's detection result.
The center and right columns present conditional heatmaps for the top three concepts, alongside example images that best represent each concept. The first concept (46) corresponds to vehicle hood, the second concept (49) corresponds to vehicle windshield, and the third concept (54) corresponds to vehicle side window. Together these concepts helped identify the vehicle in the image. (By default, concepts are numbered according to their channel number inside a middle convolutional layer of the model).

1.3. Person/vehicle detection (TFA-tech-05)

Use cases

RAS/KAHY wildfire use case scenarios.

Brief description

In flood scenarios, TFA-tech-05 analyses drone images to automatically identify and highlight individuals and vehicles, enabling rapid localization of those in need and more efficient rescue operations.

What does the end user see?

The end user sees a clear pin overlaid on a 2D situational awareness map that marks the exact location of the detected person or vehicle in the flood area. Optionally, by clicking on this pin, a pop-up window opens that displays the corresponding drone image with the detected person or vehicle clearly highlighted within a bounding box, ensuring precise identification.

Where does the end user see it?

The pins of detected persons and vehicles overlaid on the 2D situational awareness map, and the optional pop-up window are displayed on the SmartDesk provided by KAMK.

Image and description

Detected persons (red) and vehicles (green) overlaid on the raw image captured by drone, displayed on the optional pop-up window. The colour of the bounding boxes highlighting the detected persons and vehicles can be adjusted (on request) according to the end-user's preferences.

1.4. Fire/smoke/flood/background segmentation (TFA-tech-06)

Use cases

RAS/KAHY wildfire use case scenarios. BRK/D.MALIAN flood use case scenarios.

Brief description

TFA-tech-06 processes (in real time) images captured by drones to quickly identify and highlight critical areas in emergency situations.

- For wildfires, TFA-tech-06 combines both RGB and InfraRed (IR) images and automatically spots image regions with fire and smoke. This information is then overlaid on a 2D or 3D situational awareness map using Information Fusion Technology, helping policy makers and first responders to quickly pinpoint dangerous zones and plan effective responses.
- In flood scenarios, TFA-tech-06 clearly separates floodwater from the rest of the scene. The processed data is overlaid on a 2D or 3D situational awareness map using Information Fusion Technology, providing a comprehensive view of the affected areas. This helps emergency teams assess the extent of flooding, plan evacuations, and direct rescue efforts efficiently.

What does the end user see?

The end user sees a layer of information overlaid on a 2D or 3D situational awareness map. This layer combines information from the processed drone images, processed satellite imagery, social media analysis and simulation results providing a comprehensive view of the affected areas and dangerous zones. This integrated data layer precisely maps the event's exact location and spatiotemporal extent on the 2D/3D situational awareness map.

Optionally, selecting a specific location on the map opens a pop-up window that displays the drone-captured image of the event (fire/flood) with the segmentation results clearly overlaid, providing a detailed view of the affected area on this specific location.

Where does the end user see it?

The layer of information overlaid on the 2D situational awareness map, and the optional pop-up window are displayed on the SmartDesk provided by KAMK.

The layer of information overlaid on the 3D situational awareness map is displayed on the Augmented Reality (AR) Headset provided by ND.

Image and description

Fire and smoke region segmentation overlaid on the raw image captured by drone, displayed on the optional pop-up window. The regions of the image depicting fire and smoke are clearly separated from the rest of the scene. The colour and opacity of the segmentation masks can be adjusted (on request) according to the end-user's preferences.

Image and description

Flood region segmentation overlaid on the raw image captured by drone, displayed on the optional pop-up window. The regions of the image depicting flood are clearly separated from the rest of the scene. The colour and opacity of the segmentation masks can be adjusted (on request) according to the end-user's preferences.

1.5. Person re-identification (TFA-tech-07)

Use cases

RAS/KAHY wildfire use case scenarios. BRK/D.MALIAN flood use case scenarios.

Brief description

TFA-tech-07 analyses in real time the images acquired by the drone to store the characteristics of a person detection on the image and give it a unique ID, in case the same person is detected in another image it can be re-identified.

What does the end user see?

The end user would see a unique ID to each detected person per image, representing that person.

Where does the end user see it?

The end user sees it associated with the detected persons overlaid on the SmartDesk provided by KAMK.

1.6. Flood processor (TFA-tech-08)

Use cases

BRK/D.MALIAN flood use case scenarios.

Brief description

Conventional satellite-based emergency mapping methods, as deployed for example by the Copernicus Emergency Management Service (CEMS), can be slow and labour-intensive. Recent advances in deep learning and the availability of new large-scale remote sensing datasets have opened new possibilities for automated image analysis. In TEMA we have developed novel deep learning methods to automatically analyse Sentinel-1 (radar) and Sentinel-2 (multi-spectral) satellite images and to extract binary water masks at 10 meters pixel-spacing. Time-series analysis is used to further derive secondary products about permanent water bodies and flood duration. The methods are implemented into a modular processing chain for surface water monitoring that enables automatic satellite data search, pre-processing, analysis, and dissemination over predefined areas of interest.

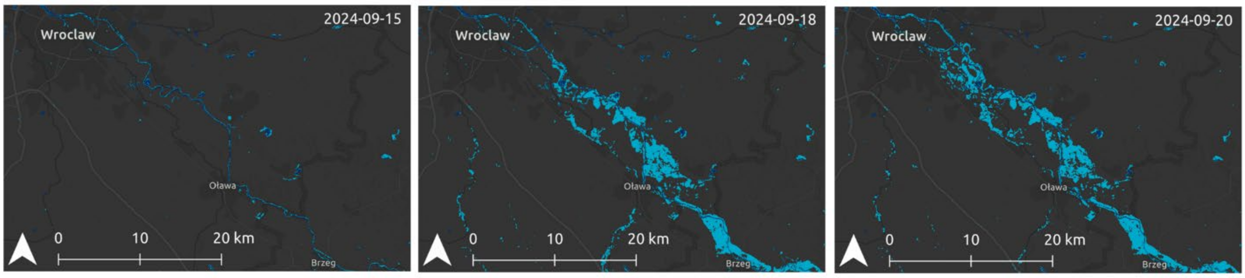
What does the end user see?

Water extent at 10 meters pixel spacing for large-scale situational awareness about potential hazard zones (flooded areas). Spatio-temporal evolution of flooded areas with a temporal resolution of 1 to 3 days (depending on satellite orbit and location of the area of interest).

Where does the end user see it?

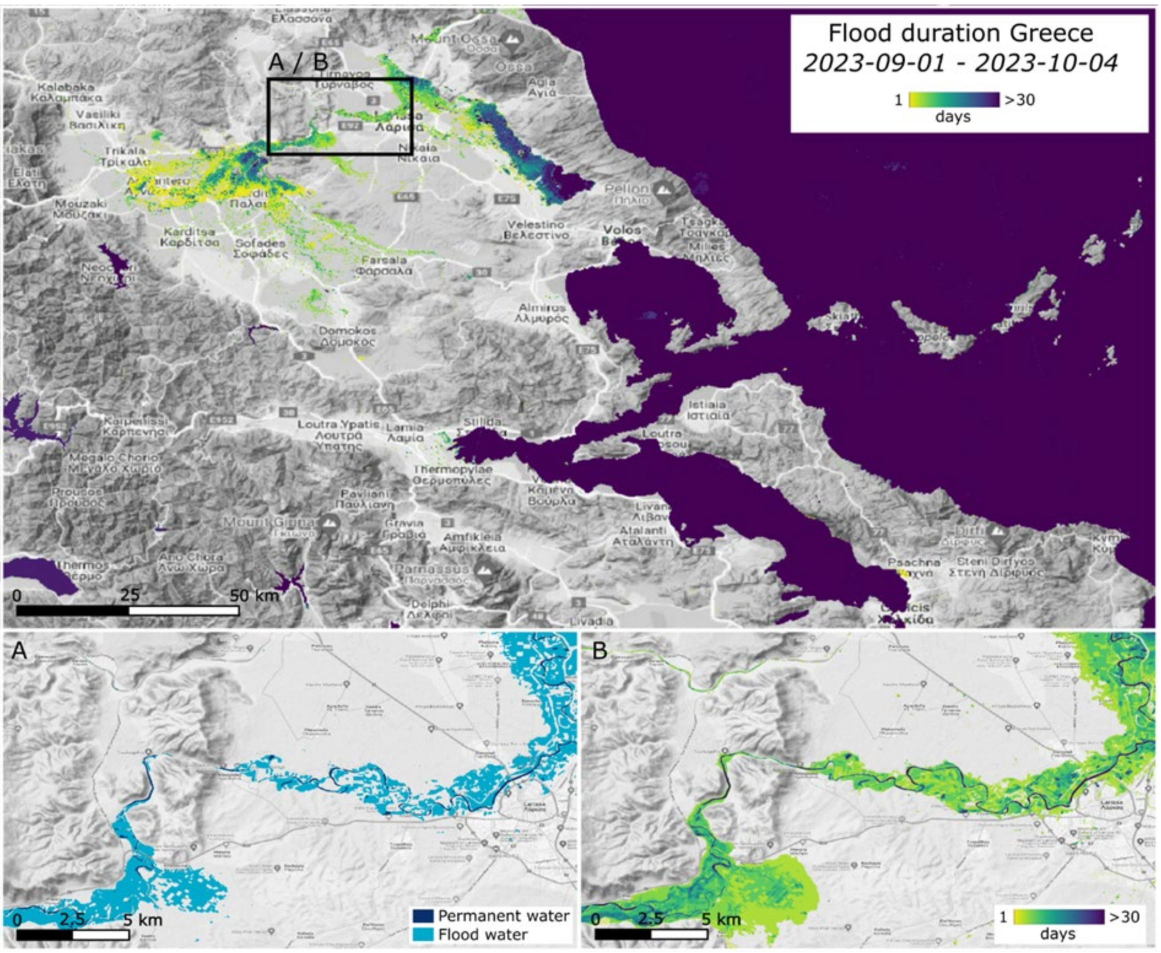
Information Fusion, Smart Desk, Digital Twin

Image and description



The flood situation over Wrozlaw, Poland between 2024-09-15 and 2024-09-20. Flood extent (light blue) and permanent water bodies (dark blue) were extracted from Sentinel-1 (radar) and Sentinel-2 (multi-spectral) satellite images by DLR's automated flood processing chain.

Image and description



Results from satellite-based flood monitoring over Greece with examples showing inundated areas on 2023-09-09 (A) and flood duration from 2023-09-01 until 2023-10-04 (B) around the city of Larissa.

1.7. Burn area processor (TFA-tech-09)

Use cases

RAS/KAHY wildfire use case scenarios

Brief description

Conventional satellite-based burnt area mapping methods, as deployed for example by the Copernicus European Forest Fire Information System (EFFIS), can be slow and labour-intensive. Deep learning methods in combination with rule-based expert knowledge allow for the derivation of accurate, automated burnt perimeters in near-real time. In TEMA we have further developed deep learning methods to automatically analyse satellite images from multiple sensors to extract burnt area masks with a spatial resolution of 250/300m and a temporal resolution of 4x / day, as well as up to 10 meters spatial resolution, available every 5 days. The methods are implemented into a modular processing chain for burnt area monitoring that enables automatic satellite data search, pre-processing, analysis, and dissemination over continental-scaled areas of interest.

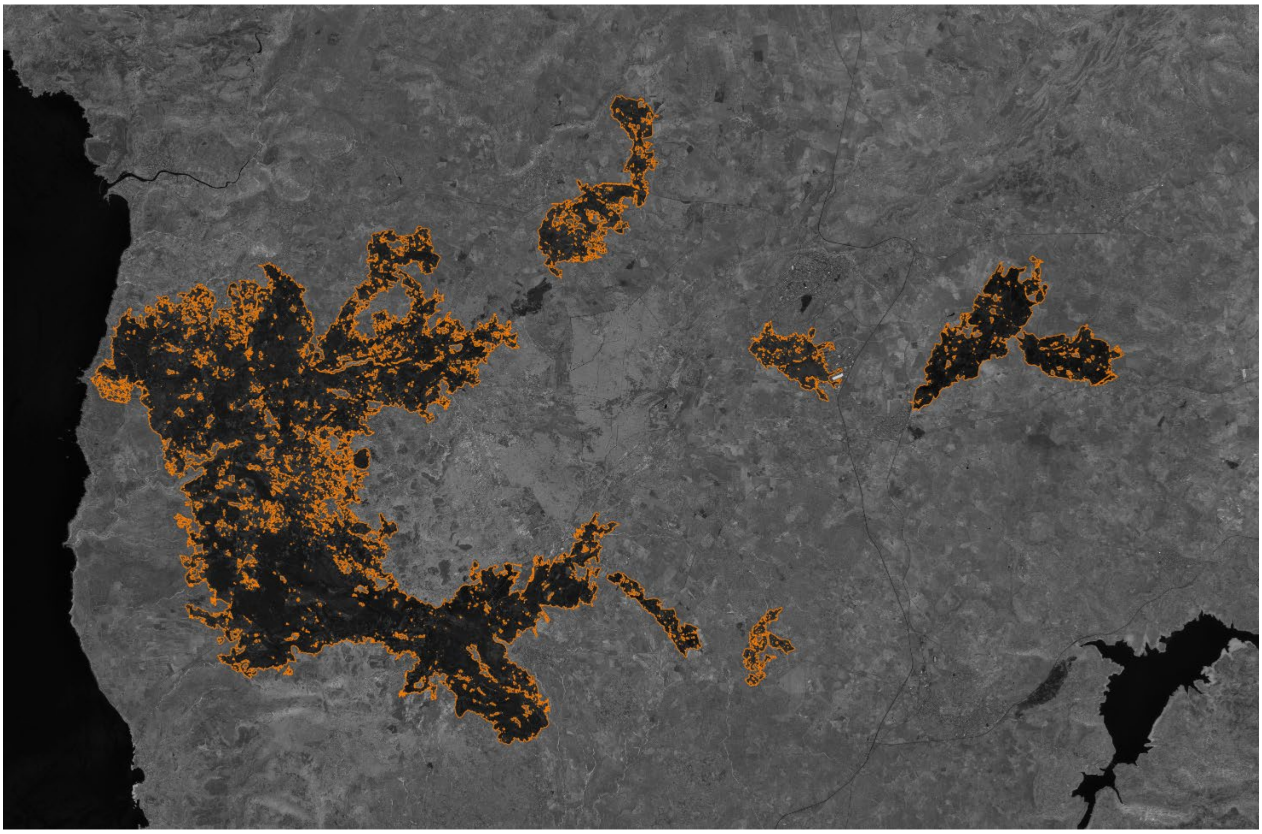
What does the end user see?

Burnt areas based on satellite imagery of the sensors Sentinel-3 OLCI, Aqua/Terra MODIS, Sentinel-2 MSI.

Where does the end user see it?

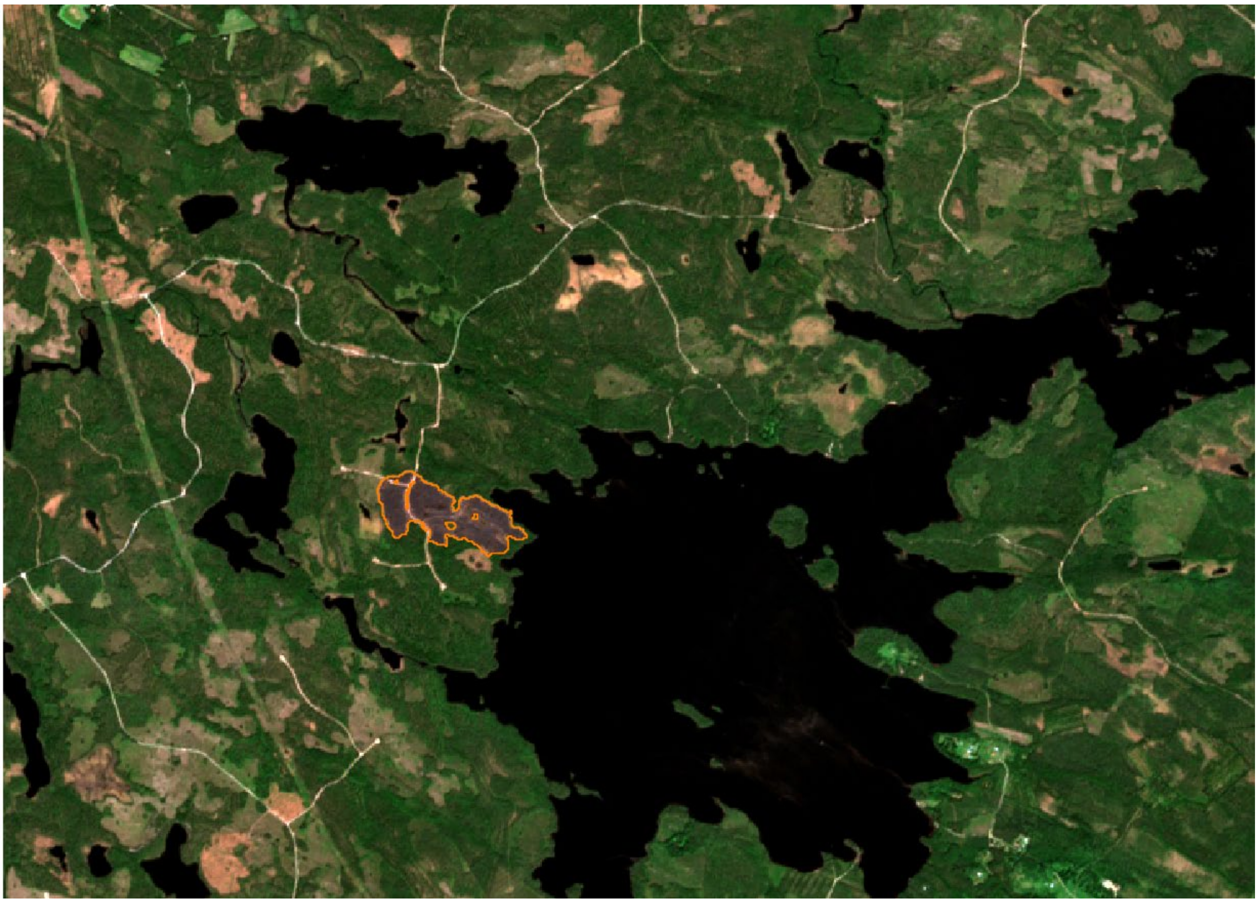
Information Fusion, Smart Desk, Digital Twin

Image and description



The image shows the derived perimeter for the Montiferri wildfire in Sardinia, August 2021. The NIR band of the Sentinel-2 (10m) image used for the derivation is shown as a background.

Image and description



The image shows the derived perimeter for the wildfire in the Kuhmo region / Finland, in May 2024. The RGB bands of the Sentinel-2 image (10m) used for the derivation are shown as a background.

1.8. Burn area processor (TFA-tech-09)

Use cases

RAS/KAHY wildfire use case scenarios. BRK/D.MALIAN flood use case scenarios.
Data processing after each trial in order to determine and address private data sharing issues.

Brief description

The privacy preservation tool receives video frame inputs and person/car detections (from TFA-tech-05) and outputs new video frames where the detected person faces, and car plates have been processed in order to render them no longer re-identifiable.

What does the end user see?

The user sees processed video frames where facial recognition and car plate reading is no longer possible.

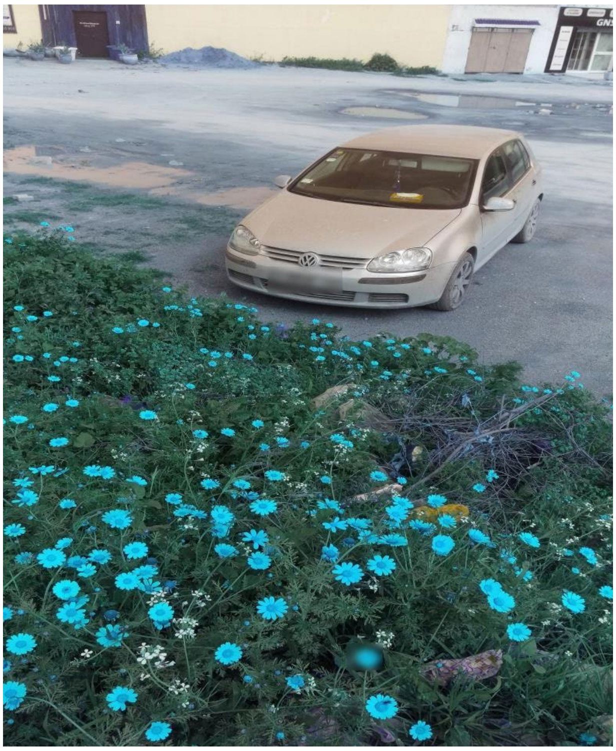
Where does the end user see it?

This technology cannot be seen by the end user during trials or in Smartdesk, as it is merely used as post-processing.

Image and description

Outputs of the technology. Processed video frames where faces are no longer recognizable.

Image and description



Processed video frames where car plates are no longer readable.

1.9. Geo-social media analysis (TFA-tech-11)

Use cases

RAS wildfire use case scenario. BRK/D.MALIAN flood use case scenarios.

Brief description

TFA-11 analyses social media content to highlight affected areas and provide crowd-sourced, in-situ information in real time. It processes posts from multiple social media platforms (X, Bluesky, TikTok, Telegram, Mastodon, etc.), extracts location and identifies thematic clusters, emotions (fear, anger, joy, sadness) and activity hot spots. These results are then overlaid on a 2D situational awareness map to support timely decision-making for emergency response teams and policy makers.

For all use cases, TFA-11 uses advanced natural language processing and geospatial analysis. It clusters posts into topics based on their text contents (topic modelling) and identifies the underlying emotions. Furthermore, it outlines those that are disaster related and uses the extracted information to specify disaster-related social media content hotspots, depicted as hexagons. The technologies used are capable of handling multiple languages simultaneously (English, German, Italian, Greek) and thus work for all use cases of TEMA.

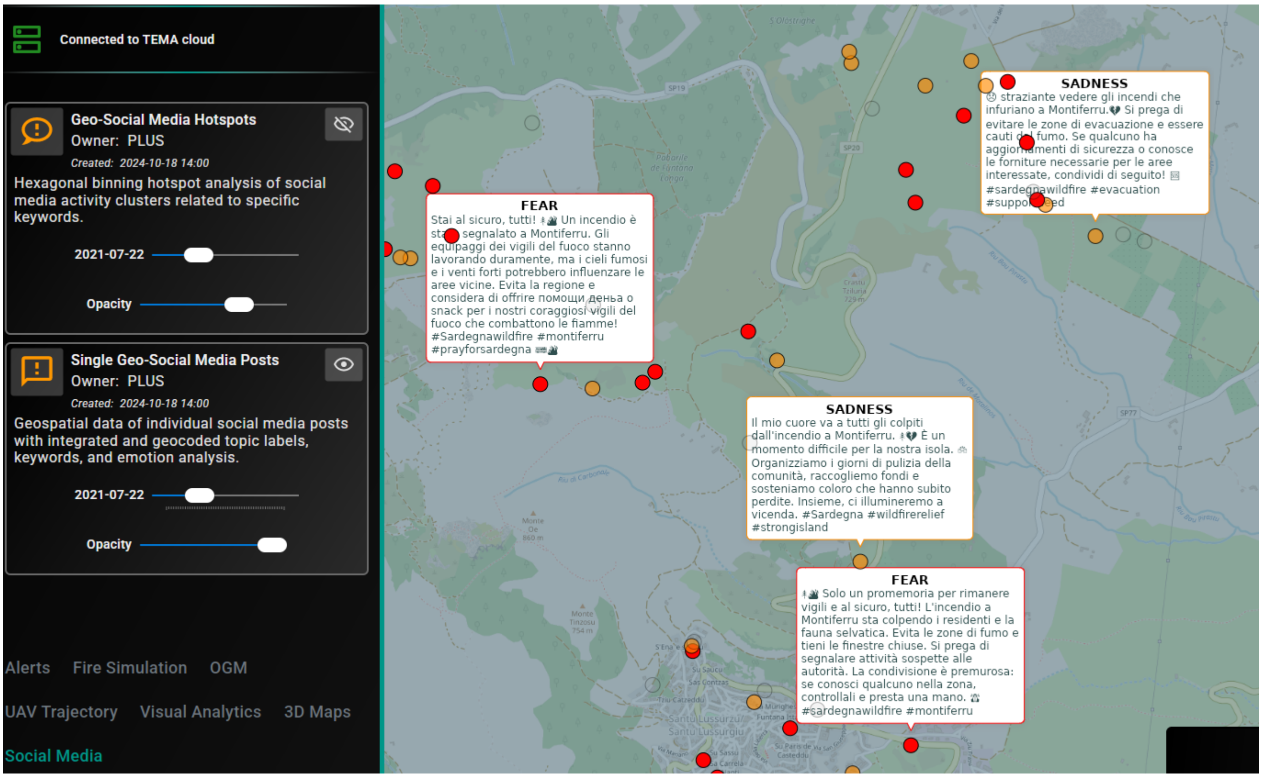
What does the end user see?

The end user sees individual posts as points on a 2D situational awareness map. The posts are coloured by their underlying emotion. Additionally, he/she sees hexagonal grid cells that cover the areas within the AOI, which are coloured based on the number of disaster-related tweets occurred within that cell. E.g. Darker cells indicate higher disaster-related tweet activity.

Where does the end user see it?

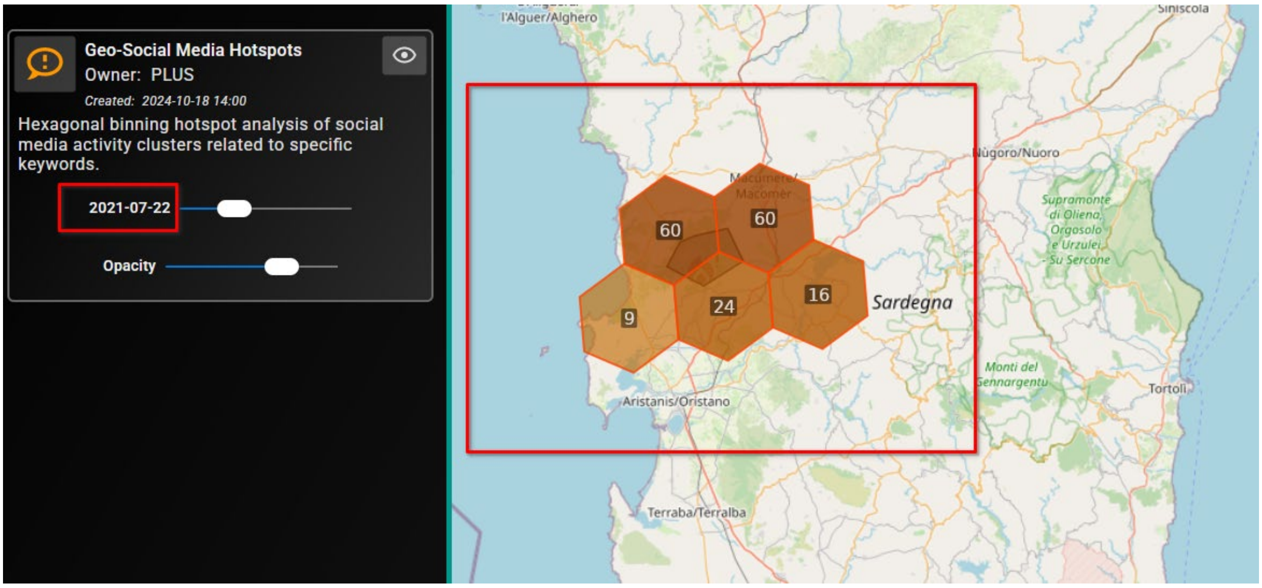
The information layer overlaid on the 2D situational awareness map, and the optional pop-up window are both displayed on the SmartDesk provided by KAMK.

Image and description



Individual social media posts, coloured by their sentiment (red=fear, orange=sadness, grey=joy) on the 2D situational awareness map. Using the date slider, the user can decide until which date the social media data should be displayed.

Image and description



Social media hotspot grids coloured based on the number of disaster-related posts occurred on the particular day selected using the slider. This number is indicated as an absolute integer in the corresponding hexagons as well.

1.10. Wildfire analyst – forest fire simulation (PDM-tech-01)

Use cases

RAS/KAHY wildfire use case scenarios.

Brief description

Wildfire Analyst® (WFA) is a software tool designed to assist fire managers, firefighters, and other stakeholders in making informed decisions regarding wildfire management and response. WFA FireSim module provides real-time analysis of wildfire behaviour and simulates the spread of wildfires in seconds to support real time decision making.

What does the end user see?

FireSim provides outputs within the considered simulation perimeter. This simulation perimeter is defined by isochrones that represent the number of hours of the simulation. Hence, the respective outputs are calculated from the location(s) of the ignition point(s) until reaching the maximum of the simulation hours that were defined.

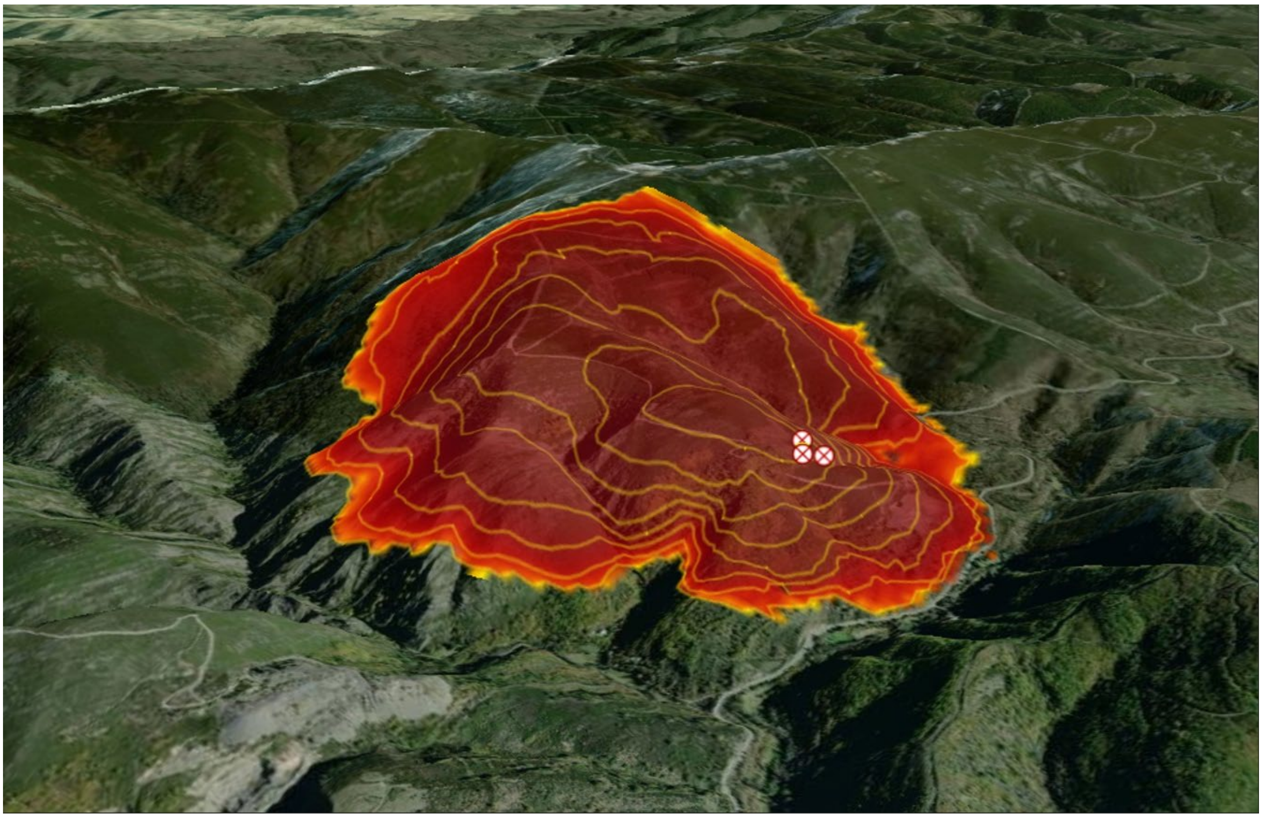
The fire behaviour outputs FireSim can provide are shown in the table below:

Fire behaviour layer	Short description
Arrival Time Vector (h)	Hourly fire perimeters
Rate of Spread (m/min)	Speed of the fire for each cell of the simulation
Flame length (m)	Expected height of the flames
Fireline Intensity (kW/m)	Expected intensity of the flames
Firepath	Main paths taken by the fire in the simulation. It shows the fire cells that are estimated to be most active in the fire (minor, secondary, main)

Where does the end user see it?

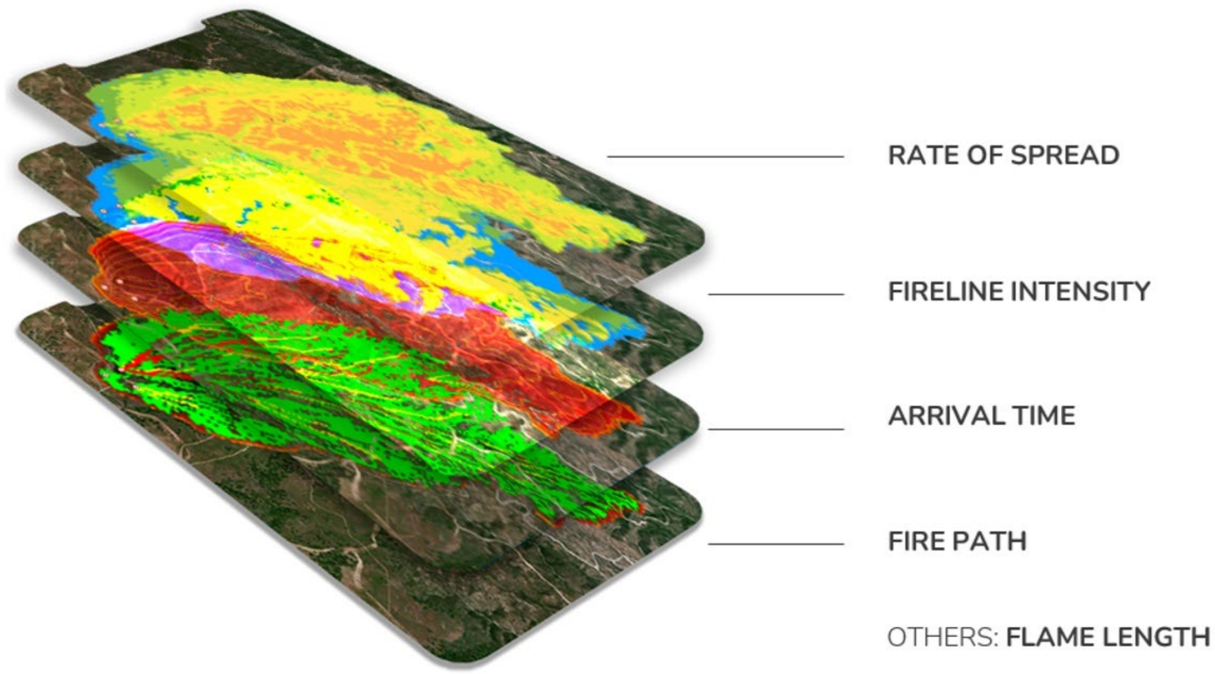
Smart Desk, Digital Twin.

Image and description



Arrival time output for an 8-hour simulation.

Image and description



Different fire behaviour outputs showing the values per pixel of the different fire variables calculated in the current simulation. A legend is generated on-the-fly for Smart Desk visualization.

1.11. Flood simulation – 3Di Water Management (PDM-tech-02)

Use cases

BRK- flood scenario and D.MALIAN flash flood scenario.

Brief description

3Di Water Management is a simulation software, which can be used in water management studies and during floods. It allows the user to simulate real-world scenarios and adjust them. The 3Di simulation software calculates in which direction water flows, how much water flows in these directions and where floods will be at a certain moment in time. It is designed for emergency response teams to gain a mutual understanding of a flood event and gives the option to try out measures in scenarios to prevent and mitigate the impact of a flood. 3Di Water Management can simulate rainfall events, riverine floods, coastal floods, dike breaches or a combination of these events.

What does the end user see?

3Di Water Management produces maps of areas of interest with information of the predicted event. For example, per timestep of the simulation, a water depth map can be generated to highlight locations which are prone to flooding, where water will accumulate or gather. Over time, it becomes visible how a flood propagates over an area and gives information about maximum water depths that occur at specific locations. This information allows emergency response teams to make informed decisions whether an area is still accessible or safe to enter.

Beside maps where water depths or water levels per time step are generated, 3Di Water Management can produce information of flow velocities at critical locations, such as bridges, dams, or highways. It can predict the arrival time of water at a certain point, so that the end-user knows when and if a location will be flooded.

Where does the end user see it?

The end-user will see these maps in the SmartDesk as 2D-maps.

The end-user will see these maps as well in a Digital Twin environment on the SmartDesk as a 3D-map, where water levels are matched and visualized in a 3D-model environment.

These 3Di Water Management results from the 3D-model are visualized as well in the XR-headsets, which will be used for training purposes of fire fighters or emergency response teams.

Image and description

Image and description

1.12. Information fusion (PDM-tech-05)

Use cases

RAS/KAHY wildfire use case scenarios.
BRK- flood scenario and D. MALIAN flash flood scenarios.

Brief description

Information Fusion is a core service that continuously consolidates all situational data into a single operational view. It ingests drone-borne segmentation masks, satellite detections, social media, and physics-based forecasts (outcomes of the predictive models, e.g., FireSim and 3D hydrodynamics), reconciles their spatial resolutions, and updates the underlying occupancy-grid model in real time. Every incoming notification is processed the moment it arrives. Probabilistic filtering assigns an explicit confidence value to each grid cell, so active fire fronts, flood extents, and tracked objects appear with clear, colour-coded probabilities. The resulting layers (Maps4Fire, Maps4Flood, Maps4Objects) are streamed directly to the TEMA dashboard to show near real-time the current status of the monitored natural disaster.

What does the end user see?

- Maps4Fire / Maps4Flood (Natural Disaster layers)
    - The natural disaster surface is rendered in grayscale:
        - Very light grey → high probability of fire or inundation in that cell.
        - Dark grey → low probability (little or no evidence of hazard).
        - As fresh drone, satellite, or forecast data arrive, the greyscale intensities adjust automatically, letting you spot the event's growth or recession at a glance.
        - A scale bar in the legend converts grey tone to probability (0 – 1) for quick interpretation.

- Maps4Objects (object-tracking layer)
    - Each detected object appears as a small marker labelled with its class and confidence:
        - Person (0) e.g., Person (0.82)
        - Vehicle (1) e.g., Vehicle (0.75)
        - The numeric score (0–1) indicates the current likelihood of the detection being correct, and it is updated every time new UAV imagery or social-media evidence is fused.

Where does the end user see it?

The end-user will see these maps in the SmartDesk as 2D maps.

Image and description

The image below illustrates the Maps4Fire probability map for the Montiferru (RAS) fire scenario. The semi-transparent grey polygon outlines the Alert's ROI, and within it, each grid cell is rendered in grayscale, very light tones for high fire probability (active flames), medium greys for moderate risk, and dark greys for low or no fire likelihood (burnt area). This layer updates automatically with new UAV, satellite, and geo-social media analysis (Hotspot), and the predictive models' inputs, providing an at-a-glance view of the fire's most intense areas.

Image and description

The image below shows the Maps4Objects; the yellow dots represent individual detections, either a person (class 0) or a vehicle (class 1) (you can know the class of the tracked object by pointing at it). The Maps4Objects shows in near real-time the detected and tracked objects.

1.13. Decision support for remote sensing (PDM-tech-06)

Use cases

BRK flood use case scenario. KAHY wildfire use case scenario.

Brief description

The decision support tool automatically processes and fuses web data (e.g. public alerts, sensor observations, weather forecasts), identifies areas of interest and intersects them with relevant satellite image acquisitions. This approach improves the end user's situational awareness by automatically generating decision proposals.

What does the end user see?

Decision proposals include a spatiotemporal representation of warning AOIs and satellite acquisitions which can be visualized, for example in a map. The user is supported by transparency on the underlying data sources, the expected (and actual) time of satellite data acquisition, attributes of relevance and overlap of satellites for events.

Where does the end user see it?

Smart Desk as well as E-Mail report containing information on incidents, related warnings & satellite acquisitions.

Image and description

Geospatial display of warning segments (purple) and selected overlapping satellite overpass (transparent white and in table) on SmartDesk.

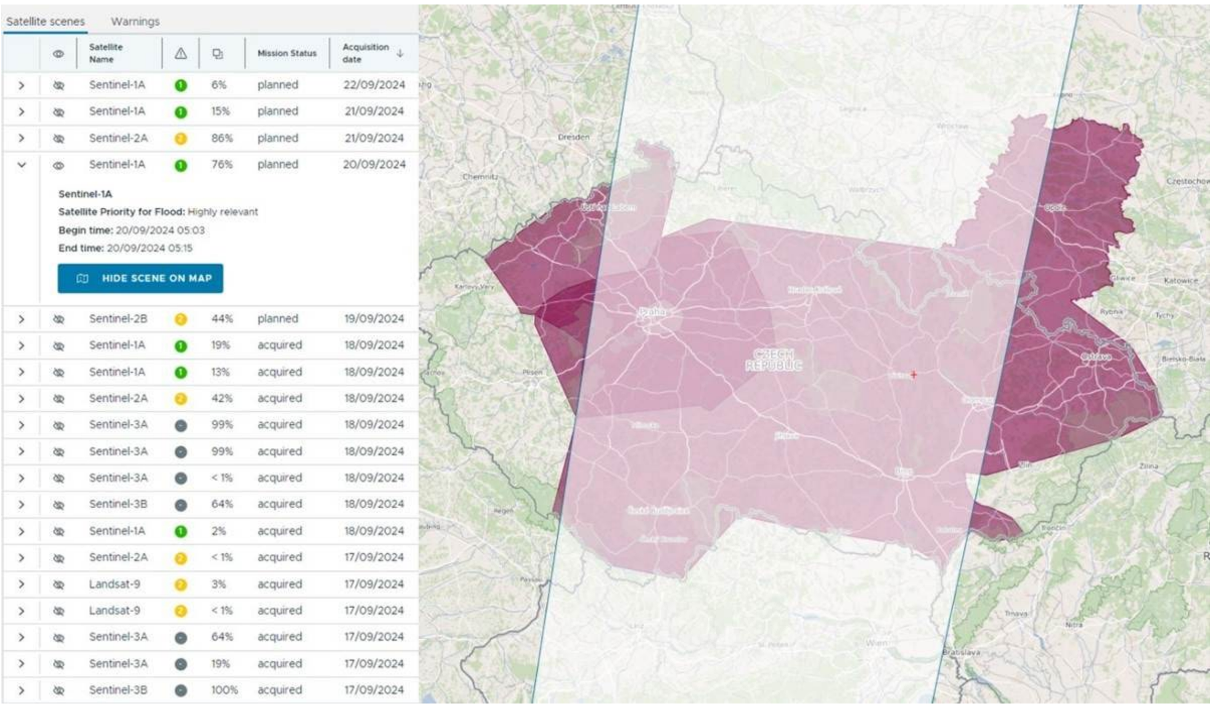


Image and description

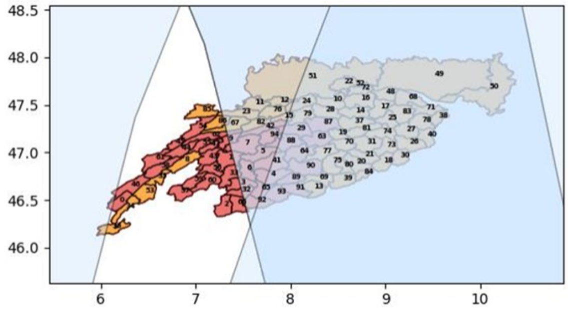
E-Mail report containing for each reported incident information on related warnings and planned/acquired overlapping satellite overpasses.

#3 Meteorology: Incident **from 2024-10-01 09:00 to 2024-10-02 09:00.**

95 warning(s) with highest severity: Severe from MeteoAlarm, DWD. The max. certainty is **Likely**

4 overlapping satellite segments found with a maximum overlap of 80%

- **Planned: 4**
- **Acquired: 0**



Satellite Segments overlapping incident

Satellite	Priority	Overlap	Mission Status	Start at
Sentinel-1A	1	80	planned	2024-10-01T17:12:00
Sentinel-1A	1	80	planned	2024-10-01T17:12:00
Sentinel-2B	2	61	planned	2024-10-02T10:17:42
Sentinel-1A	1	0	planned	2024-10-03T05:44:24

1.14. Drone-based image and data acquisition (SV-tech-01)

Use cases

RAS/KAHY wildfire use case scenarios.
BRK- flood scenario and D. MALIAN flash flood scenario

Brief description

Drone-based Image and Data Acquisition (SV-tech-01) is an edge-layer technology that captures high-resolution imagery (visual and thermal) with essential metadata and multi-sensor data directly from unmanned aerial vehicles (UAVs). Operating on both the drones and a dedicated base station, it creates a seamless front-end for the TEMA platform. During emergency-response and natural-disaster management, such as wildfires or floods, SV-tech-01 enables rapid aerial reconnaissance, streaming real-time data to first responders. These live, high-definition feeds are important to assess damage, locate survivors, and track critical assets and vehicles with precision.

What does the end user see?

Image stream

Where does the end user see it?

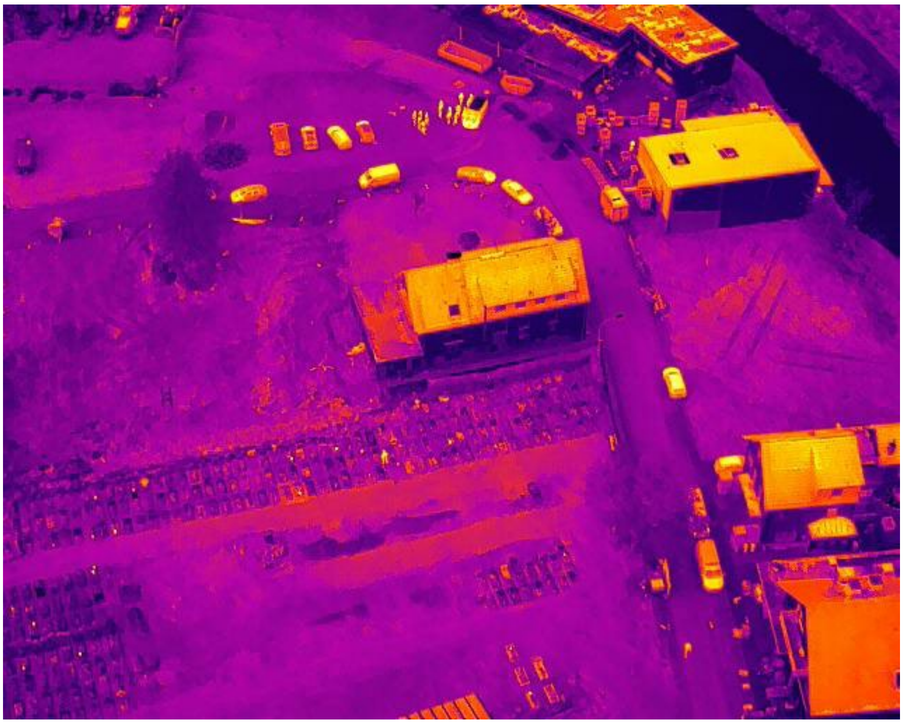
1. On the base station (e.g. laptop) on which the SV-tech-01 is deployed to receive the transmitted data e.g., stream of images
2. On the drone remote controller (RC)

Image and description

The image below presents an RGB aerial frame captured by a drone-mounted visual camera. It is enriched with comprehensive geospatial metadata, precise GPS coordinates, camera pose, viewing azimuth and pitch, flight altitude, and more, so the scene can be accurately georeferenced and seamlessly integrated into downstream mapping and analytics workflows.

Image and description

The image below illustrates a drone-captured thermal (IR) scene. It comes enriched with geospatial metadata, GPS coordinates, camera orientation, viewing angle, altitude, and other key EXIF tags, ensuring the frame can be precisely georeferenced and aligned with mapping and analytics workflows.



1.15. 3D computer vision – Photogrammetry (SV-tech-03)

Use cases

RAS/KAHY wildfire use case scenarios.
BRK/D.MALIAN flood use case scenarios.

Brief description

SV-tech-03 utilizes photogrammetry to process drone-captured images, creating high-resolution 3D models and 2D orthophotos that accurately represent the current state of an area affected by a disaster. These outputs provide detailed spatial information for emergency planning and response. The 3D models are available as interactive visualizations, while the 2D orthophotos support detailed analysis and presentation, integrating with other TEMA technologies for comprehensive situational awareness.

What does the end user see?

The end user sees a high-resolution 3D model of the disaster area, navigable in real time, alongside a 2D orthophoto providing a top-down view of the terrain. The 3D model highlights key features such as damaged infrastructure, fire perimeters, or flood extent, while the orthophoto offers precise measurements of affected areas. Both outputs are overlaid with annotations (e.g., risk zones, detected objects) from other TEMA technologies (e.g., TFA-tech-05, TFA-tech-06).

Where does the end user see it?

In the Smartdesk and the XR Viewer.

1.16. XR interactive visualization (SV-tech-06)

Use cases

RAS/KAHY wildfire use case scenarios.
BRK/D.MALIAN flood use case scenarios.

Brief description

SV-tech-06 integrates 3D models from SV-tech-03 with additional 2D and 3D data (e.g., segmentation results, simulation outputs) into an interactive XR (Extended Reality) viewer. This enables immersive exploration through a VR headset, allowing users to navigate disaster areas, analyse spatial relationships, and interact with real-time data in a fully immersive environment. The system supports intuitive controls for zooming, rotating, and annotating, enhancing decision-making for first responders and policymakers.

What does the end user see?

The end user sees an immersive 3D real-time view of the disaster area through a VR headset, combining the 3D model from SV-tech-03 with dynamic data layers (e.g., fire spread from PDM-tech-01, flood extent from PDM-tech-02). The visualization includes interactive elements such as clickable pins for detected objects (e.g., persons, vehicles from TFA-tech-05) and colour-coded risk zones. Users can toggle data layers, measure distances, and view pop-up details (e.g., water depth, flame intensity) in the immersive environment.

2.SmartDesk learning manual

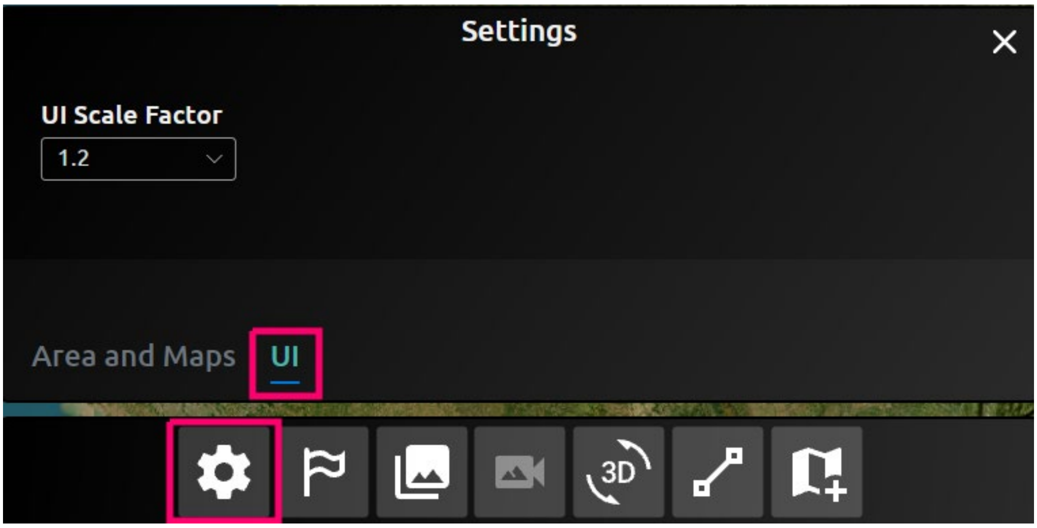
2.1. Introduction

The current software version shows sample data from a flood in Germany and a wildfire in Italy.

Settings

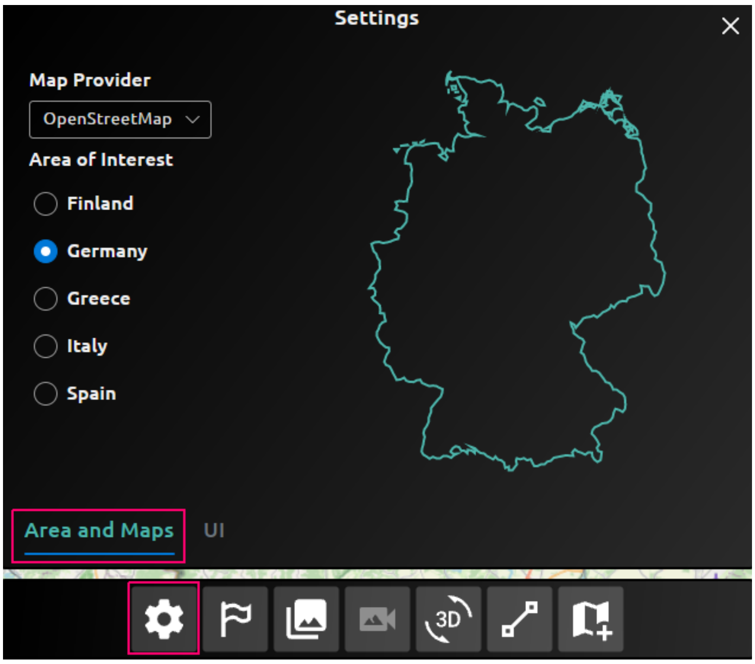
F11 - toggle full screen mode. On some laptops, [fn] button + F11 button.

Users can change the user interface scaling/ interface size to be more visible on smaller or bigger monitor. To change the size of the interface, navigate to the [Settings] and choose [UI].



Map types and country selection

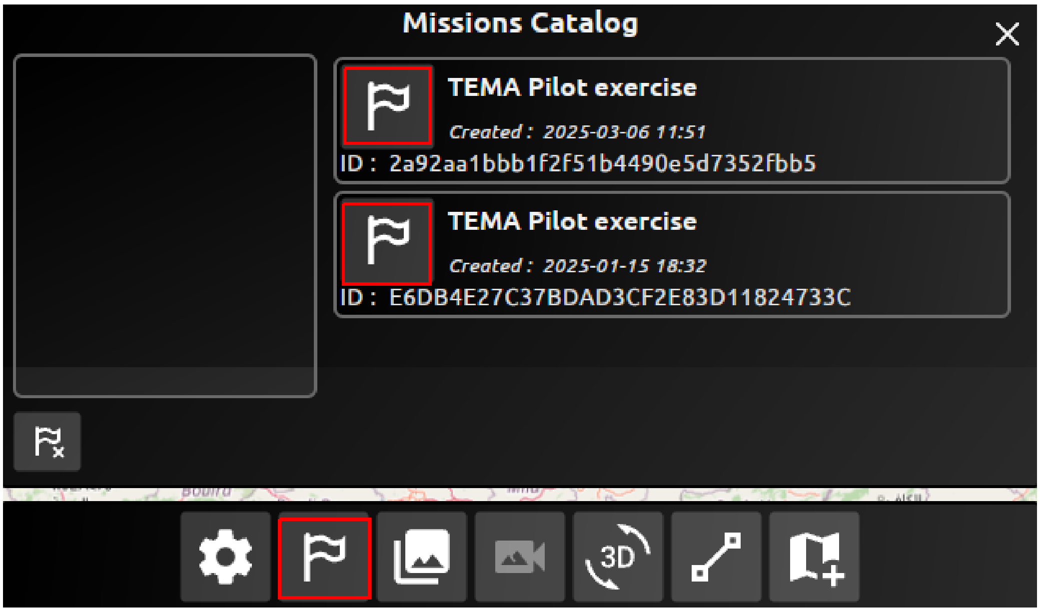
Different map types are provided and more can be added on request. Maps are selected from [Settings] icon. The map and data are focused on the specific country that is selected.



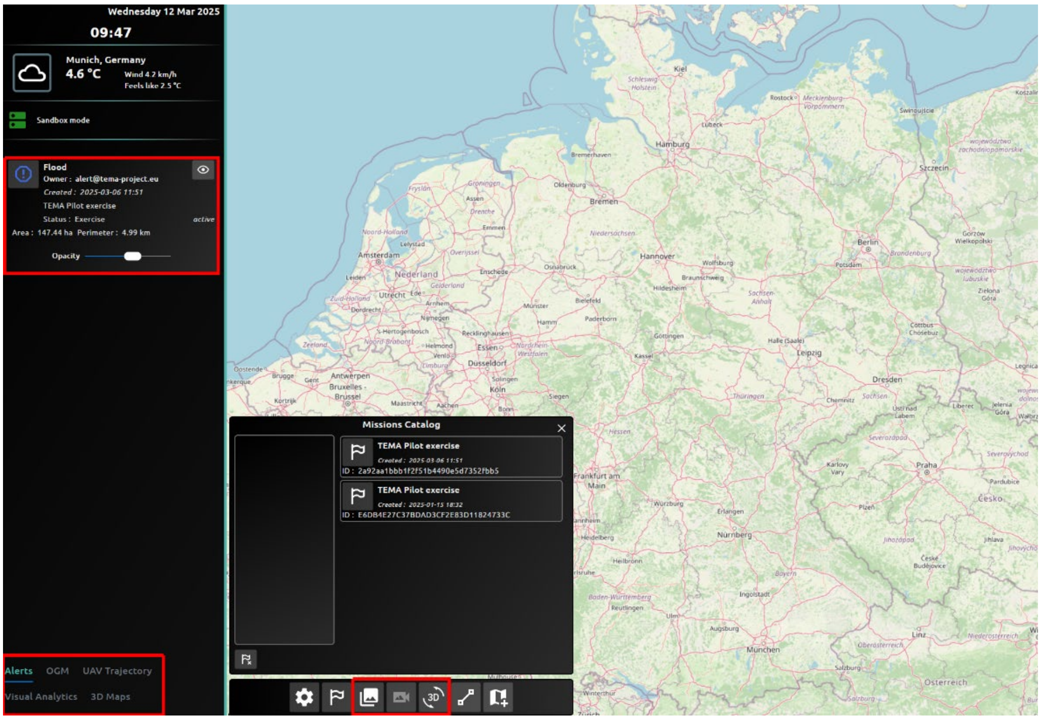
Missions Catalogue

Shows a list of missions chronologically. The sandbox version includes two missions, a flood example, and a fire example.

The [missions catalogue] is accessed by clicking the [flag icon]. To show data specific to an incident, click on the flag next to the incident information.



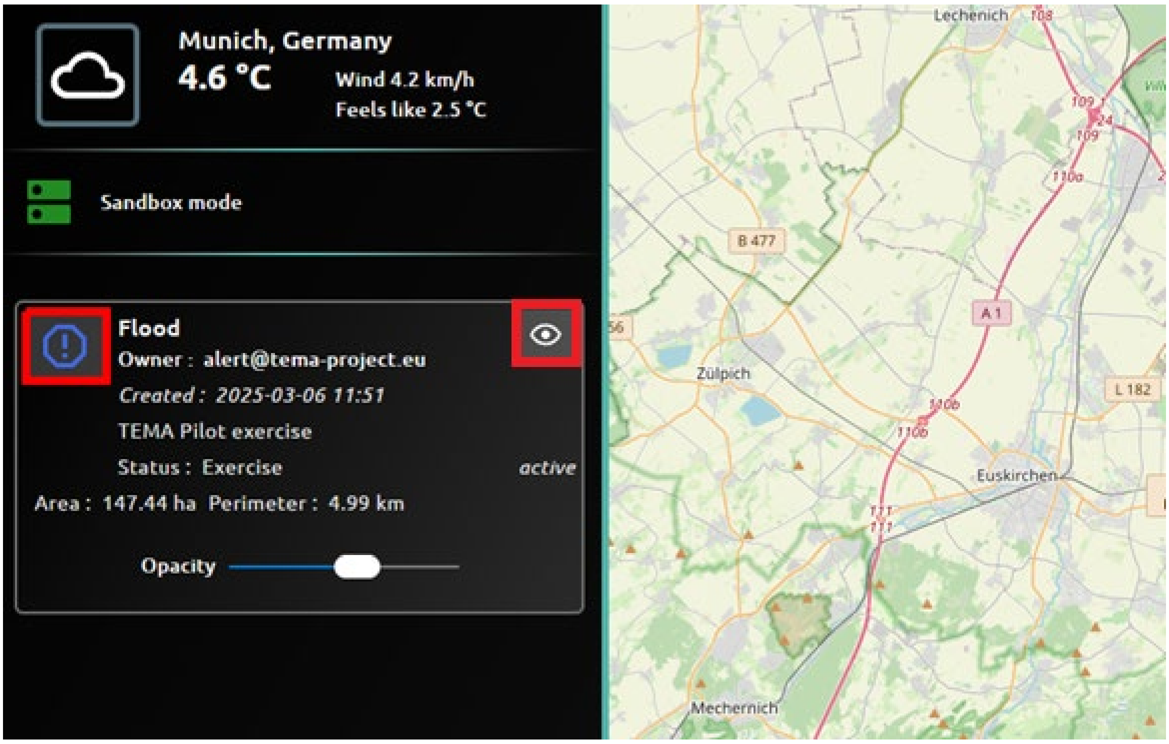
When an incident is chosen. The Smartdesk starts loading the relevant data.



2.2. Starting the mission management process

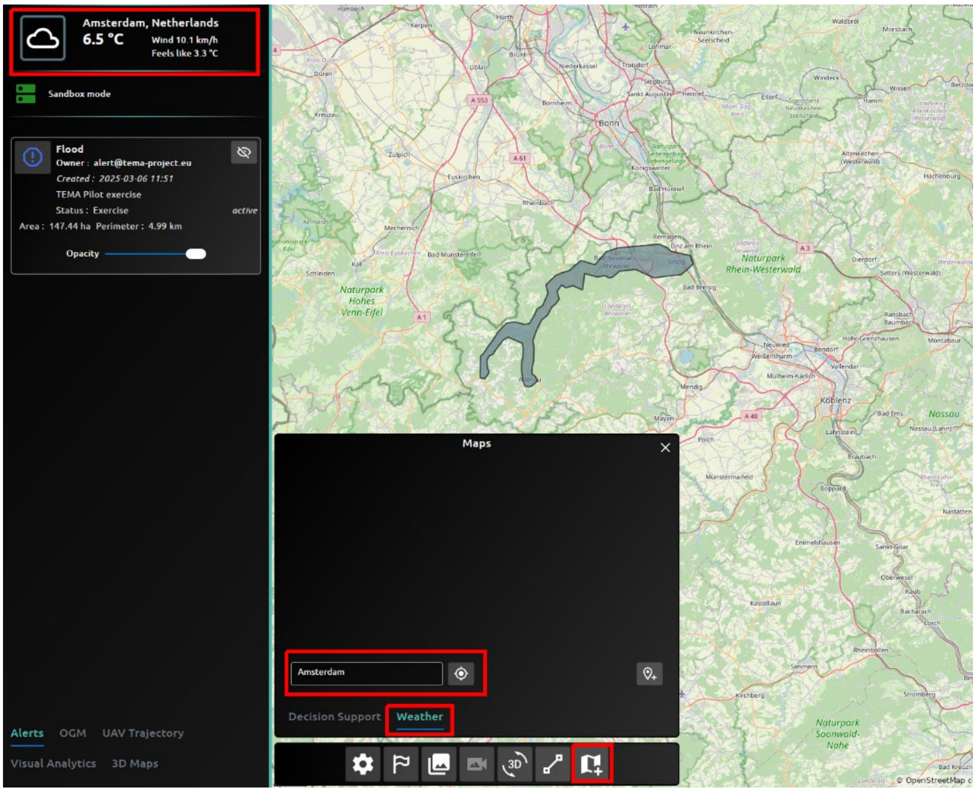
Click on the [emergency notification] icon to start managing an incident. The Smartdesk then navigates to the area of interest and shows the risk area.

By clicking the [eye] icon, the estimated incident area is shown or hidden.

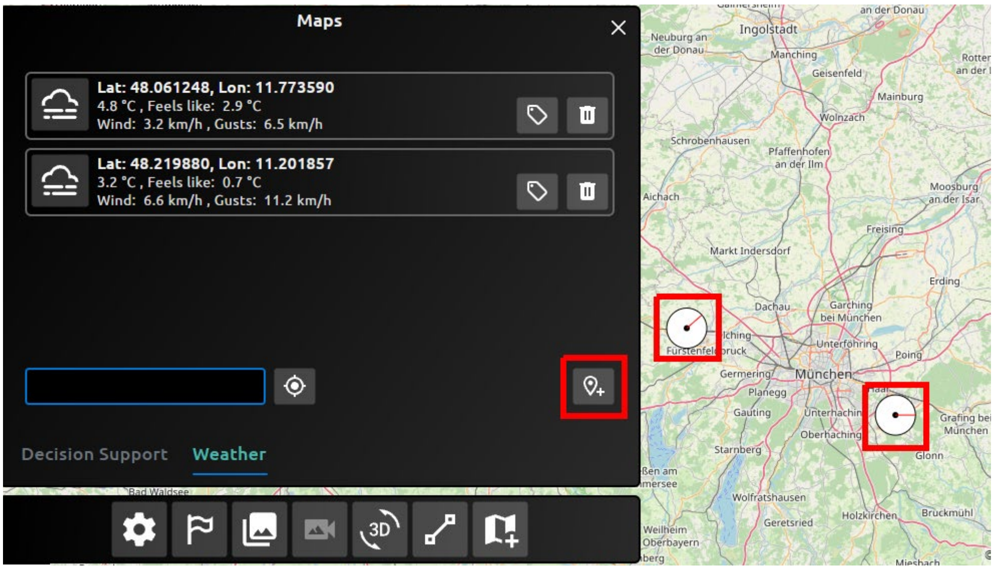


2.3. Weather

Weather in the top left info card can be changed, and additional info points for weather can be added to anywhere on the map. Select the [map icon] on the bottom and navigate to [Weather]. By typing the name of a city into the text box, the location in the info box changes.



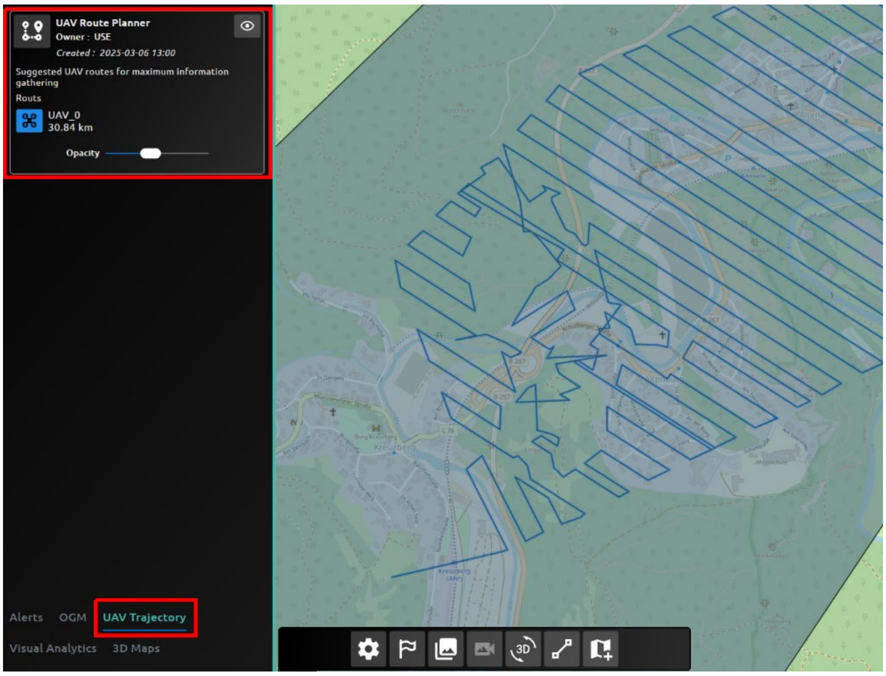
By clicking the [map point icon], and then on the map, additional weather points are added, which show coordinates and weather info on the weather tab, and wind direction on the map.



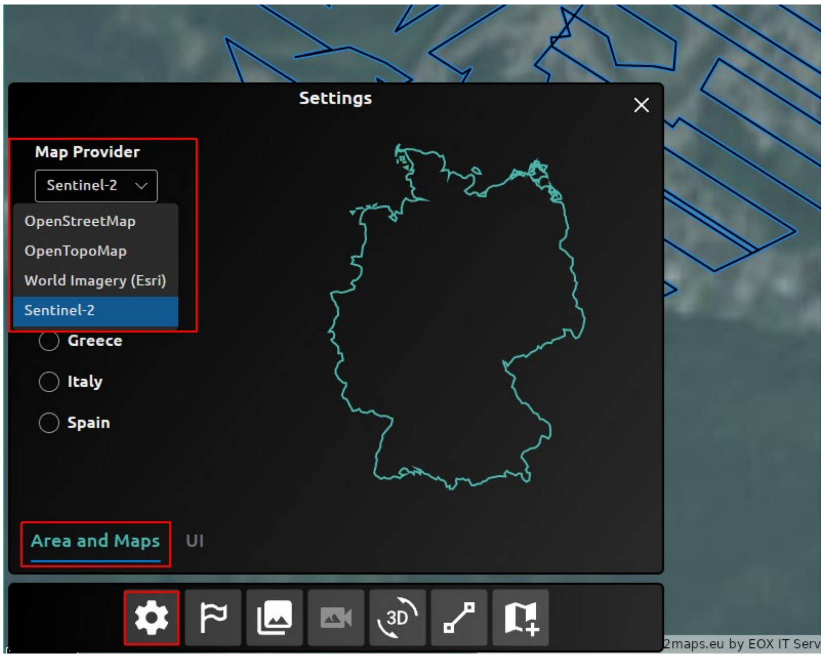
2.4. Drones and drone data

To see drone information choose [UAV trajectory] from the bottom left tab. The info cards on the left show all planned drone routes and the planned fly distance. Map types can be changed to show for example satellite images, topographic maps, or street maps.

The trajectories are automatically computed based on the defined disaster area. The limitation of what area the drone can cover is dependent on the type of drone used. This range of a drone is typically between 2 and 10km² per single battery charge. If new information is received on the disaster area, the drone trajectory can be automatically adjusted.

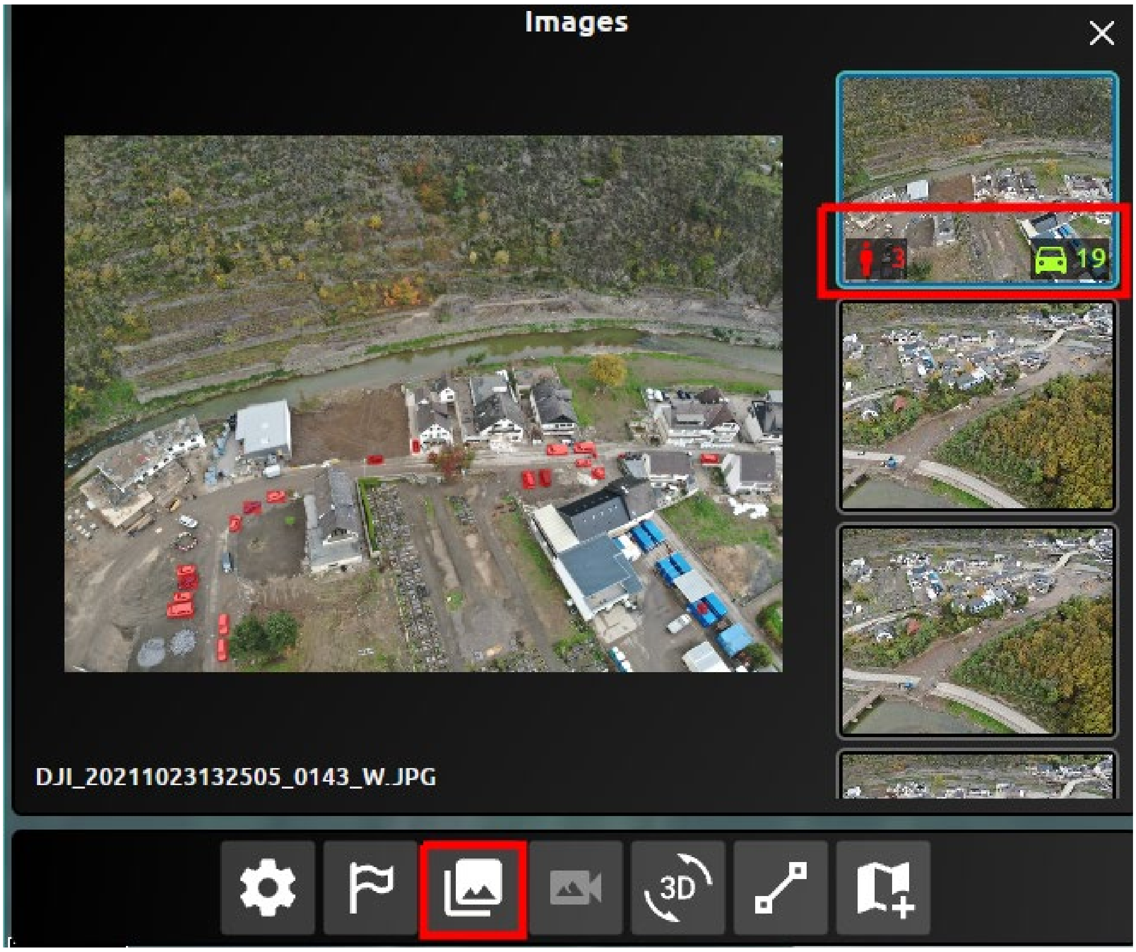


The map style can be changed from the Settings menu, in the [Area and Maps] view select [Map Provider].



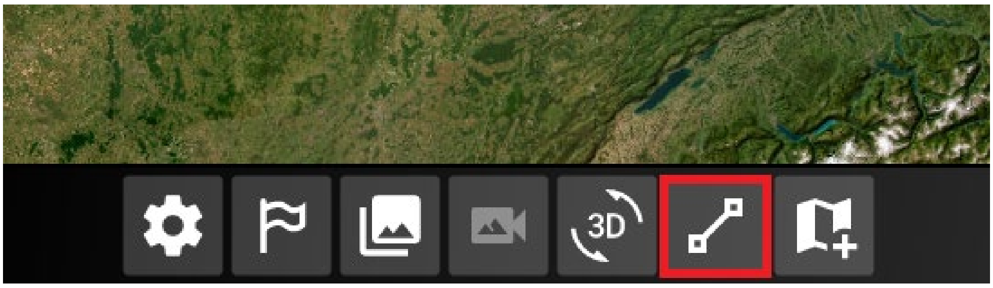
Images from drones

Images from drones can be opened by clicking on the image icon on the bottom. Pictures are uploaded from the drone. The TEMA solution will analyse images to identify any persons and cars. The number is shown for each picture. Scrolling on the image will zoom in/out.

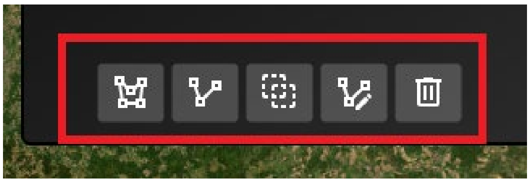


2.5. Map tools

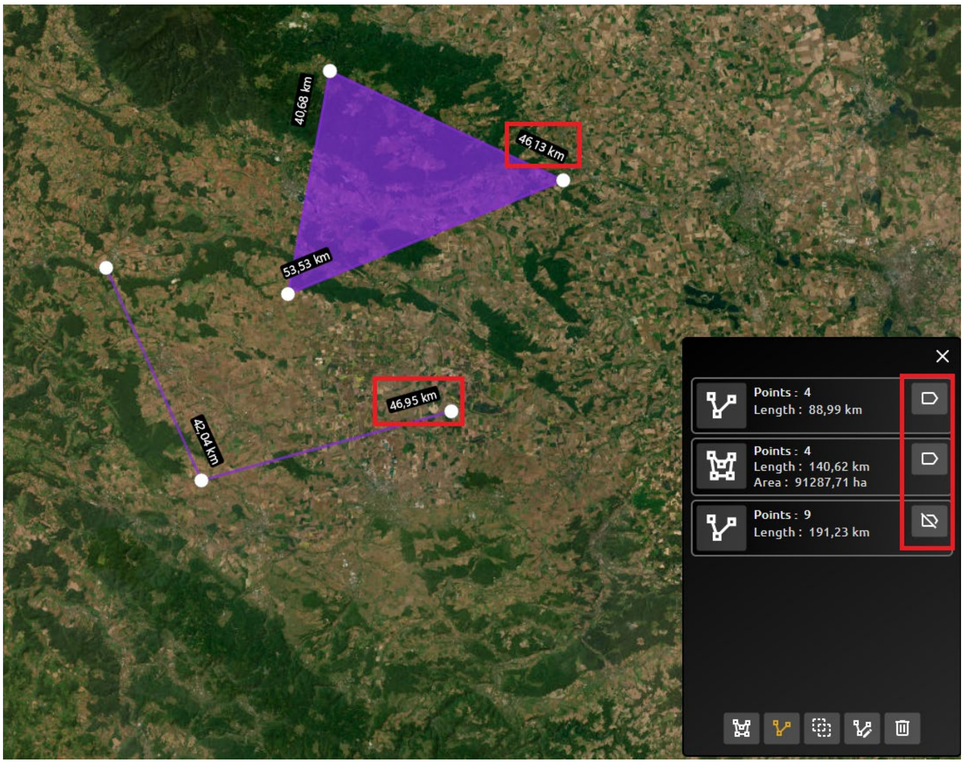
Users can measure distances, mark areas, and measure surface area. The map tools are accessed via the bottom menu bar, by selecting the map tool icon.



After clicking, a new menu appears on the right side. The map tool has the following functions now (left to right): 1) measure surface area, 2) measure distance, 3) geometry selection and 4) geometry editing.

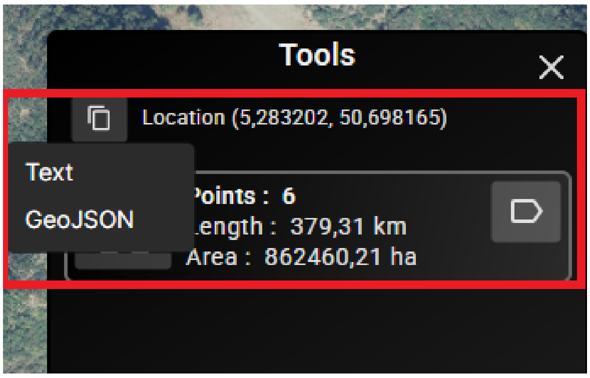


To measure a surface area, the user clicks the first icon on the left side. The mouse is then in surface measure mode. Clicking on the map will then place the measurement points. Once the points are placed. A new tab is shown on the menu, showing the length / surface of the selected area. By tapping the small arrow, the individual distances between two marked points are shown.

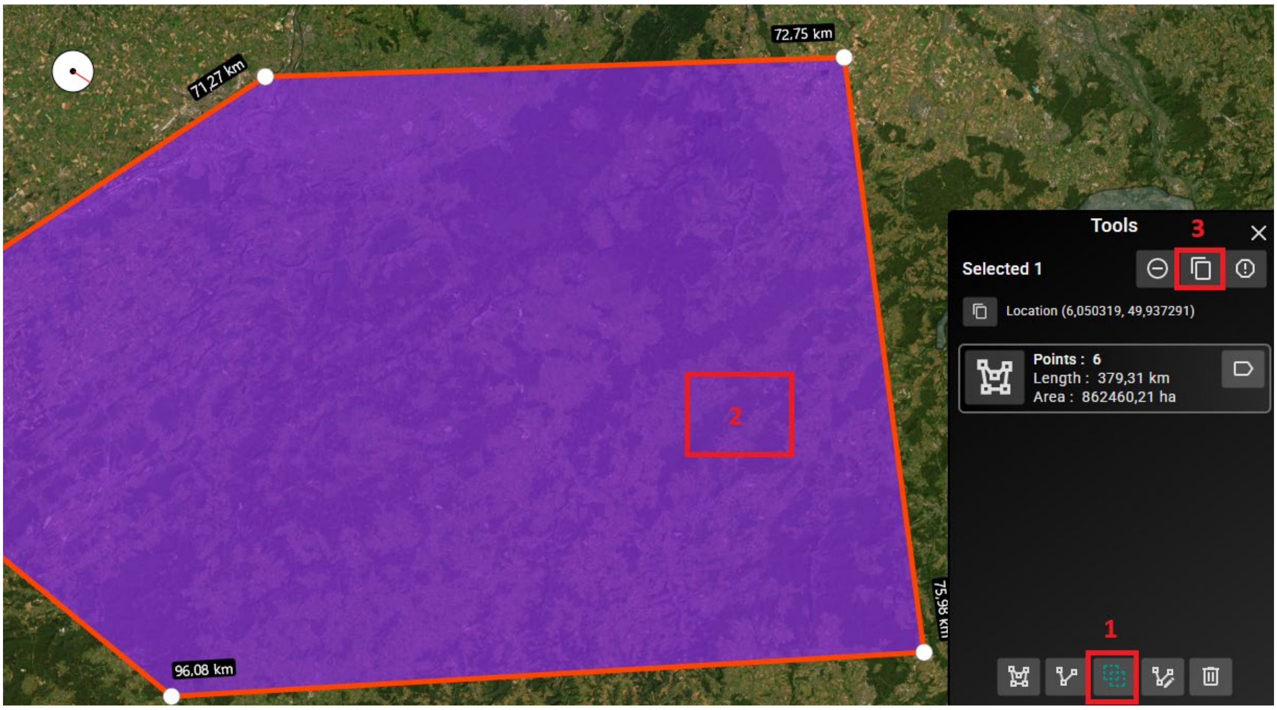


The measurement tools can be switched off by clicking on their icons in the menu, or by holding [CTRL] and left clicking on the map.

When the map tool is open, clicking on the map will show the location coordinates. The coordinates can be copied as simple text or in GeoJSON format.



Similarly, the location of a surface area can be shared. Clicking on the [geometry selection] tool and then on the shape. After picking the shape, click the [copy] icon and paste the information to any document or chat.

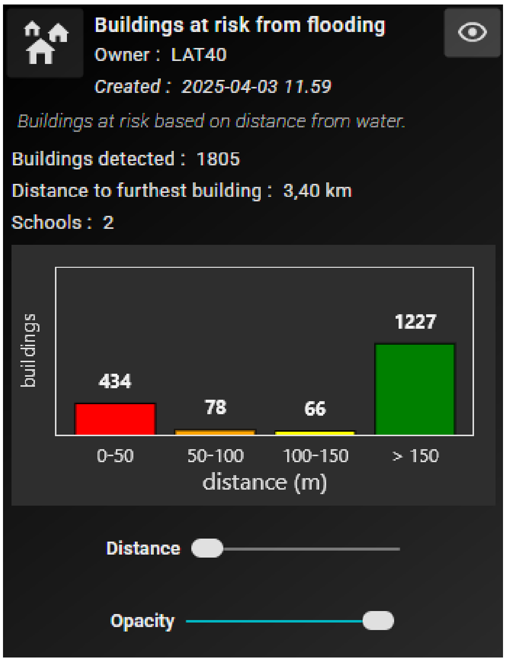


2.6. Geovisual Analytics

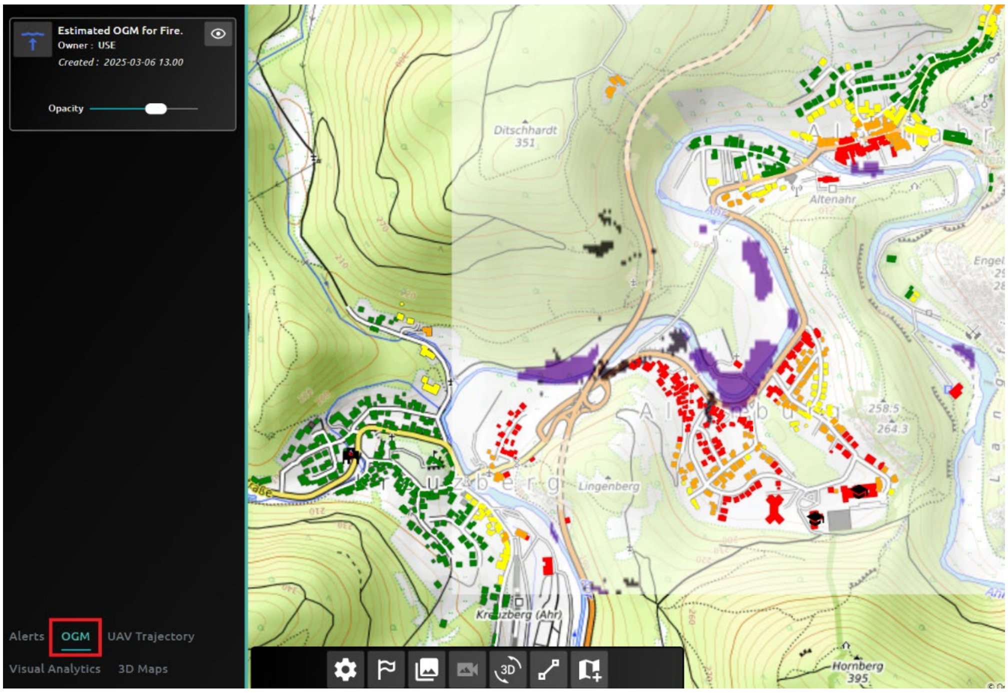
The Geovisual analytics tool shows the end user the distance from fire and distance from flood. The tool shows the total number of buildings in the disaster area and the distance to the furthest building within the area.

Using the [Distance] slider, the user can classify building into four categories, which is based on the distance from the fire or flood. The image example below shows that within 50m from the fire or flood, there are 434 buildings, 78 buildings are between 50m-100m from the incident, 66 buildings are 100m-150m from the incident, and 1227 buildings are at least 150m from the incident.

Buildings of special interest will be shown as well. The example below shows that there are 2 schools within the disaster area.

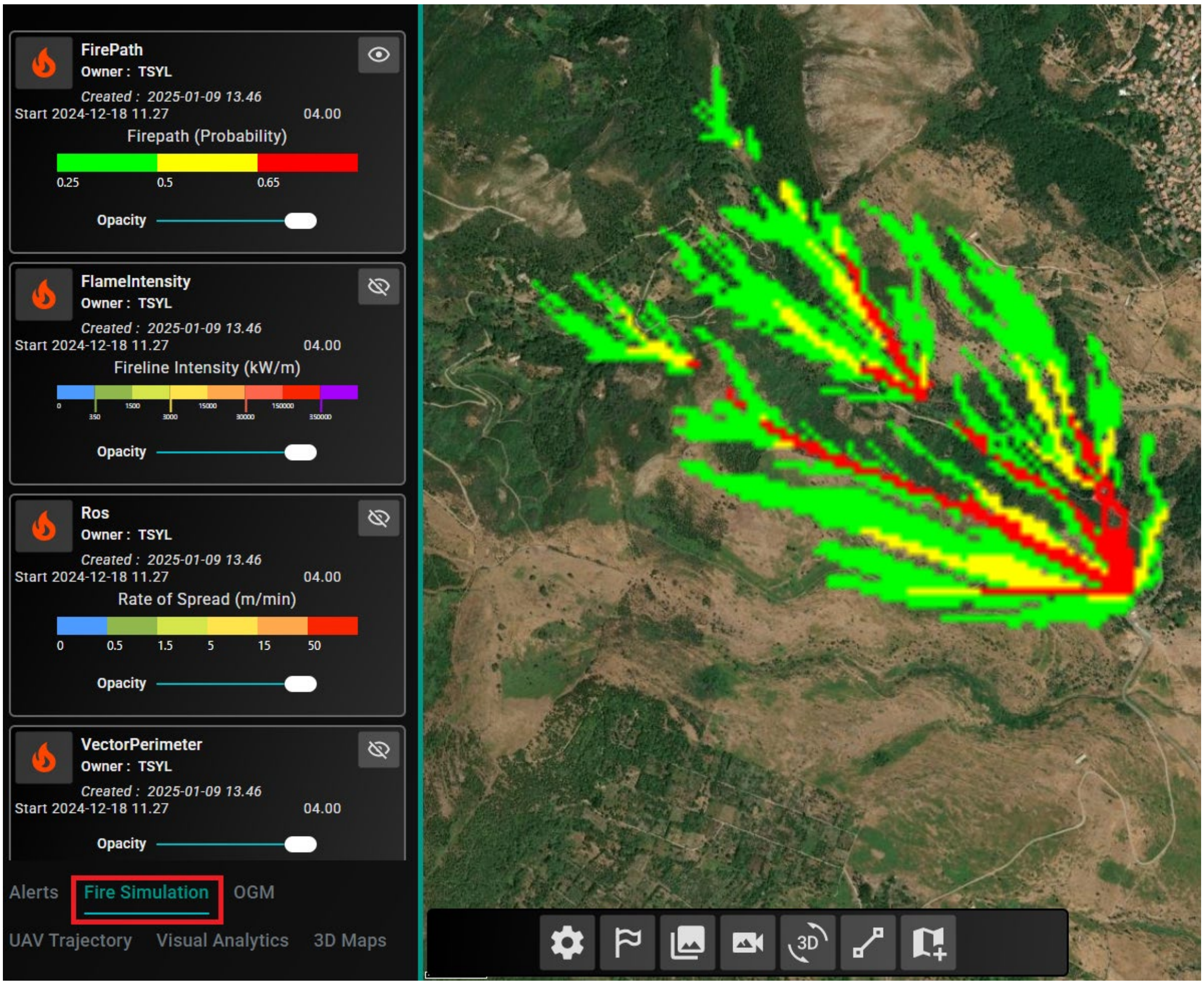


Using probability calculations, the TEMA system calculates which areas have a high probability of floods. By enabling [OGM] (Occupancy Grid Map), the map overlay shows the high flood/fire probability areas. Same as in the chart above, the colours on the map indicate the buildings' distance from the disaster area.



2.7. Fire Simulation

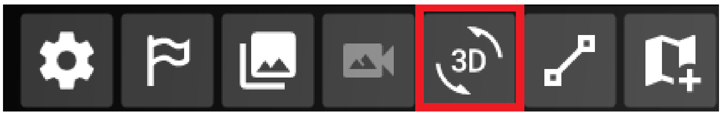
FireSim module provides real-time analysis of wildfire behaviour and simulates the spread of wildfires in seconds to support real time decision making. The module shows the fire path, flame intensity, rate of spread, hourly fire perimeters (vector perimeter) and expected height of the flames.
The FireSim is accessed through the [Fire Simulation] tab. This is only available by selecting the fire mission first.



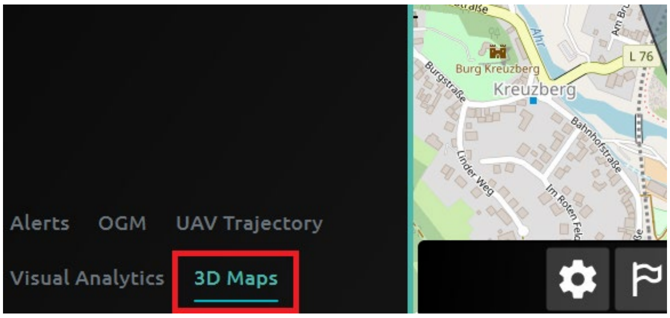
2.8. 3D maps

Note: The 3D viewer needs a moment to load. After the first step, wait that the 3D model of Earth appears. In case that nothing happens, restart the mission from the [flag button], and repeat the process.

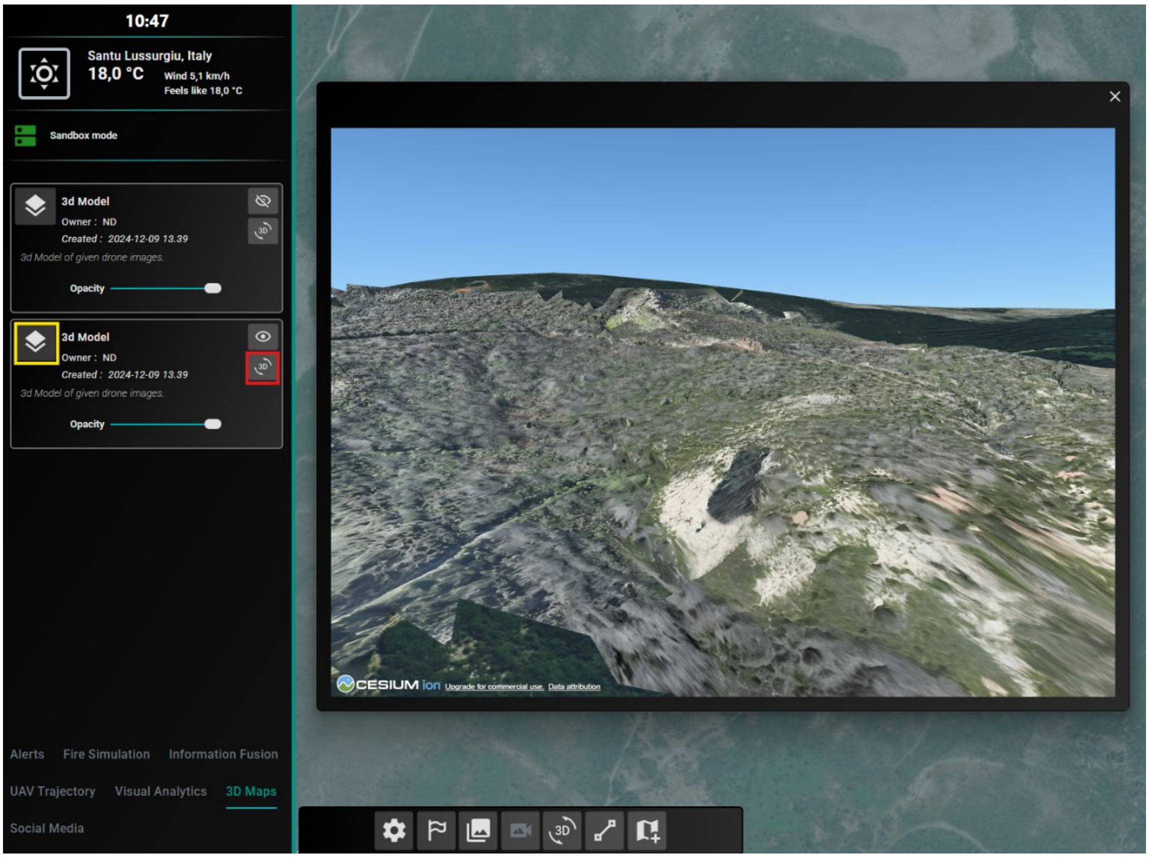
The Smartdesk visualizes 3D models of the disaster area. The user interacts with the 3D space.
Open the 3D viewer from the bottom panel. The window that shows planet Earth can be resized by dragging the bottom-right edge of the window.



Available 3D models of the disaster site can be found from the ''3D maps'' tab.

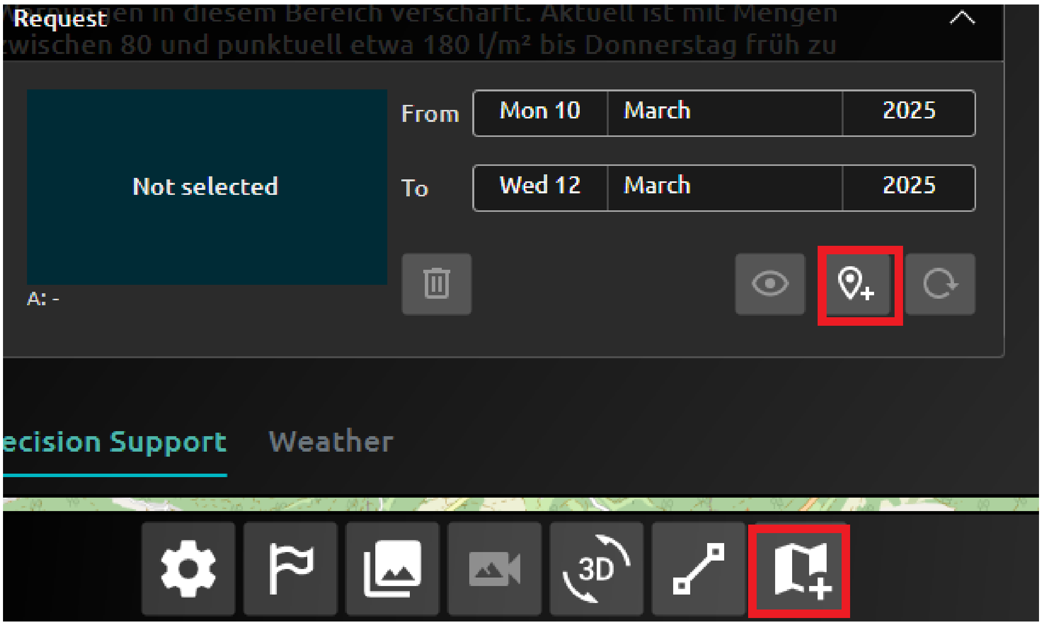


Finally, click the ''3D'' button (red) on the left info card to visualize the specific model. In addition, the same data provides a 2D scan of the area, positioned on the open map. This view is accessed through the [layers] (yellow) button.

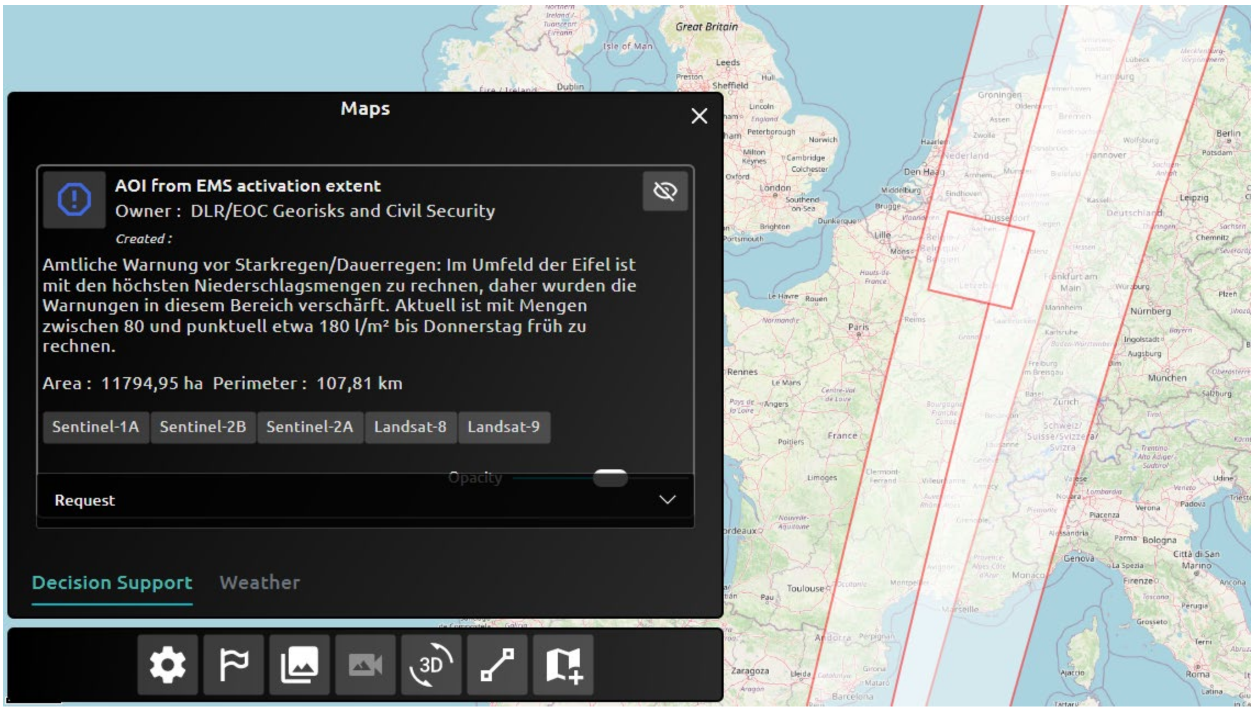


2.9. Decision support

The decision support service provides users with information on warnings, advice, and satellite images. To get information on a specific area, click 'request' on the bottom of the window, press the [map marker button], and select points on the map to mark your area of interest. Once the area is marked, click the [⟳] button to request information. For this testing, the Altenarh area has been added as an example.

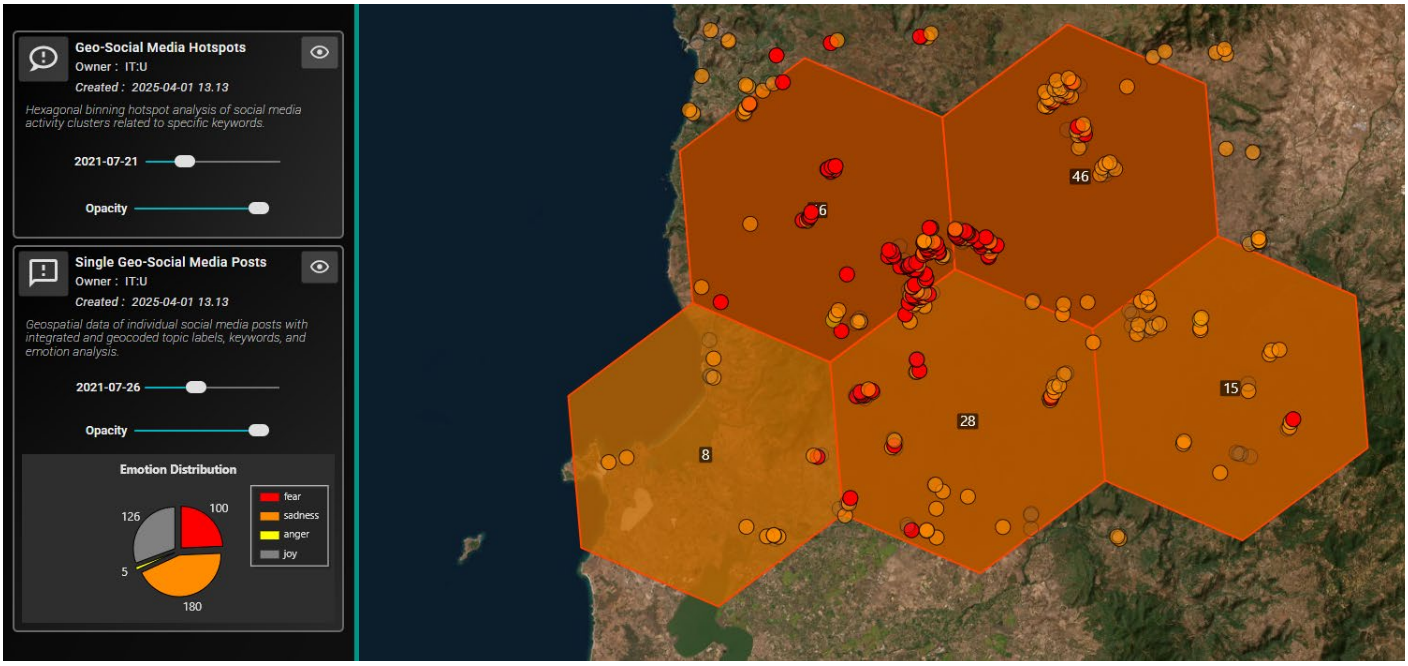


The warning for the area is then presented and relevant satellite overpasses can be toggled.



2.10. Geosocial media analysis

The social media analysis provides an overview of relevant posts made in the disaster area. The user can use the first slider to see what was posted each day. And the approximate are where the post comes from. The individual dots can be clicked to see the post texts, and the colours represent the emotions within the post. Red – fear, orange – sadness, yellow – anger, and grey – joy.



3.Training tasks

2.11. Flood training tasks

1. Adjust your scaling preferences.
    a. Change map type to OpenStreetMap
2. Navigate to the ''Missions catalogue'' and start the flood mission.
3. Add local weather to the main info card, and 2 weather info points near the incident.
4. Open drone view of the flood.
5. Drone functionality:
    a. Change the map view to show satellite map instead. (World Imagery)
    b. Review images. Zoom in to find the civilians. Have any people or cars been identified in the disaster area?
6. Open the topographic map.
    a. Mark a risk perimeter along 1km of the river.
    b. Set points on both sides of the river. Mark areas below 200m elevation. How much of the surface area is at risk?
    c. Share the area location to other operatives. (Paste to word pad for testing)
7. Open the visual analytics tab and enable the view.
    a. Set distance to 50m per risk zone.
    b. Open OGM (Occupancy Grid Map). High flood zones are marked purple.
    c. Review if the high probability zones and risk zones match. Closest to risk red, farthest green.
8. Open the 3D viewer.
    a. What is the status of the two bridges in the 3D model?
9. Decision support
    a. Request decision support for the Altenarh area

2.12. Fire training tasks

1. Adjust your scaling preferences.
    a. Change map type to OpenStreetMap
2. Navigate to the ''Missions catalogue'' and start the fire mission.
3. Add local weather to the main info card, and 3 weather info points near the ignition point.
4. Open drone view of the area.
5. Drone functionality:
    a. Change the map view to show satellite map instead. (World Imagery)
    b. Review images. Are there any people or vehicles in the risk area?
6. Open the topographic map.
    a. Measure the distance from the ignition point to a nearby house.
    b. Measure surface area between the two rivers south and east of the ignition point.
    c. Share the area location to other operatives. (Paste to word pad for testing)
7. Open the visual analytics tab and enable the view.
    a. Set distance to 50m per risk zone.
    b. Open OGM (Occupancy Grid Map). High risk ignition zones are marked purple.
    c. Review if the high probability zones and risk zones match. Closest to risk red, farthest green.
8. Open the FireSim tool and review hourly fire perimeter.
9. Open the 3D viewer.
    a. Review the types of roads and types of vegetation near roads.
10. Decision support
    a. Request decision support for the Altenarh area. (Not yet implemented for fire. Switch to flood mission)

ANNEX 7

INFORMATION SHEET

FOR RESEARCH PARTICIPATION & DATA PROCESSING

Dear participant,

You are invited to take part in the TEMA **Pilot Trial 1** carried out as part of the TEMA project (Grant Agreement 101093003).

In the context of **WP6 Integration and Validation (pilot trials)**:
(a) A Pilot Trial will be organised and hosted by **…... on …... 2025** where the technologies of TEMA will be tested, validated and evaluated**.**

Before you decide to participate, please, be informed of the following details and, if you wish, consent (a) to your participation and (b) to the processing of your personal data by signing the relevant **Informed Consent Form**.

ABOUT YOUR PARTICIPATION:

What is the TEMA project about?
TEMA will greatly improve Natural Disaster Management (NDM, e.g., for wildfires, floods) by automating precise semantic 3D mapping and disaster evolution prediction to achieve NDM goals in near-real-time. It will analyze and fuse many heterogeneous extreme data sources: smart drone and in-situ sensors, remote sensing data, topographical data, meteorological data/predictions and geosocial media data (text, image and videos). TEMA will focus on the extreme nature of the data, due to their varying resolution and quality, very large volume and update rate, different spatiotemporal resolutions and acquisition frequencies, real-time needs and multilingualism. It will develop an integrated, ground breaking NDM platform, focusing on real-time semantic extraction from multiple heterogeneous data modalities and sources, on-the-fly construction of a meaningful semantically annotated 3D disaster area map, prediction of disaster evolution and improved communication between service providers and end-users,

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through automated process triggering and response recommendations. Semantic analysis computations will be distributed across the edge-to-cloud continuum, in a federated manner, to minimize latency. Extreme data analytics will be performed in a trustworthy and transparent way, by greatly advancing state-of-the-art AI and XAI approaches. The constantly updated 3D map and the disaster evolution predictions will form the basis for an advanced, interactive, Extended Reality (XR) interface, where the current situation will be visualized and different

response strategies will be dynamically evaluated through simulation by NDM personnel. The innovative, scalable and efficient TEMA platform will provide precise NDM support, based on extreme data analytics. It will be validated on two critical disaster use-cases (wildfires and floods), in four EU countries, and will form the basis for the TEMA NDM-Analytics-as-a Service (NDM-AaaS) model.

How long is the TEMA research project likely to last?
The duration of the project is 48 months as of 1 December 2022 until 30 November 2026.

Why have you been asked to take part?
You were asked to take part due to your knowledge, expertise and active involvement in the TEMA project or due to your relation to the Pilot Trial organisers ...... and your interest in the TEMA project.

What will you need to do?
You will participate in the TEMA Pilot Trial ...... of WP6 (Integration and Validation). The trial is led by ...... and will last X days (...... 2025). You will take part once and you will contribute to the evaluation of the TEMA technologies/ the prototype TEMA platform (as a tool operator or participant…) in accordance with the scenarios. The duration of the TEMA Pilot Trial is expected to be … hours.

In addition, the TEMA project includes AI systems and the participants may interact with the AI systems. Participants shall use the AI systems during the TEMA Pilot Trial in accordance with the instructions of use presented by the providers. Please be informed that these AI tools will not process any personal data of the participants, and there will be no negative impact, nor any risk for the participants during the Pilot Trial.

Where will this take place?
The activities related to Trial X will be carried out at ....

How can you find out about the results of the activity?

Are there any foreseeable risks, discomfort or disadvantages that might ensue?
During the TEMA trial in ......, unmanned aerial vehicles (UAVs) will be used to meet the project’s objectives. A health and safety risk that has been identified is related to the potential collision or fall of a drone over humans during the Pilot Trial. The necessary health and safety

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procedures will be followed in accordance with the applicable legal framework and with the user manual issued for the drones. Competent authority designated with the necessary powers and allocated responsibilities for the authorisation and compliance of organisations and persons involved in Unmanned Aircraft operations and related training in the airspace of ...... is ...... and Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft.

When will you have the opportunity to discuss your participation?
The present Information Sheet and the relevant Informed Consent Form will be provided to you **prior to** your participation, and you will have time to carefully read them before deciding. A representative from ...... will respond to any of your questions (see contact details below). If you decide to take part, you shall first sign the Informed Consent Form.

What if you do not wish to take part?
Your participation is **totally voluntary**. You have the right to entirely or partially refuse to participate and your refusal will not disadvantage you in any way.

What if you change your mind during the study?
In that case, you are **free to withdraw your consent** to your participation from any part of the present activity at any time, without consequences by contacting a representative from **......** (see the contact details below).

ABOUT THE PROCESSING OF YOUR PERSONAL DATA:

Data controllers:

1. ……………………...

Data Protection Officers:

1. DPO at ...... : ......

Types of personal data:

Regarding the Trial, the following personal data will be processed by the data controllers for the purposes mentioned below, provided that you have consented to each processing operation:

1. Prior to the Field Trial, ... will process:

   - Names of the participants on the entrance list
   - Passport numbers / identity card numbers of the participants on the entrance list

2. During the Field Trial, ... will process:

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- Images that may identify a participant *potentially* collected through cameras or other types of sensors onboard UAVs
- Images and voice that can identify a participant collected through photos and video recordings
- Names of the participants on the Informed Consent Form and the attendance list
- Signatures of the participants on the Informed Consent Form and the attendance list

Purposes of the processing:

1. Personal data (names, passport numbers/identity card numbers) will be processed by the data controllers ...... to ensure secure access of the participants to the ......
2. Personal data (images) *may* be processed by ...... through cameras (onboard UAVs) for the execution of the trial.
3. Personal data (images, voice) will be processed by ...... for the dissemination and communication of the project's results related to the Trial.
4. Personal data on the attendance list and the Informed Consent Form (names, signatures) will be processed by ...... for compliance with the relevant GDPR provisions (Article 6 par.1 a GDPR) and for accountability reasons towards the Funding Authority (European Commission).

We will not use personal data for any other purpose, unless a new legal basis exists, in which case you will be notified accordingly or asked for renewed consent.

Legal basis for the processing:

Personal data are processed by the controllers **based on your consent** (see the Informed Consent Form to be signed) according to **Article 6 par.1 (a) GDPR** *with the following exemptions:*

[*Your name and passport number/identity card number on the entrance list are processed by **** according to **Article 6 par.1 (e) GDPR** since the processing is carried out in the exercise of official authority vested in the controller (prerequisite for secure access to the Field Trial site).*

*Your name and signature on the attendance list and the Informed Consent Form are processed as part of the informed consent procedure **for the processing to be lawful and compliant to the GDPR** and for accountability reasons in case the Funding Authority (European Commission) carries out any ethics checks or reviews.*]

Recipients:

1. Personal data (names, passport numbers/identity card numbers) collected through the entrance list to ensure secure access to ...... will be retained solely by ....
2. Personal data (images that could identify an individual) *potentially* collected for the execution of the TEMA Pilot Trial will be shared with the TEMA Consortium. (TEMA Consortium partners https://tema-project.eu/partners)

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3. Personal data (images and voice that could identify an individual) collected for dissemination and communication purposes will be shared with the TEMA Consortium and some of them will be uploaded on the official TEMA website and the TEMA social media accounts.
4. Personal data on the attendance list and Informed Consent Form will be retained solely by ....

Storage period:

1. Personal data collected through the entrance list to ensure secure access to the ...... will be retained until the end of the TEMA Pilot Trial (......).
2. Personal data *potentially* collected through cameras for the execution of the Pilot Trial will be retained by the end of the TEMA project (30 November 2026 or later if the project is officially extended).
3. Personal data collected through photographs and video recordings for dissemination and communication purposes will be retained until the end of the TEMA project (30 November 2026 or later if the project is officially extended). However, some photos or videos will be uploaded on the official TEMA website and on the TEMA social media accounts.
4. Personal data on attendance list and the Informed Consent Form will be retained for a period of 5 years after the end of the TEMA project (30 November 2031 or later if the project is officially extended) according to Articles 18.1 and 20 of the TEMA Grant Agreement.

After the aforementioned periods the personal data will be permanently deleted without keeping any copy.

Right of the data subject:

You have the right to:

- Request information about whether we hold personal information about you, and, if so, what that information is and why we are holding it (Art.15 GDPR).
- Request access to your personal information. This enables you to receive a copy of the personal information we hold about you and to check that we are lawfully processing it (Art.15 GDPR).
- Request rectification of the personal information that we hold about you. This enables you to have any incomplete or inaccurate information we hold about you corrected (Art.16 GDPR).
- Request erasure of your personal information. This enables you to ask us to delete or remove personal information where there is no good reason for us continuing to process it (Art.17 GDPR).
- Request the restriction of processing of your personal information. This enables you to ask us to suspend the processing of personal information about you (Art.18 GDPR).
- Request transfer of your personal information in an electronic and structured form to you or to another party (right to "data portability"). This enables you to take your data

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from us in an electronically usable format and to be able to transfer your data to another party in an electronically usable format (Art.20 GDPR).

- Object to the processing of passport numbers/identity card numbers through the entrance list (Art.21 GDPR).
- Lodge a complaint to the competent supervisory authority (Art.77 GDPR).
- Withdraw your consent at any time. Please note that the withdrawal does not affect the processing of your data which is based on the consent you have given before the withdrawal. Once we have received notification that you have withdrawn your consent, we will no longer process your personal information for the purpose/purposes you originally agreed to.

Contact persons:

In case you have any questions and concerns about the **TEMA Pilot Trial**, you can contact ....

For the exercise of your rights related to **data protection**, you may contact the Data Protection Officer of ...... by sending an email to ....

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ANNEX 8

INFORMED CONSENT FORM
FOR RESEARCH PARTICIPATION & DATA PROCESSING

Hereby I, ……………………………………………………..……………… (name, surname)

	YES	NO
I have carefully read the Information Sheet for the **......** **Pilot Trial X** that will be carried out on ...... as part of the WP6 "Integration and validation" of the TEMA research project (Grant Agreement 101093003). I **have been informed of my data protection rights** and I have been given the contact details of the contact persons. I understand that **I am free to withdraw my consent** at any time without giving a reason for my withdrawal and without any consequences.		
I confirm that **I am over 18 years old.**		
I wish to participate in the **......** **Pilot Trial X** (......) in .... under the conditions set out in the Information Sheet.		
I consent to the processing of **images through UAV cameras or any other means** where I may be identified.		

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I consent to the processing of **my image and voice** for **dissemination and communication purposes via the official TEMA website and the official TEMA social media accounts** (Trial X)**.**		

I wish to receive a copy of the Information Sheet. Yes ☐ No ☐

Date: ...../..../2025

Location: ......

Participant's Signature

Funded by the European Union

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ANNEX 9

Guided discussion questions for the pilot trails

1. Can you recall a moment when TEMA helped you respond faster than you would have in your usual process? What made the difference?
2. Were there any steps or information in TEMA that slowed you down or introduced unnecessary delay?
3. Did TEMA help you notice or understand aspects of the emergency you would otherwise have missed? Can you give an example?
4. Was there any information you felt was missing or unclear? How would you prefer to have that information delivered?
5. Would you prefer to integrate selected individual TEMA functionalities into your existing systems, or would you rather adopt the full TEMA platform as an additional or extended system alongside your current setup? Why?
    a. Which specific functionalities would you prioritize for integration?
    b. What advantages or challenges do you see with either approach?
6. Did TEMA reduce the amount of manual tasks or decisions you normally have to handle? Which tasks specifically?
7. Were there points where you still felt overloaded or stressed despite using TEMA? What contributed to that?
8. How intuitive did you find the system to use under time pressure? Were there any confusing parts that added to your workload?
9. If you could change one thing about TEMA to make it more useful in an emergency, what would it be?
10. Did you trust the outputs and recommendations of TEMA? Why or why not?
11. Did you experience any technical or organizational barriers when using TEMA (e.g., connectivity)?

ANNEX 10

Questions for the Observers during the trials

- How user-friendly did the end-users find the TEMA platform during the operation?
- Were there any features of the TEMA tools that the end-users found particularly helpful or challenging?
- Did the end-users encounter any technical issues or downtime with the TEMA tools? If so, please describe.
- What improvements or additional features did the end-users suggest for the TEMA tools?
- Do you have any other observations that you would like to share with technical partners?